#PHC2023Pantnagar

Progressive Horticulture Conclave

TRANSFORMING HORTICULTURE SCIENCE INTO TECHNOLOGY

February 3-5, 2023

Souvenir-cum-Compendium of Abstracts

Organised By

G.B. Pant University of Agriculture & Technology Pantnagar, Uttarakhand, India

Indian Society of Horticultural Research & Development (ISHRD) Uttarakhand, India

Souvenir-cum-Compendium of Abstracts

Progressive Horticulture Conclave towards Transforming Horticulture: Science into Technology

Editors:

Ranjan K Srivastava | Ratna Rai
D.C. Dimri | Yograj Kushwaha
Sheeba Belwal | S.K. Dwivedi
Satish Chand

Organized by

Govind Ballabh Pant University of Agriculture & Technology
Pantnagar-263 145, U.S. Nagar, Uttarakhand, India
Indian Society of Horticultural Research & Development (ISHRD), Uttarakhand, India

Souvenir-cum-Compendium of Abstracts
Progressive Horticulture Conclave towards Transforming Horticulture: Science into Technology

Editors:
Ranjan K Srivastava, Professor Horticulture
G.B. Pant University of Agriculture & Technology, Pantnagar
Ratna Rai, Professor Horticulture
G.B. Pant University of Agriculture & Technology, Pantnagar
D.C. Dimri, Professor & Head Horticulture
G.B. Pant University of Agriculture & Technology, Pantnagar
Yograj Kushwaha, Research Scholar
G.B. Pant University of Agriculture & Technology, Pantnagar
Sheeba Belwal, Research Scholar
G.B. Pant University of Agriculture & Technology, Pantnagar
S.K. Dwivedi, Director Personnel
Defence Research and Development Organization
Satish Chand, Senior Research Officer Horticulture
G.B. Pant University of Agriculture & Technology, Pantnagar

Edition: 2023

ISBN: **978-93-91664-13-8**

Sponsored by **Indian Society of Horticultural Research and Development (ISHRD)**

Published on behalf of:
Directorate of Research and College of Agriculture,
Govind Ballabh Pant University of Agriculture & Technology,
Pantnagar-263 145, U.S. Nagar, Uttarakhand

Printed and published by:
Ocean Publication
Near Hanuman Temple, ChahSotiyan, Rajdwara
Rampur-244 901, U.P. , Ph. : 9045440373
E-mail : ocean.publication.rampur@gmail.com

Foreword

Dr. M. S. Chauhan
FNA, FNASC, FNAAS, FNADS
Vice-Chancellor

G. B. PANT UNIVERSITY OF AGRICULTURE
& TECHNOLOGY
PANTNAGAR - 263 145, DISTT. U.S. NAGAR,
(UTTARAKHAND), INDIA

Increasing demand for horticultural produce in the last five decades has made this sector a priority area where greater emphasis has to be laid upon research and development. A major transformation has been observed in the production of horticultural crops in the past few years and we have seen that it has proved itself to be a prime mover of economic growth. The innovations made in terms of technology development have made visible contribution during the COVID pandemic.

Horticulture contributes 30.4% of the agriculture gross domestic product (GDP) using only 13.1% of country's gross cropped area. Environmentally sustainable technological innovations based on optimization of resources can accelerate farmers' income and thus must be central to transform horticulture industry to be more productive and remunerative.

Regionally differentiated technologies must come up as solution for catering to the needs of not only the large but also the small and marginal farmers who comprise a vast majority. Market demand driven value chain for these perishable commodities will require more emphasis on reduction in various kinds of losses occurring from production to consumption pathway.

Adoption of Hi-tech technologies like drip irrigation, artificial intelligence, drone technology, IOT, blockchain need to stay abreast for improving production and productivity of horticultural crops. Skill development for efficient transfer of technology from lab to field is imperative for the required transformation. Horticulture based start ups and boom in the retail sector have reshaped horticulture industry.

I compliment my faculty of the Department of Horticulture, who have understood the need for deliberation on such a pertinent topic. I am sure that the academic discourse which will roll out during the three days will go a long way in enlightening the students, faculty as well as farmers attending. I am also grateful to ISHRD for collaborating with the University for such an Important Event. I hope organization of Progressive Horticulture Conclave will play a major role in creating a road map of improved and sustainable horticultural scenario for Uttarakhand in particular and the country at large.

I convey my good wishes for the success of the conclave and also for the publication of the Souvenir.

(M. S. Chauhan)

दूरभाष (कार्यालय) : 05944-233333, 7500122224, 9991652455 (मो0), फैक्स : 05944-233500 (कार्यालय)
E-mail: vcgbpuat@gmail.com, Website: www.gbpuat.ac.in

CONTENTS

POSTERS PRESENTATION

Session-2: Seed, Planting Material & Nursery Management

INVITED LECTURE

ORAL PRESENTATION

POSTERS PRESENTATION

Session-4: Organic and Natural Farming of Horticulture Crops

INVITED LECTURES

ORAL PRESENTATION

Session-5: Precision Horticulture and Geo Spatial Tools

INVITED LECTURES

ORAL PRESENTATION

Session-9: Horti-Extension, Marketing, Certification and Horti-business

INVITED LECTURES

ORAL PRESENTATION

Organized by:
G.B. Pant University of Agriculture and Technology, Pantnagar-, U.S. Nagar, Uttarakhand
Indian Society of Horticultural Research & Development (ISHRD), Uttarakhand India

Session-11: Interface with Farmers and Industry

KEYNOTE ADDRESS

KEY NOTE ADDRESS

P-1 Cosmic Nutrient Management in Horticultural Crops: A Ray of hope for Nutrition, Health, Economic & Environmental Security

R.K. Pathak
Former Director, Homa Teacher & Preacher, Fivefold Path Mission

Back Ground

Breathable air, drinkable water, eatable food, organic carbon rich soil (Ataman) and PranicUrja rich biosphere are essentialities for harmonious survival. Industrial Agriculture is based on finite source of fossil fuels and imported once, which are dwindling, becoming expensive to government, farmers and the society. Soil organic carbon should be more than one percent has been reduced to less than 0.5 percent in many regions. Government has to enhance fertilizers subsidy to the tune of 2.25 lakh crores. Even then farmers are in crises. This needs serious introspection. Cosmic nutrient management, could provide a ray of hope.

Points to be considered for plant nutrition

Things to ponder- *There is a common saying that Kuber's (God of wealth), children were unaware of wealth of his father, thereby by always striving for money, similar is our situation with respect to plant nutrient management. On one hand enormous quantum of cosmic energy is available freely, but owing to ignorance, striving for nutrient management. Nature's representatives are-Cow-Dung- Urine, Soils microbial consortia including dwellers and vegetation for survival of humans. For cosmic nutrient management, one has to conceive techniques to mediate infinite source of cosmic energy in nutrient management for sustainability and nutritionally rich foods.*

Horticultural crops are grown for higher production, therapeutic, nutritional, health and aesthetic values. If these are loaded with cocktail of hazardous chemicals, concept gets jeopardized. In few vegetables, often hazardous pesticides are spread in evening and crops are harvested in the early morning. There is minimum gap between farms & fork, most of these are consumed fresh or for juice /salad, hence these should be free from any contamination. In fact, most of chemicals, few are cariogenic invade human body through vegetables.

Things to ponder- Plants require 30 + elements for quality production which can be provided through humus rich soil and pollution free biosphere. Plants have only organic diet *i.e.*, in oxidized, chelate or in ionic forms. These transformations are performed by soil microbial consortia and dwellers. Fertilizers available hardly can provide 5-8 nutrients. Almost 78 percent free N is available freely in biosphere. Plenty of P and the other elements needed by plants are available in soil, may be in deeper soil horizon. These have to be moved to upper layer and their availability is to be enhanced. Potash is non constituent element, burrowed from soil and a large part is returned back through bio mass. Humus content in the soil is potent accumulator of cosmic energy, moisture, even has capacity to trans mutate any elements which are deficient but required by the plant. Maintenance of high soil humus is key component for high quality production.

Two cows-based organic systems *i.e.*, Biodynamic Farming and Homa Organic Farming validated at CISH, are twin sisters acting in complementary & supplementary mode. Biodynamics emphasizes enhancing soil biology and Homa for combating pollution of the basic elements thereby enhancing 'PranicUrja- *i.e.*, life energy. It will encourage all production factors *i.e.*, soil fertility, nutrients availability, water quality, availability biodiversity of flora, fauna, including earthworms in soil, predators and pollinators in biosphere, thereby quality production in all crops and varying situations.

Nutrient deficiency, incidence of disease and pests are indication of diminishing Aura Energy of soil and plants. Hence there is need to enhance soil organic carbon and PranicUrja of biosphere. Assertive promotion of cosmic farming is capable of addressing both issues.

Cosmic Nano Nutrient management (Hypothesis)

In recent decades, new approach is underway by few industries and institutes to innovate new techniques of Nano nutrient management. Cosmic Farming which pertains integration of few select techniques of Biodynamic and Homa Organic Farming can resolve nutrient requirement. It will consist of incorporation of enriched composts, green manuring, auro-greens, use of BD-500, 62.5 gram, BD-501, 2.5-gram, Cow Pat Pit, 2.5 kg/ Biosol 10-15 % or Agnihotra ash one kg per hectare, need base application of BD- Pesticides, any crop can be grown without a gram of agro-chemicals.

Keeping in mind the ill impacts of industrial agriculture, it is most opportune time to initiate systematic research and its validation by scientists and few institutions. It's difficult to believe on my statements, but I urge please move out of box for any new innovations. In fact, there is dire need for mindset change from 'oil to soil based strategy'.

Conclusion

Enrich organic input with better nutrients and microbial population to make soil healthy and suitable for higher production. Crop cultivation on ridges in North-South direction, recycling of crop residue, mulching, frequent use of Jeevamrit during field preparation & irrigation and 4-6 times foliar spray of CPP/ Biosol, Panchagavya/ Vermi wash as per convenience, without use of a gram of agrochemicals higher production could be obtained in all crops all situations. Building up of right microbial culture is much more important than to count N, P and K in the menu. Feeding N, P and K through chemical route, will not sustain agriculture for long what is being experienced. Owing to NPK mindset in recent decades, there is need for change of mindset from 'oil to soil'.*We must respect mother Earth with respect, conserving the land will conserve humanity.* Relevant available data will be presented but there is need of systematic research and validation.

◆◆◆◆◆◆

Session-1

Crop Improvement and Genetic Enrichment

INVITED LECTURES

I-1 Conservation of Horticultural Diversity at ICAR-NBPGR

Sandhya Gupta, Vartika Srivastava and G P Singh
ICAR-National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi-110012

The Indian Council of Agricultural Research-National Bureau of Plant Genetic Resources (ICAR-NBPGR) was established in 1976 with the mandate to act as a nodal institute at the national level for the acquisition and management of indigenous and exotic plant genetic resources (PGR) for food and agriculture, as well as to carry out related research and human resource development. The Bureau manages huge genetic diversity of various agri-hoticultural crops through a strong framework of national network of Regional Stations, ICAR Institutes and SAUs. The ICAR-NBPGR headquarters at New Delhi house the world's second largest genebank, which includes a Seed Genebank for storage of orthodox seeds and state-of-the-art facilities for medium-term and long-term conservation of horticultural crops (vegetatively propagated/ producing non-othrodox seeds) in the *In Vitro*Genebank and Cryobank, respectively. *Ex situ* conservation of perennial horticultural species is being carried out at the field genebanks at Regional Stations situated at different agro-ecological zones. In the National Genebank, presently 4,62,982 accessions of orthodox seeds are conserved, including 42,415 accessions of different horticultural crops. A total of 12,573 accessions, including 7,595 accessions of horticultural crops bearing intermediate and recalcitrant seeds are being conserved in the Cryobank using seeds, embryo and embryonic axes as explants and vegetative dormant buds of fruit crops such as *Morus* spp., *Salix* spp. and others (389 accessions), as well as pollen of Mango, Litchi and others (642 accessions). In the *In Vitro*Genebank, 1,964 accessions of mandated crops are currently maintained *in vitro* in the form of 40,000 cultures and/or *in vitro* cryopreserved meristems/shoot tips. Complementary conservation strategies are immensely important to ensure the effective conservation of horticultural crops.

◆◆◆◆◆◆

I-2 PVP in Respect to Horticultural Crops in India

U. K. Dubey
Protection of Plant varieties and Farmers' Rights Authority
Ministry of Agriculture & Farmers' Welfare, Government of India, New Delhi -110012.

The "Protection of Plant Varieties and Farmers' Rights Act" (53 of 2001) is a unique Act which fulfills the spirit of International Treaty on Plant Genetic Resources for Food & Agriculture (ITPGRFA). It also strikes a balance between the rights to breeders and the farmers as per the national requirement. The Authority, since its establishment in the year 2005, has been consistently improvising the system of registering the plant varieties, connecting the stakeholders, encourage innovation in seed sector, acknowledge the contribution by the farmers/ communities towards conservation of plant genetic resources and making them available to plant breeders, established a National Gene Fund, build and maintain gene banks etc. The Government of India has notified 179 crop species on the recommendations of PPV&FR Authority for plant variety registration.

Objectives of the PPV&FR Act, 2001:

- To establish an effective system for protection of plant varieties, the rights of farmers and plant breeders and to encourage the development of new varieties of plants.
- To recognize and protect the rights of the farmers in respect of their contribution made at any time in conserving, improving and making available plant genetic resources for the development of new plant varieties.
- Toaccelerate agricultural development in the country, protect plant breeders' rights; stimulate investment for research and development both in the public and private sector for development of new plant varieties.
- To facilitate the growth of seed industry in the country that will ensure the availability of high quality seeds and planting material to the farmers.

Salient features of the Act:

The PPV&FR Act is based on the option under TRIPS Agreement for a member country to protect the rights of plant breeders sui generis system by enactment by legislation if they would not opt for UPOV (International Union for Protection of New Varieties of Plants, Geneva) Convention and is also unique in the sense that it concurrently recognizes the rights of plant breeders, farmers (including their right as plant breeders), farming communities and researchers who breed new varieties as well as those already bred and existing prior to protection (extant). It confers exclusive rights upon the breeder or his successor, his agent or licensee, to produce, sell, market, distribute, import or export of the registered variety. As far as farmers' rights are concerned, the Act recognizes a farmer as cultivator, conserver and breeder and provides that the farmers' variety can also be registered. Further, the Act provides for compulsory license of a registered variety, if the seeds/propagating material is not available to the public at a reasonable price or quantity. Any person or group of persons or any organization can also claim for benefit sharing, if the plant genetic material belonging to them is used in the development of a registered variety. The researchers are conferred the right to use any registered variety for conducting experiment or research and the use of a variety by any person as an initial source of variety for the purpose of creating the other varieties. India is a pioneer country where a national legislation has been enacted to establish and secure Farmers' Rights. The Act also recognizes the past, present and future contributions of the farming communities and provides an opportunity for the award to farming communities/farmers for their contributions in agro-biodiversity conservation.

PPV&FR Authority

The PPV&FR Authority is a Statutory Body established by the Parliament of India through the PPV&FR

Act of 2001. The Authority is a body corporate, having perpetual succession and a common seal with the power to acquire, hold and dispose of movable and immovable properties and to contract and shall by the said name sue and be sued. The head office of the Authority is at New Delhi and it is functioning from a leased space in the premise of the National Agricultural Science Centre Complex, Dev Prakash Shastri Marg, Pusa Campus, New Delhi.

Plant variety registration

The PPV&FR Authority has finalized the distinctiveness, uniformity and stability (DUS) test guidelines for registration of **179** crop species covering cereals, pulses, millets, oilseeds, spices, vegetables, flowers, medicinal and aromatic plants and fiber crops. The Authority has issued **5084** certificates of registration for plant varieties **(under new, extant and farmers' variety category)** till 16.12.2022. To facilitate more applications seeking plant varieties protection from different stakeholders, the Authority regularly organizes/supports awareness and capacity building programmes. The PPV&FR Authority has also established network of DUS test centres across the country under the Central Sector Scheme for the implementation of PPV&FR Act, 2001, to verify the claims of candidate varieties by applicants, maintenance breeding, multiplication of reference/example varieties/ the varieties notified under section 5 of the Seeds Act, 1966 and generation of database for varietal characteristics as per crop specific DUS (Distinctiveness, Uniformity and Stability) guidelines. In addition, DUS tests for the candidate varieties are being conducted at crop specific centres. The data recorded as per the DUS test guidelines is submitted by these centres to Authority for further analysis. The Authority, in consultation with the ICAR institutes and SAUs has identified potential crop species of economic importance and supports projects for the development of the DUS guidelines. The Authority has established its National Gene Bank, field gene banks across the country. It regularly publishes Plant Variety Journal of India and maintains the National Register of Plant Varieties at Headquarters and also its branch offices.

Categories of protection of plant varieties

The plant variety protection as enshrined in the Act follows a broad principle of internationally recognized system of DUS and novelty for a new variety. Any person can apply for registration in any of the following:

New variety of such genera and species as specified under section 29(2) of the Act.

Extant variety (To a limited period after the species is notified (in the case of new and VCKvarieties) as announced time to time by the Authority)

- Notified under section 5 of Seeds Act, 1966,

- Variety of common knowledge (VCK),

-Farmers' variety

- Traditionally cultivated and evolved by the farmers in their fields,

- Wild relative or landrace of a variety about which the farmers possess common knowledge.

Essentially derived variety (EDV)

A variety predominantly derived from an initial variety, or from a variety that itself is predominantly derived from such initial variety, while retaining the expression of the essential characteristics that result from the genotype or combination of genotypes of such initial variety.

Registration Of Plant Varieties

An application for registration of a plant variety and its denomination can be made under the following

categories:

- **New Variety:** On the date of filing of application for registration if the variety has been commercialized for period of less than one year then it is a new variety
- **Extant Variety:** Consist of the following categories namely:
  - **Extant variety notified** under section 5 of Seeds Act, 1966: Varieties notified under Section 5 of Seeds Act, 1966 are eligible for registration under this category
  - **Variety of Common Knowledge:** which are not notified under Section 5 of Seeds Act, 1966 and are in commercial chain for more than a year
- **Essentially Derived Variety:** A variety pre-dominantly derived from an initial variety and should fall either under new or extant category
- **Farmers' variety:** Traditionally cultivated and evolved by the farmers in their fields and includes wild relative or land race or a variety about which the farmers possess common knowledge

Extent and Nature of Field-Testing (DUS Testing) of Varieties

The application is processed and depending on the category of the variety claimed for registration, the applicant is required to deposit DUS test, registration and any other fees, as may be required. After receipt of necessary fees and seeds and to a satisfactory examination of the application at the Plant Varieties Registry, the Registrar shall send the variety to crop specific centres for conducting DUS test. The period of DUS testing is as follows:

New Varieties: Two similar crop seasons at two locations.

Farmers' Variety and VCK: One crop season at two locations.

Extant variety notified under section 5 of Seeds Act, 1966: No DUS testing is conducted but variety is processed by an Extant Variety Recommendation Committee (EVRC) as per regulation 6 of PPVFR Regulations 2006.

EDV: DUS testing is not mandatory but field test is conducted to ascertain DUS criteria.

After the receipt of DUS test result, the application is processed and distinctiveness is ascertained through DUS test and comparison across the database. Subsequently, the passport data of the variety is published in the Plant Varieties Journal of India. The application is advertised in Plant Variety Journal of India inviting opposition within a period of three months from the date of publications. If no opposition is filed or if opposition filed is rejected, the variety proceeds for registration.

Protection Period in Different Types of Crops:

A total of 179 crop species are presently eligible for protection. The total period of protection for field crops is of 15 years with 6 years of protection at the time of registration renewable to next 9 years, whereas that of trees and vines is for 18 years with 9 years of protection at the time of registration renewable to next 9 years. The extant varieties notified are given a protection for 15 or 18 years for field crops or trees and vines respectively, from date of notification under Seeds Act, 1966.

Award/Rewards to Farmers'/Farming Communities:

Section 45(2) of the Act reads with Rules 70 (2) (a) of PPV&FR Rules, 2003 provides for support and reward, to farmers, communities of farmers, particularly the tribal and rural communities engaged in conservation,

Award	Details	Application
Plant Genome Saviour Community Awards	Five farming communities are awarded each year. Each award includes a citation, a memento and Rs. 10 lakhs.	Advertisement for these awards is published in the National dailies and on the Authority website: (http://www. plantauthority. gov.in/forms .htm)
Plant Genome Saviour Farmers' Rewards	Ten farmers are rewarded every year. Each reward includes a citation, a memento and cash of Rs. 1.5 lakh.	The applications should be forwarded by Chairperson/Secretary of the concerned Panchayat Biodiversity Management Committee or Concerned District Agricultural Officer or Director of Research of Concerned State Agriculture University or Concerned District Tribal Development Officer
Plant Genome Saviour Farmers' Recognitions	Twenty farmers are rewarded every year. Each reward includes a citation, a memento and cash of Rs. 1 lakh.	

improvement and preservation of genetic resources of economic plants and their wild relatives, particularly in areas identified as agro-biodiversity hotspots from National Gene Fund. To operationalize these provisions, Plant Genome Savior Community Award was instituted in 2009–10. A maximum of five such awards can be conferred annually. Along with this, ten farmers are conferred the Plant Genome Saviour Farmer Reward and twenty farmers are conferred Plant Genome Saviour Farmer Recognition certificates. The details of the awards conferred are mentioned in Table below. The selection of awardees is made by a committee of experts/ scientists headed by an eminent scientist/ subject matter specialist.

Status of Horticultural crops

A total of 17691 applications were received for registration till date of which 5080 certificates of registration (RC) was issued as on 16.12.2022. In case of horticultural crops a total of 3947 applications were received out of which 555 registration certificates were issued.

The status of horticultural crops as under:

S.No.	Cucurbits	Applications received	RC issued as on 16.12.2022
1	Bitter Gourd	116	11
2	Bottle gourd	172	12
3	Cucumber	90	4
4	Pumpkin	101	3
5	Ridge gourd	60	3
6	Sponge gourd	5	0
	Total	**544**	**33**

S. No.	Category	Applications Received	RC issued as on 16.12.2022
1	Cucurbits	544	33
2	Flowers	87	11
3	Fruits	748	64
4	Medicinal and aromatic plants	18	1
5	Plantation crops	29	6
6	Spices	528	41
7	Tuber crop	3	-
8	Vegetables	1990	399
	Total	**3947**	**555**

S.No.	Flowers	Applications received	RC issued as on 16.12.2022
1	Bougainvillea	3	0
2	Canna	1	0
3	Carnation	1	1
4	Chrysanthemum	16	0
5	Gladiolus	7	0
6	Jasmine	1	0
7	Marigold	10	0
8	Orchid	11	5
9	Rose	35	4
10	Tuberose	2	1
	Total	87	11

S.No.	Fruits	Applications received	RC issued as on 16.12.2022
1	Acid lime	26	0
2	Almond	1	0
3	apple	14	2
4	apricot	43	30
5	bael	13	0
6	banana	38	0
7	cashew	5	1
8	cherry	1	0
9	custard apple	10	1
10	date palm	3	0
11	grapes	42	13
12	guava	10	2
13	indian jujube (Ber)	174	0
14	Jackfruit	14	0
15	jamun	5	0
16	litchi	2	0
17	mandarin	2	0
18	mango	273	8
19	mulberry	6	0
20	papaya	27	0
21	peach	6	0
22	pear	4	0
23	pomegranate	11	3
24	seabuckthorn	3	0
25	sweet orange	3	0
26	walnut	12	4
	Total	748	64

S.No.	Medicinal and Aromatic	Applications received	RC issued as on 16.12.2022
1	Betelvine	1	0
2	Brahmi	3	0
3	Indian gooseberry	1	0
4	Isabgol	2	0

5	Karanji	1	0
6	Menthol (Mint)	8	0
7	Noni	2	1
	Total	18	1

S.No.	Plantation Crops	Applications received	RC issued as on 16.12.2022
1	Coconut	25	6
2	Tea	4	0

S.No.	Spices	Applications received	RC issued as on 16.12.2022
1	Black pepper	13	9
2	Coriander	102	1
3	Fenugreek	36	1
4	Garlic	86	8
5	Ginger	78	3
6	Nutmeg	31	0
7	Small Cardamom	17	9
8	Turmeric	165	10
		528	**41**

◆◆◆◆◆◆

I-3 Indian Walnut: Status, Constraints and Prospects

R. M. Sharma, A. K. Dubey, O. P. Awasthi, A. K. Goswami and Nimisha Sharma
Division of Fruits & Horticultural Technology
ICAR-Indian Agricultural Research Institute, New Delhi

Walnut has tremendous economic importance due to its nourishing nuts and excellent wood quality. Mainly, three types of walnuts are grown worldwide namely Persian walnut (*Juglans regia*), black walnut (*J. nigra*) and white or butternut walnut (*J. cinerea*), however, only Persian walnut is being grown commercially in India. Walnut is seed (kernel) food of plant origin, which is a rich source of minerals (Cu, Mn, Ca, Zn, Mg, K, Se, Fe, I etc.), vitamins (A, E, K, B1, B2, B6, B9 and B12), fat (56.4-70.6%), protein (13.6-22.3%), carbohydrate (8.05-13.23%) and ash (2.0%). The walnut fat is composed of 72% polysaturated fatty acids (59% linoleic and 13.0% α linolenic), 18.0% monosaturated fatty acids (oleic acid) and 10.0% saturated fatty acids. Most of the required amino acids can be supplied, if walnut is consumed together with legumes. In addition, walnut is a good dietary source of antioxidants (catechin, ellagic acid, ellagitannins and melatonin). The ingredients contained in the nuts are expected to decrease the incidence of cancer, delay or mitigate neurodegenerative diseases and reduce the severity of cardiovascular diseases.

It is estimated that 2314.71 thousand tons walnut is being produced in the world (Statista, 2021-22). China is the leading walnut producer (47.52%), followed by USA (28.41%), Chile (16.60%), Europen Union (6.31%), Ukrain (4.98%), Turkey (2.94%) and India (1.55%). In India, highest walnut production is being contributed by Jammu and Kashmir (91.68%) followed by Uttarakhand (6.71%), Himachal Pradesh (1.39%) and Arunachal Pradesh (0.22%). India exports 248.55 tonns walnut (mostly kernel) worth of Rs 73.98 crores annually. Simultaneously, India imports 30087.75 tonns of walnut annnually, particularly from Chile (70.12%), USA (12.61%) and Iran (2.36%) valued to Rs 474.44 crores, because of high domestic demand. Even then, the per capita walnut consumption in India is lower (0.02 Kg) as against USA (2.72 Kg) and China (1.8 Kg).

The efforts made so far to boost the Indian walnut industry is meager, as this industry has several constraints like spring frost injury, poor supply of quality planting materials (18000-20000 plants against the demand of lakhs of plants per year) including scion and rootstocks with intended traits, costly planting materials (Rs 300-800/ grafted plant and Rs 15-20/ rootstock), high mortality in young plantations (20%), huge variability in nuts harvested from the seedling trees, poor nut yield (30-40 Kg/tree) and low shelling percentatge (mostly 48-52%), strict restrictions under J&K Prevention of Specified Tree Act, 1969, excessive rains at the time of nut harvesting, genetic erosion, biotic stresses (walnut weevil, anthracnose, foot rot, mistletoe parasite etc.), poor export due to non-availability of sufficient produce, huge investment for import, poor technical-know how about the extraction of nut and kernel in respect of hygiene etc.

Keeping in view the availability of vast underutilized area and high domestic and overseas demands of Indian walnuts, some interventions at various levels (farmers, development department, researchers and State Government) including systematic walnut improvement, conservation of huge genetic wealth, value addition including kernel, wood and shell, scrapping of stringent law, precise control of pests and diseases and creation of nursery infrastructure are essentially required to revolutionize the Indian walnut industry.

◆◆◆◆◆◆

I-4 Exotic MinorFruits: Genetic Resources and utilization

Dr. Prakash Chandra Tripathi
Division of Fruit crops
ICAR -Indian Institute of Horticultural Research, Bangalore

Minor fruit cropsrefer to those fruits which may be high in value but that are not widely grown. An exact definition of minor fruit crops is perhaps difficult. In a general sense, these fruits are consumable by in relatively less quantity may be due to less palatable or less availability than other fruits. These fruit s may have lesser demand in the market or grown in a limited extent. Other terms for these fruits are less-known, less appealing, less-exploited fruits, underutilized, stray fruits, wild fruits etc. However, any sharp line of distinction between the major and minor fruits is difficult. A fruits which is major fruit in one region or country may be minor in other region or country. The minor crops may categorised in several groups such as tropical and subtropical; native and introduced. Alongside their commercial potential, many of the underused crops also provide important environmental services, as they are adapted to marginal soil and climate conditions. Globally there are more than 4200 edible fruits are nuts species .Out of these 3000 Species are of tropical origin and 1200 speices are of Temperate origin. The Distribution of Underutilized Edible Fruits and Nuts in the Regions of Diversity is given in Table1 (Source: Zeven and de Wet (1982) in O.P. Pareek, Sunil Sharma and R.K. Arora (1998).

Table 1. Distribution of Underutilized Edible Fruits and Nuts

Region	Species	Region	Species
Chinese-Japanese	222	African	131
Indochinese-Indonesia	226	European-Siberian	62
Australian	57	South American	263
Hindustani-Indian	344	Central American and Mexican	122
Central Asian and Near Eastern	38	North American	255
Mediterranean	30		

Several minor fruits such as Rambutan, mangosteen, longan, avocado, water apple, hog plum, macadamia nut, kiwifruit, longsat, durian, passion fruit, dragon fruit, pulasan, carmbola, etc. were introduced during last few centuries and several are naturalized in Indian conditions (Arora, 1985; Arora, 1998. Pareek*et al.*, 1998; Table 2). Several fruit plant species as rambutan, mangosteen, longan, avocado, water apple, hog plum, macadamia nut, longsat, durian, passion fruit, dragon fruit, pulasan, carambola, etc. were introduced during last few centuries and several are naturalized in Indian conditions.

Table 2 : Exotic Minor Fruits in India

Common Name	Scientific Name	Family	Common Name	Scientific Name	Family
West Indian Cherry	*Malpighia glabra*	Malpighiaceae	Malay Apple	*Syzygiummalaccense*	Myrtaceae
Durian	*Duriozibethinus*	Malvaceae	Mangosteen	*Garcinia mangostana*	Clusiaceae
Soursop	*Annona muricata*	Annonaceae	Rambutan	*Nepheliumlappaceum*	Sapindaceae
Passion Fruit	*Passiflora edulis*	Passifloraceae	Custard Apple	*Annona squamosa*	Annonaceae
Atemoya	*Annona atemoya*	Annonaceae	Manila Tamarind	*Pithecellobium dulce*	Fabaceae
Dragon fruit	*Hylocereus.spp*	Cactaceae	Avocado	*Persia americana*	Lauraceae
Longan	*Dimocarpuslongan*	Sapindaceae	Macadamia nut	*Macadamia integrifolia*	Proteaceae
Longsat	Lansiumdomesticum	Meliaceae	Manila Tamarind	*Pithecellobium dulce*	Fabaceae
Kiwifruit	*Actinidia chinensis*	Actinidiaceae	Java Apple	Syzygiumsamarangense	Myrtaceae
Surinam cherry	Eugenia uniflora	Myrtaceae	Tamarind	*Tamarindusindica*	Fabaceae
Persimmon	*Diospyros kaki*	Ebenaceae	Hickory	*Caryatomentosa*	Juglandaceae
Egg fruit	Pouteriacampechiana	Sapotaecae	Carambola	*Averrhoa Carambola*	*Oxalidaceae*

Very recently rambutan, avocado, dragon fruit etc. have became popular in several parts of the country. As far the genetic resources of exotic fruits are concerned, the variability in these fruits is limited. Some of these fruits were introduced almost one century back and grown in home stead gardens. Most of the present accessions available in these fruits have been collected from these home stead gardens. The area under minor fruits is around 10 percent of the total area under fruits and production is less than 7 percent of total fruits production. Most the the minor fruits are cultivation in dry and less fertile lands thus the productivity is low except in jackfruit. Among them highest area is under jack fruit followed by kiwi fruit and Aonla. The cultivation of kiwifruit is confined to hill states of North India. The custard apple also occupied sizeable area under cultivation particularly in the arid and semi arid regions.

Important of exotic Minor fruits

A number of species of minor fruits are being used by the people in Asia and Africa as suitable food, food supplements and sources of spices and condiments, edible oils etc. These provide life support and ameliorate the rigours of unfavourable conditions. In African plum tree (*Dacryodes edulis*) provide food during off season (Okafar, 1991). The peach palm (*Bactris gasipaes*) of South and central America is another example. Some underutilized fruits and nuts are god source of protein. These are Macadamia nut (*Macadamia integrifolia*), Pilinut (*Canarium ovatum*), java almond (*Canarium indicum*, Shea butter tree (*Butyrospermumparkii*), brazil nut (*Berthlletia excelsa*), African bread fruits (*Treculia africana*), marula nut (*Sclerocaryacaffra*), Mogongo nut (*Ricinodendronrautanenii*), Melinjo (*Gnetumgnemon*), pine nut (*Pinus edulis*),butternut (*Juglans cineria*) etc (Pareek *et al*., 1998) are good source of protein. Most of the fruits are rich in carbohydrates. Among the minor fruits Bael (*Aegle marmelos*) , Bread fruit (*Artocarpus altilis*), Galonut (*Anacolosa frutescense)* pulp, Sancoya (*Annona purpurea*), Pejibaye (*Bactris gasipaes*), Chinese chest nut (*Castanea mollissima*) Phog (*Callgonum polygonoides*), Durian (*Durio zebithinus*) contain higher amount of carbohydrates (Gopalan *et al*., 1994; Pareek *et al*., 1998). Most of the nuts Chinese Chest nut (*Castanea mollissima),*Oysternut (*Telfairea pedata*), Macadamia nut (*Macadamia integrifolia*), Brazil nut (*Bertholletia excelsa),* Pilinut (*Canarium ovatum*), Grugrunut (*Acromia totai*) pulp, Shia butter tree (*Butyrospermum parkii*), Marula nut (*Sclerocary acaffra*) seed are rich in fats. Among the pulpy fruits Avocado (*Persia americana*) pulp is rich in fat. Some of the underutilized fruits such as *Astrocaryumacu leatum* (51667IU), *Eugenia stipitata* (12917 IU), melinjo leave (*Gnetumgnemon*) (10889 IU), peach palm (*Bactrisgasipaes*)(7300 IU), persimmon (*Diospyrus kaki*) (2710IU), Barbados gooseberry (*Pereskiaaculeata*) (3215 IU), Eggfruit (*Pouteriacampechiana*)(2000IU), Cape goose berry (*Physalis peruviana*) (1000-5000 IU) are rich source of Vitamin A. Pine nut (*Pinus edulis*), Coastal copper (*Capparis spinosa*), Shia butter tree (*Butyrospermum parkii*) are rich source of Vitamin A (Pareek *et al*., 1998). Chinese Chest nut (*Castanea mollissima)*, Mahua (*Madhuca indica*) flower, Ilama *(Annona diversifolia)* , Egg fruit (Pouteriacampechiana)are rich source of Vitamin B2 .Some the very rich source of vitamin c are Barbados cherry (*Malpighia glabra*, 1550-5600 mg), Camu-camu (*Myrciaria dubia*,2994-4000 mg), jaboticaba (*Myrciaria cauliflora*, 700-2400 mg), seabuckthorn (*Hippophae rhamnoides*, 600-2500 mg), cabeludinha (*Eugenia tementosa*, 931 mg). Beal, durian, macadamia nut sour sop are rich source of potassium. Beal, durian, macadamia nut sour sop are rich source of potassium . Soncoya (*Annona purperea*), Brazil nut (*Bertholletia excelsa)*, are good source of phosphorus. Durian (10 mg), longan (10 mg), Carambola (10 mg), Barbados cherry (18 mg) are good source of magnesium((USDA database, 2017). Among the minor fruits durian (28 mg), mangosteen (0.21 mg), Carambola (0.12 mg), are good source of Zinc (USDA, 2017).

2. Conservation

Some of these exotic species were introduced in India during last 500 years form different regions. Some of them naturized in all over India and some are confined to some species areas due to some reasons such specific climatic requirements, dietary suitability. Thus a little variability is found in most of the exotic minor fruits

in the country. Little of work on exploration of these fruit species have been done in India. These species are found in homestead garden in several regions of south India. But there is no systematic conservation have been so far in India on these crops. Recently some of the commercial varieties are these crops are being imported by several privte firms, nurseries. Some of these species have been conversed by some of ICAR institutes, State Agricultural Universities and Research stations (Table 3).

Table 3. Detail of some of the wild species conserved at different organizations

Institute	No. of species	Major species and No. of Accessions
IIHR, Bangalore	**11**	Macadamia nut (5), longan (1), mangosteen (1), dragon fruit (1), Barbados cherry(1), Surinam cherry (2), Manila tamarind(1), snake fruit (1), avocado (4), miracle fruit(1), green sapota (1), Malayan apple (3),Peanut butter fruit (1), Olive (1), Quanquat (1), Blue berry (2)
CHES, Chettalli	**13**	Rambutan (150), Macadamia nut (1), longan(20), mangosteen (9), durian (3), dragon fruit (3), Pulasan (1), avocado (65), Passion fruit (12), Barbados cherry (1), Velvet apple (1), Green sapota (1), Malayan apple (32)
CHES, Hirehalli	**3**	Dragon fruit (56), Barbados cherry, Surinam cherry, avocado (16), miracle fruits(1)
Fruit Research station, Kullar	**3**	Rambutan, longan, mangosteen, durian
Fruit Research station, Burilar	**3**	Rambutan, longan, mangosteen, durian,
KAU, Thrissure	**1**	Rambutan
TNAU, Coimbatore and its regional centre	**1**	Avocado (60)

Source: Websites of Institutes and personal Communications

3.0 Utilization

Recent decades some of the commercial varieties of rambutan, avocado, mangosteen have been introduced by Govt and private nurseries. Some of varieties and elite lines of some fruits such as Rambutan , avocado, passion fruits etc have been identified and released but the overall

Crops	Variety	Promising line
Rambutan	Arka Coorg Arun Arka	CHESR-14
	Coorg Peetah (CHES)	CHESR-26
Passion fruit	Kaveri	-
Avocado	TKD-1	CHESA-1, CHESPA-III-1
	Arka supreme,	CHESPA-XIII-1, Avocado-12
	Arka Coorg RAvi	
Malayan apple	-	CHESM-1

Genetic base of the accessions available in India is very narrow. These are needed to introduce more accessions from their respective centres of origin. So that more varieties and lines suitable for different agro-climatic region of the country may be identified.

◆◆◆◆◆◆

I-5 Underexploited horticultural crops of North East India and their exploitation potential

B.N. Hazarika
Central Agricultural University, College of Horticulture and Forestry,
Pasighat -7911102, Arunachal Pradesh

The North-East India the richest reservoir of plant diversity in India and is one of the 'biodiversity hotspots' of the world supporting about 50 % of India's biodiversity. The distinct tribes in the region have rich indigenous knowledge system on the use of components of biodiversity for their daily sustenance like food, fodder, shelter and healthcare. The region has several unique features such as fertile land, abundant water resources, evergreen dense forests of about 66%, high rainfall and agriculture-friendly climate. Its unique phyto-geographical positions, topography and high degree of precipitation are some of the important factors which are mainly responsible for its enormous biological diversity. As a result, an array of diverse plants is grown across the region ranging from tropical to alpine. A large number of diversity in fruits belonging to the genera Artocarpus, Annona, Averrhoa, Garcinia, Musa, Passiflora, Phyllanthus, etc. are reported from the region. Besides diverse vegetables particularly wild leafy vegetables, rare genotypes of cucurbits, solanaceous vegetables, chilli, ginger, turmeric, etc. are there with some unique quality because of their locational advantage. The region has a great ethno-cultural diversity with major and sub-tribes, which explains the wealth of traditional ecological knowledge among farmers. People of region have their own culture, tradition and medicinal system of treatment and knowledge acquired through close observation of nature. Its ethnic people living in the remote forest areas still depend to a greater extent on the forest ecosystems for their livelihood This paper will discuss the potentialities of underutilized plants of North-East India.

◆◆◆◆◆◆

I-6 Diversification of Temperate Fruits in Western Himalayas: An alternate to Climate Change

Desh Beer Singh
Former Director, ICAR-Central Institute of Temperate Horticulture
Old Air Field, Rangreth, Srinagar-07, J & K.

Variation in climatic conditions and short term abrasions in weather parameters has raised levels of uncertainty, vulnerability and risk of investments in horticulture. In the face of warmer temperatures due to climate change, winter chill requirements will become harder to meet in many important temperate-fruit and nut-producing areas. There is large scope for diversification of temperate fruits which can fit in to changing climatic situations and can tolerate biotic and abiotic stress under fragile Himalayan ecosystem. The identification of new species, their characterization, conservation and sustainable utilization is the key to improve agricultural productivity and sustainability, therefore contributing to national development, food security and poverty alleviation. Variation in climatic conditions and short term abrasions in weather parameters has raised levels of uncertainty, vulnerability and risk of investments in horticulture. In the face of warmer temperatures due to climate change, winter chill requirements will become harder to meet in many important temperate-fruit and nut-producing areas. Future fruits like black berries, raspberries, persimmon, rose hips, Chinese jujube, cape gooseberries, currants, kiwi fruit, nectarines, olive and un tapped nuts like hazel nut, chest nut having nutraceutical, ecological and economical importance special attention in respect of introduction, collection, evaluation, production technology, sustainable exploitation. Majority of these future fruits, such as strawberry, blackberry, blue berry, currants, crane berry, gooseberry, rosehips, kiwi, lingon berry, red currant, rasp berry, sour cherry, apricot, peach etc contain phytochemicals of nutraceutical importance. These phytochemicals, either alone and/or in combination, have tremendous therapeutic potential.

◆◆◆◆◆◆

I-7 Genetic Improvement in Onion for Wide Adaptability

Amar Jeet Gupta, V. Mahajan and Major Singh
ICAR-Directorate of Onion and Garlic Research,
Rajgurunagar-410 505, Pune (Maharashtra)

Onion (*Allium cepa* L.) is an important vegetable crop grown and consume throughout the world. Diverse genetic materials are required to meet the everchanging demands of crop improvement. Diversity in onion species occurs in the form of land races, traditional varieties, wild edible forms and related non-edible wild and weedy species. ICAR-Directorate of Onion and Garlic Research, Pune has been identified as National Active Germplasm Site for onion and garlic germplasm collection and conservation in the country. Extensive germplasm surveys have been done from 16 states of the country in collaboration with ICAR-NBPGR as well as several lines of onion have been introduced from different countries through ICAR-NBPGR. A genepool of dark red, light red, white and yellow onion types have been collected. A total of 1264 germplasm accessions are being maintained at ICAR-DOGR consisting of 325 (dark red), 518 (light red), 309 (white), 35 (yellow), 9 (rose type), 62 (multiplier type), 89 (lines of 18 *Allium* species) and 82 (exotic).In India, about 72 onion varieties have been released from different public sector organizations and their number is expected to increase in future. Based on genetic improvement and selection in the germplasm, ten onion varieties have been released at national level. Among these Bhima Super, Bhima Red, Bhima Raj, Bhima Dark Red, Bhima Shubhra and Bhima Safed are suitable for *kharif* season whereas, Bhima Shakti, Bhima Kiran, Bhima Light Red and Bhima Shweta are suitable for *rabi*season. Bhima Shakti, Bhima Red, Bhima Raj and Bhima Shubhra are also suitable for late *kharif* which indicates that these varieties have wide adaptability in changing climate. All the ten onion verities have been notified by CVRC and in farmers' demand. Out of ten, nine onion varieties have been registered with PPV&FRA for their protection.One dark red onion unique line 'DOGR-1203-DR' has been registered as genetic stock for very early maturity and uniform neck-fall with ICAR-NBPGR whereas, one pink multiplier onion unique line 'DOGR-1549-Agg' registered as genetic stock for earliness and suitable for both *rabi* and *kharif* season. About 72 elite/ advance red onion lines are under evaluation for different traits and seasonal adaptability.

◆◆◆◆◆◆

I-8 Molecular basis of flowering regulation in Mango

Bal Krishna, S.N Vyavahare, S. I. Patil and P. V. Sane
Molecular Biology Lab, Jain R&D, Jain Hills,
Agri Park, Shirsoli Road, Jalgaon, Maharashtra, India, 425001

Flowering is an important aspect of plant biology and in mango it is one of the most crucial events for commercial success of crop. Flowering behavior of many popular mango cultivars is irregular or shows alternate year flowering. Number of factors are responsible for the induction of flowering in mango which includes horticultural, environmental, biochemical and genetic. Most of the genetic factors operate through an intricate network of genes. The network of these genes has been studied well in model plants and several flowering pathways have been identified. These include photoperiod pathway, vernalization, autonomous, gibberellins (GA) and a newly identified age pathway. In the past few years our group has been involved in characterization and expression studies of genes of flowering pathways in mango. Gene homologues were identified, cloned, sequenced and their expressions were studied at different phenological stages in various plant tissues. The florigen or flowering factor known for a long time is now identified as the *FLOWERING LOCUS T (FT)* gene in model plant. Homologue of the FT gene is also functional in mango and plays a central role in flowering regulation; it has at least three copies in the mango genome *(MiFT1, MiFT2 and MiFT3)*. Structurally a close relative of FT, flowering repressor *TERMINAL FLOWER LIKE 1* (*TFL1), MiTFL1* and *MiTFL1a* are also involved in regulation of flowering specially maintaining vegetative phase in mango. The *FLOWERING LOCUS D (FD)* which interacts with *FT* has also been identified by us in mango and is involved in regulation of flowering. Another important group of genes regulating flowering in mango are those regulated through circadian rhythm. These are *GIGENTIA (GI),FLAVIN BINDING KELCH REPEAT F BOX 1 (FKF1), CYCLIC DOF FACTOR 1 LIKE (CDF1)* and *CONSTANS (CO)*. *GI-FKF1-CDF1-CO* works as a module and seems to be working in mango although it is a day-neutral crop. The presence of temperature sensitive elements in the promoter region of GI may be the key to the temperature dependent flowering regulation in mango. Other genes involved in regulation of mango flowering are *SUPPRESSOR OF OVEREXPRESSION OF CONSTANS1 (SOC1)* and *SHORT VEGETATIVE PHASE (SVP)*. A group of microRNAs has been also identified in mango which is involved in regulation of flowering in model plants. The microRNA 172 (miR172) is a positive regulator and microRNA 156 (miR156) is a negative regulator of flowering in mango. The interaction of above positive (*MiCO1, MiCO2, MiFT1, MiFT2* and *MiFT3, MiFD, MiGI2, MiSOC1 and MiCDF1)* and suppressors (*MiTFL1, MiTFL1a* and *MiSVP)* leads to expression of meristem identity genes *APETALA 1 (MiAP1-1 and MiAP1-2) and LEAFY (MiLFY)* which regulate the development of floral organs. This work gives a comprehensive understanding on regulation of flowering in mango in the light of the current knowledge of molecular biology of flowering.

◆◆◆◆◆◆

ORAL PRESENTATION

Collection and evaluation of local turf grass germplasm of the South Gujarat region

M.A. Patel, S.L. Chawla and Dipal S. Bhatt
ASPEE College of Horticulture, Navsari Agricultural University, Navsari - 396 450, Gujarat

ABSTRACT

Turf is one of the blessing of nature and considered as the soul of garden, because the lush green lawn provides a great satisfaction to the owner and becomes a center of the garden for major activities and also widely used for many sports. There is an immense scope for the collection and exploitation of local turf grasses around the South Gujarat regions. Keeping in view the importance of collection and evaluation of turf grasses, an investigation was carried out during 2017-2020 at Floriculture Research Farm, NAU, Navsari to exploit the local turf grass genotypes for their different uses. Total 09 (nine) local genotypes were collected from different areas and evaluated along with the *Cynodondactylon* L. cv. Selection 1 which is widely used for sports as well as utility turf in India. The experiment was laid out in Randomized Block Design with three replications. Among the 10 genotypes,G_{9} (*Cynodon dactylon* L.) showed the superior result and was at par with the Selection 1 for the salient characters *viz.,* turfing ability, aesthetic appearance and turf intensity. The local genotype G_{9} also showed the excellent performance with higher establishment rate (minimum days taken for 90% coverage) along with higher root depth, lowest shoot root ratio as compared to Selection 1. Thus, it can be further explored to use under water scarcity area.

◆◆◆◆◆◆

Study on genetic divergence in various genotypes of watermelon [*Citrullus lanatus* (Thunb.) Mansf.]

Uday Singh
Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004, Haryana

ABSTRACT

The experimental material was consisted of twenty-one genotypes of watermelon, raised in RBD design with three replications during *summer* season 2020-21, at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar (Haryana). The results of the analysis of variance indicated that substantial genetic variability was present among the twenty-one genotypes for yield and yield attributing characteristics. The twenty-one genotypes were grouped into six clusters using Tocher's method. The maximum intra-cluster distance was recorded for cluster III (49.75), which indicates the existence of maximum genetic variability within this cluster. Whereas, the inter-cluster distance was recorded maximum between clusters V and VI (94.81), which indicate that the genotypes present in these clusters had highest genetic diversity. So, it is desirable to select accessions from the clusters having high inter-cluster distance in the recombination breeding programs. The minimum inter-cluster distance was recorded between clusterI and cluster V (50.92), which indicate the close relationship between the genotypes presented in these clusters. Based on yield and yield contributing characters, the genotypes *viz.,* VRW-14, VRW-12, VRW- 20 and VRW-17 were found promising for the future improvement programme.

◆◆◆◆◆◆

Improvement of biofortified vegetables through transgenic approaches: A review

Mangilal1, K. D. Desai, Mahesha, K. N and A. D. Chaudhary
NAHEP-CAAST-M.Sc. Scholar, Department of Vegetable Science, ACHF, NAU, Navsari

ABSTRACT

Food security has been a top global concern in recent decades. The emphasis is now on nutritional security after taking a successful lead in food security. Vitamins and micronutrients are crucial for human growth and development, a lack of these substances cause "hidden hunger." Eliminating malnutrition in children and women in underdeveloped countries can be accomplished by improving these factors. Important elements of the biofortification programme are micronutrients and vitamins. The growth of staple crops (cereals and vegetables) with enhance micronutrient using conventional plant breeding methods, modern biotechnology and agronomical approaches is known as biofortification. Biofortification of vegetable varieties is the practice of increasing the essential micronutrients and vitamins, so as to improve the nutritional quality of the food supply and provide a public health benefit. It can be done by three major techniques, *viz.*, conventional breeding, agronomic approach and genetic engineering. Transgenic technology is used to deploy the genes of interest either from the primary gene pool or even unrelated organisms and deliver to the host plant genome with the desired trait expression to make it as useful and productive as possible. This process provides advantages like improving shelf life, higher yield, improved quality, pest resistance, tolerant to heat, cold and drought resistance. Improvement of nutritive value of a crop is major goal of any crop improvement programme in that way biofortification plays an important role in enhancement of nutritive value of crop.

◆◆◆◆◆◆

Performance of dahlia cultivars (*Dahlia variabilis* L.) under tarai region of Uttarakhand

Anju Pal and Priyanka Rilkotia
Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar-263145, U.S. Nagar, Uttarakhand

ABSTRACT

An experimnet was laid out to evaluate the growth and flowering performance of dahlia cultivars under *tarai* region of Uttarakhand. Eleven cultivars of dahlia were evaluated namely 'Sachin', 'Matungini', 'Pride of India', 'Jishu', 'Anadinath', 'Hiranmoyee', 'Lokeshwar', 'Pue Sona', 'Giani Zail Singh', 'Kenya Orange' and 'Tenzin'. The cultivar 'Tenzin' recorded the maximum plant height (108.50 cm), plant spread (51.37 cm), number of branches (11.23) and internodal length (17.76 cm). 'Hiranmoyee' recorded the least plant height 58.46 cm). Maximum stem girth (1.50 cm), flower stalk length (21.62 cm) and prolonged vase life (5.89 days) were observed in cultivar 'Jishu'. Maximum number of leaves per plant (99.79) and number of flowers per plant (19.91) were reported in 'Kenya Orange'. The cultivar 'Matungini' recorded the maximum leaf area (220.13 cm^2), flower diameter (21.85 cm) and flower weight (41.79 gm). Maximum number of days to bud appearance and days to flowering was recorded in 'Sachin' (90 and 119.50 days, respectively) whereas minimum was recorded in 'Matungini' (68.33 and 90.23 days, respectively). Maximum flowering duration was recorded in cultivar 'Lokeshwar' (59.26 days).

◆◆◆◆◆◆

Varietal Evaluation of Tuberose (*Polianthes tuberosa* L.) for its Suitability as Cut Flower Under Punjab Conditions

Madhu Bala, Mohini Prabha Singh and Shaik Rehana
Department of Floriculture and Landscaping, Punjab Agricultural University,
Ludhiana, Punjab, India, 141 004

ABSTRACT

Tuberose (*Polianthestuberosa L.*) being one of the most popular tropical ornamental bulbous flowering plant, is grown commerciallyfor its fragrant and attractive cut and loose flowers all over India.The cut spikes are used for bouquet making, vase decoration and flower arrangement. As commercial tuberose production grows in popularity, introduction, evaluation and identification of high yielding varieties for cultivation under Punjab conditions is necessary. Therefore, an experiment was laid out to evaluate the performance of fourdouble flowered tuberose genotypes (Bidhan Star, BRH-17; Bidhan Pearl, BRH-18; BRH-19 and Suvasini)at PAU, Ludhiana, Punjab during 2021-22 for sixteen growth and flowering parameters under randomized block design (RBD) with threereplications each. Among genotypes tested, theearly sprouting of bulbs (14.66 days), days to spike emergence (59.50 days), first floret opening (80.44 days)and flower diameter (3.86 cm) were observedto be the best in BRH-19 which also exhibited highest spikesnumber/clump (2.00),spikes per hectare (1.20), number of bulbs per clump(2.00) and bulbletsnumber per clump (14.00), suggesting that it can be grown to achieve maximum bulb yield. The genotype,Suvasini recorded an elevated spike length (77.17 cm),floretsnumber/spike (32.00), floret length (4.60 cm) and weight of 100 florets (268.91 g). Rachis length (32.19 cm) was, however, found maximum in BRH-17. It is hence, concluded that genotype,Suvasini is best suited as cut flower followed by BRH-18 and BRH-17, being equally good in their cut flower characteristics.These varieties were found promising for the large-scale commercial production in Punjab.

◆◆◆◆◆◆

Genetic Diversity of Aonla and Bael: A Boon for Climate Resilient Horticulture

D. Pandey
Princial Scientist and Director (Atg.)
ICAR - Central Institute For Subtropical Horticulture, Rehmankhera, P.O. - Kakori
Lucknow - 226 101 (Uttar Pradesh) INDIA

ABSTRACT

Cultivation of a fruit crop in an area depends on availability of congenial climate and suitable cultivars/ varieties. The understanding of plant responses to change in environmental conditions is crucial for cultivation of perennial fruit crops in climate change perspective because plant growth and development are strongly influenced by the perception of signals from the environment.Hence, basic information and study of relationship of plant responses to environmental conditions might be crucial for selection of suitable crops.

Seven commercial aonla cultivars *i.e.*, NA-6, NA-7, Krishna, Kanchan, NA-10, Chakaiya and Lakshmi-52 were selected for studies. Fruit bearing behaviour and biochemical traits were evaluated. Fruits of these cultivars were picked during different maturity period at fortnight intervals starting from 1st week of October 2015 to last week of February 2016. Different physical and biochemical parameters *i.e.*, fruit weight, fruit length, fruit breadth, TSS, acidity, ascorbic acid, total phenol, total sugar and reducing sugar were estimated using standard procedures. The cv. NA-7 (408.68 mg/100g) and NA-6 (454.34 mg/100g) recorded maximum ascorbic acid content when fruit were harvested in 1st week of October. Further, Kanchan (396.28 mg/100g) and Chakaiya

(399.23 mg/100g) performed best in the 1st week of November while, Lakshmi-52 (4040.39 mg/100g) and NA-10 (399.23 mg/100g) recorded highest ascorbic acid in 2nd week of November.

Similarly, nine cultivars of bael (*Aegle marmelos* Correa.) were characterized for morphological characters, flowering behaviour, physico-chemical traits and yield attributes under subtropical conditions. Results reveal that different cultivars exhibited considerable variation in vegetative characters, flowering behaviour and yield attributes. Maximum terminal leaf length (13.50 cm) and breadth (8.40 cm) was recorded in *cv*. CISH-B-2 whereas, lateral leaf length (10.38 cm) in *cv*. CISH-B-2 and lateral leaf breadth (6.54 cm) in *cv*. NB-5. Flower bud emergence was found to start from 2nd week of May to 3rd week of May while earliest flower bud emergence took place in *cv*. NB-5*i.e*. on April, 30. The flowering period starts from 15th May and till 29thJunewith peak flowering starts from 2nd week of June to 3rd week of June in most of the cultivars. Fruit weight in cv. NB-17 (1.80 kg), fruit circumference in *cv*. CISH-B-2 (50.01 cm), fruit length in *cv*. CISH-B-1 (17.20 cm) was found to be maximum. Minimum number of seeds/fruit were found in cultivar NB-5 (82 seeds/fruit), number of seed sacs in *cv*. Pant Shivani (11 seed sacs), seed percentage (0.364 %) in NB-17, shell weight in *cv*. CISH-B-2 (0.548 g), shell percentage (16.63 %) in Pant Aparna, shell thickness in *cv*. NB-5 (1.5 mm), pulp weight (1.30 kg) in *cv*. NB-17 and pulp percentage (82.39 %) in *cv*. Pant Aparna was found to be maximum respectively.

Drastic variation in climatic conditions is available in the different agro-climatic regions of the country. However, fruit crops having wider adaptability to climatic variations are still lacking.In view of variability in agro-climatic conditions as well as in climate change perspective, the utmost requirement is to promote fruit crops which can sustain vagaries of weather.Ample diversity of aonla and bael available in morpho-physiological traits may be harnessed for cultivation in different agro climatic zones for climate resilient horticulture.

◆◆◆◆◆◆

Genetic improvement in onion for wide adaptability

Amar Jeet Gupta, V. Mahajan and Major Singh
ICAR-:Directorate of Onion and Garlic Research, Rajgurunagar-410 505
Pune (Maharashtra)

ABSTRACT

Onion (*Allium cepa* L.) is an important vegetable crop grown and consume throughout the world. Diverse genetic materials are required to meet the ever changing demands of crop improvement. Diversity in onion species occurs in the form of land races, traditional varieties, wild edible forms and related non-edible wild and weedy species. ICAR-Directorate of Onion and Garlic Research, Pune has been identified as National Active Germplasm Site for onion and garlic germplasm collection and conservation in the country. Extensive germplasm surveys have been done from 16 states of the country in collaboration with ICAR-NBPGR as well as several lines of onion have been introduced from different countries through ICAR-NBPGR. A genepool of dark red, light red, white and yellow onion types has been collected. A total of 1264 germplasm accessions are being maintained at ICAR-DOGR consisting of 325 (dark red), 518 (light red), 309 (white), 35 (yellow), 9 (rose type), 62 (multiplier type), 89 (lines of 18 *Allium* species) and 82 (exotic).In India, about 72 onion varieties have been released from different public sector organizations and their number is expected to increase in future. Based on genetic improvement and selection in the germplasm, ten onion varieties have been released at national level. Among these Bhima Super, Bhima Red, Bhima Raj, Bhima Dark Red, Bhima Shubhra and Bhima Safed are suitable for *kharif* season whereas, Bhima Shakti, Bhima Kiran, Bhima Light Red and Bhima Shweta are suitable for *rabi* season. Bhima Shakti, Bhima Red, Bhima Raj and Bhima Shubhra are also suitable for *late kharif* which indicates that these varieties have wide adaptability in changing climate. All the ten onion verities have been notified by CVRC and in farmers' demand. Out of ten, nine onion varieties have been registered with

PPV&FRA for their protection.One dark red onion unique line 'DOGR-1203-DR' has been registered as genetic stock for very early maturity and uniform neck-fall with ICAR-NBPGR whereas, one pink multiplier onion unique line 'DOGR-1549-Agg' registered as genetic stock for earliness and suitable for both *rabi* and *kharif* season. About 72 elite/ advance red onion lines are under evaluation for different traits and seasonal adaptability.

◆◆◆◆◆◆

Genetic Diversity studies using morpho-molecular markers in Peach (*Prunus persica* (L.) Batsch)

Manika Goswami[1], Vikas Kumar Sharma[1], Som Dev Sharma[1] and Kaushal Attri[2]
[1]Department of Fruit Science Dr YS Parmar University of Horticulture and Forestry Nauni Solan 173230;
[2]Department of Plant Pathology College of Horticulture and Forestry Thunag Mandi, UHF Nauni 173230.

ABSTRACT

The rising interest in the stone fruits due to their high nutritive value and market demand initiated this investigation about genetic diversity study in peach (*Prunus persica*). Different markers *viz.*, biochemical, morphological and molecular markers can be used to study the genetic diversity studied among which morphological characterization forms the preliminary step. However genetic diversity cannot be revealed alone on the basis of morphological data, so molecular characterization should be done to avoid environmental variation and limited polymorphism. Total of twelve varieties of peach grown in H.P. has been characterized using morpho-molecular markers using RAPD markers. High heritability was observed in fruit length, yield, fruit weight, leaf breadth, stone width and leaf length. Stone weight had high phenotypic coefficient of variation (PCV) and moderate genetic coefficient of variation (GCV) followed by yield. Genetic and phenotypic correlation study showed that yield had positive and significant correlation with fruit length, fruit weight, fruit width, stone width and leaf width. Twenty two primers out of fifty two were found informative which resulted into thirteen unique bands. High polymorphism was observed among twelve cultivars of peach i.e.83.54%. The similiarity coefficient in twelve cultivars ranged from 0.090 to 0.667. Maximum similarity index was observed in Earligrande and Shan-i-Punjab (0.667) while minimum similarity index was observed in Pratap and Royal Paradelux (0.090).

Keywords: Heritability, Polymorphism, PCV(Phenotypic correlation coefficient), GCV(Genotyping correlation coefficient)

◆◆◆◆◆◆

Important Morphological Markers for characterization of mutants in Gladiolus Variety Prince of Orange

[1]Sheeba Belwal, [2]Ranjan Srivastava,[3]B.D. Bhuj, [4]Ajit Kumar,[5]Satish Chand, [6]Kanchan Karki
[1,2,3,4,5]G.B. Pant University of Agriculture & Technology, Pantnagar-263145 Uttarakhand
[6] Uttarakhand Council of Biotechnology, Haldi, Uttarakhand

ABSTRACT

The present investigation was carried out in the Model Floriculture centre of the university to induce/ release genetic variability and to isolate desirable mutants in the commercial gladiolus cultivar Prince of Orange. The standard size corms of were treated with different doses of gamma radiations (4.0 to 5.5 Kr) and Ethyl Methane Sulphonate (EMS) (0.2 to 0.6% for 6 hours). The EMS treated corms were thoroughly washed with distilled water and dried under shade before planting. The number of tillers increased with increased doses of

gamma rays whereas number and size of floret, spike length, rachis length, vase life, weight and size of corms and cormels were reduced. With increased concentration of EMS, an increase in plant height was obtained over control, with the tallest plant height, spike length and rachis length recorded at EMS (0.6%). Moreover, more lodging resistance was obtained as the EMS doses were advanced. However a decrease in survival percentage was obtained with the increment in the doses. As many as 09 mutants have been obtained which will be studied for stability in vM_2 and subsequent generations.

◆◆◆◆◆◆

Evaluation of Chrysanthemum cultivars under low Hills of Himachal Pradesh

Dr Priyanka Thakur, Ali Haidar Shah, Yogendra Adhikari,Manish Kumar and Sudhanshu Verma
Regional Horticulture Research and Training Station, Dhaulakuan (Sirmour)HP
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh

ABSTRACT

It is a well-known flower with significant commercial value. Different chrysanthemum cultivars exhibit a wide variety of diversity in terms of flower quantity, size, colour, duration of flowering etc. In the present investigation, efforts were made to evaluate 15 chrysanthemum cultivars for their growth and flowering characteristics being suitable for pot plant, bedding and cut flowers under low hills of Himachal Pradesh. The study was conducted at the Experimental Farm of Regional Horticultural Research and Training Station, Dhaulakuan during 2020-2022. The experiment was laid out in a randomized block design with 15 chrysanthemum cultivars (treatments), with three replications, under open field conditions. Among the 15 cultivars evaluated under study, plant height varied from 73.17 to 112.75 cm. The maximum plant height (112.75 cm) was recorded in Cv. Yellow Star while minimum (73.17 cm) in Cv. Ajay. Among all cultivars, days to flower varied from 121.00 to 144.17 days. The maximum days to flower (144.17 days) was recorded with Cv. Yellow Star while minimum (121.00) in Cv. Pusa Anmol. Among these evaluated cultivars, number of flowers per plant ranged from 5.83 to 64.33 flowers. The maximum number of flowers per plant (64.33) was recorded with Cv. Chandermallika while minimum (5.83) was recorded with Cv. Apricot Parasol. However, flower size varied from 3.27 to10.8 3cm in which largest flower size (10.83 cm) was recorded in cultivars Apricot Parasol and Yellow Star, respectively, while smallest size (3.27cm) was recorded with Cv. Yellow Button. Whereas duration of flowering varied from 24.33 to 40.67 days. Among all selected cultivars the maximum flower duration (40.67 days) was recorded with Cv. Yellow Button, whereas minimum (24.33) was recorded with Cv. Pusa Anmol.

◆◆◆◆◆◆

Breeding for introgression of scab resistance and quality improvement in apple (*Malus domestica* Borkh)

J. I. Mir, O. C. Sharma, K. K. Srivastava, N. Ahmed, W. H. Raja, S. U. Nabi, M Abas Shah, S Yasmeen, S Sami Ullah and M. A. Sheikh
ICAR-Central Institute of Temperate Horticulture, Srinagar – 191132 (J & K)

ABSTRACT

Apple is an important fruit crop cultivated worldwide for its immense market demand and consumer acceptance as a fresh fruit. Apple crop is exposed to a diverse set of environmental and biological factors that affect the productivity and quality. Maximum efforts and costs for apple production rely on reducing the incidence of fungal diseases especially apple scab caused by *Venturia inaequalis*. In addition improvement of apple with respect to quality traits like fruit colour, TSS, firmness, shelf life etc significantly adds to the acceptance of the

fruit in the market with higher demand. Introgression of scab resistance in commercial apple cultivars like Red Delicious and Ambri was done from resistance source "Prima". Population (s) was screened for the presence of resistant gene through molecular approaches and two scab resistant hybrids viz Pride (Prima x Red Delicious) and Priame (Prima x Ambri) have been identified for release and commercialization. In addition two hybrids "Ammol" and Amrit" with improved fruit quality in apple cultivar "Ambri" were produced by transferring the fruit quality traits from Mollies Delicious and Top Red respectively. Registration of germplasm through ICAR-NBPGR has been done Mutation breeding involving gamma irradiation (30-40 Gy) and EMS treatment to scion sticks of apple cultivar Ambri was done to introduce better fruit colour traits in Ambri. The population (s) generated (10, 000 grafted/budded plants) is under evaluation with respect to quality traits and disease resistance. Identified elite hybrids are being propagated on large scale for multi-locational testing, commercialization and popularization.

Keywords: Apple, scab, TSS, firmness, hybridization

◆◆◆◆◆◆

Uderexploited Diversity of horticultural crops of North East India and their exploitation potential

B N Hazarika
Central Agricultural University, College of Horticulture and Forestry,
Pasighat -7911102, Arunachal Pradesh

ABSTRACT

The North-East India the richest reservoir of plant diversity in India and is one of the 'biodiversity hotspots' of the world supporting about 50 % of India's biodiversity. Northeastern region occupy 7.7 % of total geographical area of country and harbours 50 % of Indian flora (8,000 species) of which about 4 % is endemic (2,526 species). The distinct tribes in the region have rich indigenous knowledge system on the use of components of biodiversity for their daily sustenance like food, fodder, shelter and healthcare. The region has several unique features such as fertile land, abundant water resources, evergreen dense forests of about 66%, high rainfall and agriculture-friendly climate. Its unique phyto-geographical positions, topography and high degree of precipitation are some of the important factors which are mainly responsible for its enormous biological diversity. As a result, an array of diverseplants are grown across the region ranging from tropical to alpine. A large number of diversity in fruits belonging to the genera Artocarpus, Annona, Averrhoa, Garcinia, Musa, Passiflora, Phyllanthus, etc. are reported from the region. Besides diverse vegetables particularly wild leafy vegetables, rare genotypes of cucurbits, solanaceous vegetables, chilli, ginger, turmeric, etc. are there with some unique quality because of their locational advantage. The region has a great ethno-cultural diversity with major and sub-tribes, which explains the wealth of traditional ecological knowledge among farmers. People of region have their ownculture, tradition and medicinal system of treatment and knowledge acquired through close observation of nature. Its ethnic people living in the remote forest areas still depend to a greater extent on the forest ecosystems for their livelihood They collect different medicinal plants and use them in traditional ways to cure their health related forms. The minor and wild fruits are mostly used to cure various gastrointestinal disorders, respiratory problems, cardiovascular compliance, muscular illness, bone diseases, gynaecological problem, cancers, snake bite, allergy and malaria etc. by local people of the region. This indigenous system of treatment based on such fruits is still an important part in social life and culture of the tribal people. However, this traditional knowledge of the local people has been transferred from generation to generation without proper technological interventions.

◆◆◆◆◆◆

Underexploited horticultural crops of North East India and their exploitation potential

B N Hazarika
Central Agricultural University, College of Horticulture and Forestry, Pasighat -7911102,
Arunachal Pradesh, India

ABSTRACT

The North-East India the richest reservoir of plant diversity in India and is one of the 'biodiversity hotspots' of the world supporting about 50 % of India's biodiversity. The distinct tribes in the region have rich indigenous knowledge system on the use of components of biodiversity for their daily sustenance like food, fodder, shelter and healthcare. The region has several unique features such as fertile land, abundant water resources, evergreen dense forests of about 66%, high rainfall and agriculture-friendly climate. Its unique phyto-geographical positions, topography and high degree of precipitation are some of the important factors which are mainly responsible for its enormous biological diversity. As a result, an array of diverse plants are grown across the region ranging from tropical to alpine. A large number of diversity in fruits belonging to the genera Artocarpus, Annona, Averrhoa, Garcinia, Musa, Passiflora, Phyllanthus, etc. are reported from the region. Besides diverse vegetables particularly wild leafy vegetables, rare genotypes of cucurbits, solanaceous vegetables, chilli, ginger, turmeric, etc. are there with some unique quality because of their locational advantage. The region has a great ethno-cultural diversity with major and sub-tribes, which explains the wealth of traditional ecological knowledge among farmers. People of region have their own culture, tradition and medicinal system of treatment and knowledge acquired through close observation of nature. Its ethnic people living in the remote forest areas still depend to a greater extent on the forest ecosystems for their livelihood This paper will discuss the potentialities of underutilized plants of North-East India.

◆◆◆◆◆◆

Gamma IR radiation induced mutagenesis in litchi

Sunil Kumar and Abhay Kumar
ICAR- National Research Centre on Litchi, Muzaffarpur- 842 002 (Bihar), India

ABSTRACT

Litchi (*Litchi chinensis Sonn.*), popularly known as "the queen of fruits" is an important fruit tree in the tropical and subtropical regions of the world. Despite the fact that the litchi is one of the finest fruit and has a growing demand in national and international markets, productivity continues to be low and a gap exists between potential and existing yield. The probable reasons for low yield are the narrow genetic base of the crop and non-availability of suitable superior cultivars, as most of the present day cultivated varieties are the result of clonal selection or seedling selection. Due to its long reproductive cycle and highly heterozygous genetic background, new litchi cultivars are difficult to create via conventional breeding methods. However, mutagenesis can induce genetic variability, high mutation numbers and modify physiological and biochemical characteristics of plant species to create new or novel mutants. The gamma ray is the most widely used ionizing radiation in mutagenesis. Therefore, mutant populations in litchi were developed by exposing fresh seeds to gamma rays at a dose range from 10-50 Gy. Initial observations highlights that gamma irradiation at higher doses have the potential to generate much needed variation in litchi.

◆◆◆◆◆◆

Gamma rays induced mutagenesis in fennel (*Foeniculumvulgare Mill*) crop for earliness and moisture stress

A.K. Verma[1], Harisha C.B.[2], Sharda Choudhary[1], R.S. Meena[1], Ravindra Singh[1]and S.N. Saxena[1]
[1]ICAR- National Research Centre on Seed Spices, Ajmer- 305 206, Rajasthan
[2]ICAR-National Institute of Abiotic Stress Management, Baramati- 413115, Maharashtra

ABSTRACT

Fennel is an important spice crop belongs to family Apiaceae. Fennel is traditionally used for medicinal and culinary purposes. The plant height of crop grow ~2 meter that makes it susceptible to lodging and reduces the yield and quality of crop. Due to the long duration crop, its requires more inputs to grow. In addition, crop production is itself facing the problem of irrigation water in fennel growing regions. Hence, farmers are needed dwarf and short duration type fennel variety which can be grown under moisture stress condition. An attempt was made at ICAR-NRCSS by using gamma rays mutagen. The fennel seeds irradiated with different doses (150, 175, 200, 225 and 250Gy) of gamma rays and M_1 generation was raised.A total of 108 mutants were identified based on different morphological characters in M_2 generation. The maximum number of mutants were selected from the gamma rays dose of 225 Gy (35) followed by 200 Gy (29), 250 Gy (19), 175 Gy (14) and 150 Gy (11). The identified mutants were evaluated for dwarf and earliness with better yield and quality from M_3 to M_7 generation.When the selected mutant lines were showing the stable characters, they have evaluated for the moisture stress tolerance. Under moisture stress, induced by Polyethylene glycol (PEG), highest root, shoot growth, fresh weight and dry weight was recorded on M-1 followed by M-14, M-18 and M-25. Mutant line M-1 recorded highest seed yield (2357 kg/ ha) followed by M- 25 (2350 kg/ha) under the moisture stress condition.

Key words: Fennel, Gamma rays, Induced mutagenesis, Moisture tress, Mutant lines

◆◆◆◆◆◆

Utilization of Exoticvarieties in Mango Improvement

Ashish Yadav, VishambharDayal, Anshuman Singh,Vineet Singh and S. Rajan
ICAR-Central Institute for Subtropical Horticulture, Kakori, Lucknow, U.P.

ABSTRACT

Mango is the most important fruit crop of India which leads in production and it is a source of livelihood for millions of farmers. It has its own role in livelihood support and in export. India exports mango to over 40 countries worldwide. India conquers first place in mango production of the world and accounts for almost half of the global production and area. Mango genetic resources play an important role in developing newer varieties as per the farmers need and it will become more vital in near future. In mango, so far natural genetic variability has been exploited for improving productivity as well as introducing new varieties with specific traits. In this context, maintenance of exotic mango gene pool is important for current and future breeding programs. At ICAR-Central Institute for Subtropical Horticulture (ICAR-CISH), collection of mango varieties started in 1975 with the establishment of Central Mango Research Station, Lucknow.Currently, 18 exotic mango varieties are being conserved at the institute field gene bank.The institutehas about 35 years old Mango Breeding Programfocused on the development of red-peeled varieties having good sugar: acid blend, long shelf-life, regular bearing habit and high yield of fruit for domestic as well as export market. Various hybrids *viz.*, H-1042, H-1723, H-1739, H-2047, H-2709, H-2805, H-3669, H-3803, H-3842, H-4015, H-4061, H-4065, H-4104, H-4133, H-4189, H-4208, H-4252, H-4267 andH-4352are being developed using exotic mango varieties as a parent.Promising hybrids and are in the advance stage of evaluations.A promising mango hybrid H-1739 is under multi location testing of ICAR-AICRP (Fruits) trial and is

performing well at many centers.The exotic mango cultivars are extensively usedin mango breeding programsbecause of their high adaptabilityin many agro-ecological regions, regular bearing nature, attractive red blush at maturity, firm pulp and high pulp to seed ratio.

◆◆◆◆◆◆

Performance of Dahlia cultivars under Shiwalik foot hills of HP

Priyanka Thakur, Rahul Kumar Chaudhary, Manish Kumar, Yogendra Adhikari, Ali Haidar Shah, Sudhanshu Verma

Regional Horticultural Research and Training Station Dhaulakuan Sirmour (HP)
Dr. Yashwant Singh Parmar University of Horticulture and Forestry Nauni, Solan HP.

ABSTRACT

Dahlia cultivars namely Arthur Humbley, Bhikhu's Mother, Bhikhu's Red, Cooch Behar, Eternity, Giani Zail Singh, Kelvin, Kenya Dark Pink, Kenya Light Pink, Kenya Orange, Kenya Pink, Kenya White, Kenya Yellow, Maa Sharda, Piyushuna, Red Army, Romeo, SP Srimati were evaluated under Shiwalik foot hills of HP during 2018-2022 and their performance studies w.r.t vegetative and flowering parameters were conducted.The maximum plant height was recorded in Cv. 'Giani Zail Singh'(139.70 cm) and the minimum in 'Arthur Humbley'(73.74 cm). The Cv. 'SP Srimati' had maximum plant spread (86.13 cm) whereas, 'Arthur Humbley' had minimum plant spread (40.77 cm). Minimum number of days to flower was recorded in Cv. 'Kenya Yellow'(100.83 days) and maximum was found in Cv. 'Red Army'(135.53 days). However, largest flower size (15.18 cm) was found in Cv. 'Arthur Humbley' and smallest flower size recorded in Cv.'Kelvin'(9.26 cm).Among all the dahlia cultivars, maximum number of flowers/plant (29.02) were recorded in cultivar 'Kenya Pink' and found statistically at par with cultivar 'Kenya Dark Pink' (28.85) and 'Kenya Orange' (28.53) whereas, minimum number of flowers/plant (18.30) were recorded in Cv.'Arthur Humbely'. However, maximum flowering duration was recorded in Cv.'Kenya Yellow'(104.98 days) which is statistically at par with cultivar 'Bhikhu's Mother' (104.69 days), 'Romeo' (104.33 days), 'Arthur Humbley' (104.17 days), 'Kelvin' (104.05 days) and 'Piyushuna' (103.95 days), respectively. The minimum flowering duration of 92.76 days was found in Cv. 'SP Srimati'.

◆◆◆◆◆◆

Stratification and SSR Markers Integration for Promoting Low Chill Peach Hybridization in Foot Hills of Himalayas

Rajender Kumar[1], D C Dimri[1], N K Singh[1], Kanchan Karki[2]

[1]G. B. Pant University of Agriculture & Technology, Pantnagar-263145 and
[2]UCB, Haldi, Pantnagar-263145, Uttarakhand, India

ABSTRACT

The fruit development period of most low peach cultivars is short, which leads to embryo abortion and is one of the primary factors limiting the germination of low chill hybrid progenies. Therefore, the summer stratification under controlled conditions and hybridity confirmation *via* SSR markers was performed at HRC, Patharchatta, G. B. Pant University of Agriculture & Technology Pantnagar and MBGE Laboratory of UCB, Haldi, Pantnagar, U.S. Nagar, Uttarakhand from January, 2021 to June, 2022. In hybridization studies, crosses were made between selected low chill peach cultivars. The maximum fruit set (76.74%) was noted for hybrid H_2 (Saharanpur Prabhat × Pratap) and minimum (55.93%) in H_5 (SharbatiSurkha × Pratap). Maximum fruit retention was registered in hybrid H_4 (Sharbati Late × Florida Red) *i.e.*, 71.15%, whereas, hybrid H_2 showed minimum fruit retention (39.85%).Summer stratification under controlled conditions were accomplished by harvesting fully matured

fruits and storing them at 5°C for up to two days until the seed was extracted.The seeds were then stratified in media, containing cocopeat + perlite (2:1) and were stored at 4±2°C for stratification till 25-30% radicle emergence is seen in the seeds.The seeds of hybrid H5 took the maximum days for stratification (58.75 days) and H_2 registered the minimum (48.25 days). The germination percentage was estimated maximum (83.88%) in H_4 and minimum in H_2 (65.99%). In the present investigation, 25 SSR markers were employed for the hybridity testing, where only 3 primers set (CPPCT-022, UDP96-005 and UDP98-407) were found to confirm the hybridity of the F_1 seedlings.

Keywords: Peach, Hybridization, Summer Stratification, SSR Marker, Hybridity Confirmation

◆◆◆◆◆◆

Breeding for pigment enrichment in vegetable crops: current approaches and achievements

T. A. Tandel[1] and M. Sarkar[2]
[1]Department of Vegetable Science, ACHF, NAU, Navsari-396450, Gujarat
[2] Assistant Professor (Horticulture), College of Agriculture, NAU, Waghai- 394730, The Dangs, Gujarat

ABSTRACT

Increasing population, inadequate food coupled with malnutrition are bigger challenges in developing countries like India. Vitamin A deficiency is one of the major problems in India and about 15% of population having VAD which causes blindness. Pigments are special chemical compound in plants that absorb at different wavelength of visible light and appear colourful. Plant pigments are usually referring to four major classes: Chlorophylls, carotenoids, flavonoids and betalains. Each pigment responsible for various colour. All compounds have ability in prevention of disease and specific benefits in human health. Chlorophyll is the primary pigment in plants and it is chlorin that absorbs yellow and blue wavelength of light while reflecting green. Carotenoids are called as anti carcinogenic and macular pigment. Flavonoids are a huge family of water-soluble polyphenolic compounds. Anthocyanin is associated with reduced incidence of major chronic diseases such as cancer, cardiovascular problems, diabetes, alzheimer etc. Betalins are a class of water-soluble indole-derived glycoside pigment that are found only in the order Caryophyllales and beneficial in lowering inflammation. There are several breeding approaches for enrichment of pigments using wild germplasm or other sources in vegetable crops as selection, hybridization, inter specific hybridization, mutagenesis, somaclonal variation and genetic engineering.

Keywords: Pigments, Breeding approaches

◆◆◆◆◆◆

Ascertaining an ideal ovule age for in-vitro embryo rescue in seedless grape genotypes under sub-tropical conditions

A. K. Jadhavand S. K. Singh
Head and Principal Scientist, Division of FHT, ICAR-IARI-New Delhi-110012

ABSTRACT

The experiment was conducted in 2019 involving early maturing seeded × seedless and seedless × seedless cross combinations for high plant recovery using soft seeded (Pearl-of-Csaba and Cardinal) and seedless (Beauty Seedless, Flame Seedless, Centennial Seedless, Perlette and Pusa Urvashi) genotypes for ascertaining ideal ovule stage (DAP) for in-ovulo embryo rescue using parameters like in vitro ovule growth (mm2), ovule

maturity,days to callus initiation during maturation, days to embryo germination after inoculation and germination percentage.It is found that in seedless grape breeding, ovule age(post pollination) for embryo rescue varieswith the grape genotypes.22 DAP (days after pollination) was found best for centennial seedless, 27 DAP for hybrid combination Beauty Seedless xPusa Urvashi and 32 DAP is best suited for genotypes like Perlette, Beauty Seedless, Pusa Urvashi, PusaTrishar, Pusa Aditi, Flame seedless, Cardinal and hybrid combination likePusa Aditi x Beauty Seedless, Pearl of Casaba x Beauty Seedless, PusaUrvashi x Perlette andPusaTrishar x Perlettegenotypes by recording maximum embryorescue and germinationunder sub-tropical conditions of Delhi.

Keywords: grape, In-ovulo embryo rescue. Days after pollination, germination

◆◆◆◆◆◆

Application of DNA markers linked to the genes for late blight and potato cyst nematode resistance inindigenous potato genotypes

Dalamu[1], A Bairwa[2], JK Tiwari[3], AK Sharma[1]and S Sharma[2]
[1]ICAR-CPRI Kufri-Fagu Unit, Kufri 171 012; [2]ICAR-CPRI Shimla 171 001;
[3]ICAR-IIVR Varanasi 221 305

ABSTRACT

Late blight disease caused by the fungus *Phytophthora infestans* persists as a major threat for potato production across the globe. Potato Cyst Nematode (PCN) is another pest of economic importance and is a quarantine organism. Exploitation of genetic resistance in varieties is the most preferred management strategy. Resistance to late blight is both qualitative and quantitative while resistance to PCN is imparted either by major genes conferring extreme resistance to one or more pathotypes or *QTL* regions imparting partial resistance. Development of plant molecular technologies resulted in mapping and cloning of most of *R* genes as well as QTLs. Seventy-two indigenous potato genotypes collected from different parts of the country were evaluated phenotypically and through molecular markers for LB and PCN resistance. Phenotypic evaluations for LB classified the genotypes into: highly resistant (2), resistant (2), moderately resistant (2), susceptible (7) and highly susceptible (59) while for PCN, the genotypic distribution was: highly resistant (3; 3), resistant (0; 1), moderately resistant (4; 10), susceptible (19; 19) and highly susceptible (46; 39) for*Globodera rostochiensis* and *G. pallida*, respectively. The phenotypic results were further corroborated with LB resistance genes *viz.*, *R1*, *R2* and *R3a* and PCN resistance genes ie *H1*, *GpaVvrnQTL*, *Gro1-4*, *Gpa5 QTL* and *Grp1* using molecular markers. Twelve genotypes were found carrying either single, double or three LB resistance genes while 11 genotypes were positive for PCN resistance genes. The identified accessions are valuable sources of LB and PCN resistance that can be utilized in biotic stress resistance breeding.

◆◆◆◆◆◆

Towards molecular breeding in Grape: Identification of genomic regions for berry traits (*Vitis vinifera* L.) and development of allele specific markers for berry trait

Anuradha Upadhyay[1], Komal D Thorat, Roshni R. Samarth, D.N. Gawande and R.G. Somkuwar
ICAR- National Research Centre for Grapes, Pune

ABSTRACT

Grapevine (*Vitis vinifera* L.) is a fruit crop with considerable economic value grown for various purposes like fresh consumption, processed to obtain wine and raisins, extraction of seed oil and secondary metabolites. In

India, grape is majorly grown for fresh consumption and hence appearance of grape bunch determines its market value. Bunches with bold and uniformly sized berries fetch higher price. Application of growth regulators at various stages of bunch development coupled with manual thinning is required for obtain bunches with desired appearance. Thus, development of varieties with loose bunch and bold berries is the focus of research for grape breeders. In this study, two-pronged approach of genome-wide association mapping and QTL linkage mapping was used to identify the genomic region controlling berry traits in grape. Three year phenotyping data and SNP data obtained by genotyping by sequencing (GBS) of selected grape genotypes and segregating population of Carolina Blackrose x Thompson Seedless was used for the analysis. QTL mapping identified major QTLs for berry length, berry width, berry weight and bunch weight on LG 14, Lg19, LG 8 and LG17. Genome wide association analysis of genotyping and phenotyping data using Maximum likelihood Model (MLM) identified SNPs closely linked with berry traits with high level of significance. Allele specific primers (ASP) were designed for selected linked markers and validated using grape genotypes with contrasting values for the traits. One ASP showed strong co-segregation with the berry traits. These results gave important insight into genetics of bunch and berry traits in grape which will be useful for the identification of candidate genes for the traits as well as development of functional markers for their use in ongoing varietal development program.

◆◆◆◆◆◆

Physiological, biochemical and molecular characterization of gamma mutants of guava (*Psidium guajava L.*) cv Arka Amulya

Sukhjinder Singh Maan[1], Jaswinder Singh Brar[1]

[1]Department of Fruit Science, College of Horticulture and Forestry, Punjab Agricultural University, Ludhiana, Punjab, India-141004

ABSTRACT

This study primarily designed with the aim of characterization of gamma-irradiation-induced genetic variability in guava cv Arka Amulya with various physiological and microsatellite markers for establishment of some early criteria for selection against dwarfism trait. Stomata impression prepared from the abaxial surface with the help of dried nail polish method. PCR reactions for SSR markers were performed according to the published protocol.Maximal reduction of leaf stomatal densitywith 250 Gy (12.61 %) treatment followed by 150 Gy and highest stomataldensitywas recorded in non-mutagenized plants. While, the hormetic response for stomata guard-cell size with 50 Gy mutants [1.5 % - 2.38 % (stomata length) and 1.34 % - 1.81 % (stomata breadth)].Similarly, leaf transpiration rate, stomatal conductance, internal CO_2 concentration was significantly affected by different concentrations of gamma rays, with maximum reduction at 250 Gy. Out of 40 SSR primers used for amplification, 11markers produced twenty-ninereproducible bands (2 to 4 amplified DNA fragments per primer) with an average of 2.63allele per locus. The average polymorphism rate, PIC value (Polymorphic Information Content) and size of the detected alleles of 27.50 %, 0.64 and 110-210 bp respectively for the amplified primers. Similarly, UPGMA cluster analysis of genetic distances and PCO distinguish the mutated genotypes as separate taxonomic entities. To conclude, this study indicates the potentiality of physio-biochemical along with SSR markers for the characterization of mutated population as an early selection criteria for desirable traits.

Keywords: Gamma irradiation, PIC, Stomatal traits, SSR markers

◆◆◆◆◆◆

Reap the crop wild relatives for breeding future fruit crops

Roja[1], H. S.; Tandel,Y. N[2].and Patel, V. K[3].
[1]NAHEP-CAAST-M.Sc. Scholar, Department of Fruit Science, ACHF, NAU, Navsari
[2]Associate Professor, Dept. Fruit science, ACHF, NAU, Navsari
[3]Senior Research Fellow, CAAST Secretariat, Directorate of Research
Navsari Agriculture University (NAU), Navsari- Gujarat -396450

ABSTRACT

The agricultural production is one of the most basic elements contribute to the economic income and food security. Innovations in plant breeding and agronomy has been employed in achieving continuous growth in world food production. Crop Wild Relatives (CWRs) constitutes a vast array of beneficial traits are essential for improvement of crops in adverse climates and to sustain global food supplies, provided breeders with several useful genes. Wild ancestors, primitive cultivars, wild forms, wild relatives and traditional landraces are pool of important traits, containing broad genetic base to resist the stress condition, abiotic (salinity, drought, temperature fluctuation, high wind velocity) and biotic (pest and diseases) and embounded with unique quality traits in fruits *e.g.,Mangifera caesia* white pulp, sweet, fragnant in mango, *Musa accuminata ssp. Malacensis* flower used as vegetable in banana, *Vasconella quercifolia* high papain content in papaya *etc*. Crop wild relatives contain different traits possess advantageous character for future potential fruit production which approached through various breeding methods like distant hybridization, somatic hybridization, germplasm characterization, next generation sequencing technologies, cisgenics, transgenics approaches *etc*.

Keywords: Crop Wild Relatives (CWRs), fruit crops, breeding approaches.

◆◆◆◆◆◆

Okra Breeding in India: Present Status and Future Challenges

R.K. Yadav, Vinay ND, Mahesh Badiger, B.S. Tomar, Harshwardhan Choudhary and Suman Lata
Division of Vegetable Science,
ICAR-Indian Agricultural Research Institute, NewDelhi-110012

ABSTRACT

Okra (*Abelmoschus esculentus* L. Moench), is an important crop of tropical and subtropical regions of India which tender pods are used in fresh and processed form. Okra pods have high nutritive value, extensive industrial application and significant forex earnings. Presence of high genetic diversity in India for various traits, has been exploited to develop number of improved varieties in the past. A wide range of breeding methods and techniques have been employed to breed high yielding, stress tolerant varieties also keeping consumer preference as priority. In the beginning, researchers applied conventional breeding methods such as pure line selection and hybridization for cultivar development. “Pedigree method” has been the most widely followed method in okra improvement and while in case of interspecific hybridization “backcross pedigree” is employed. Most popular and widely adapted cultivars, like Pusa Sawani, Hissar Unnat, Varsha Uphar, Kashi Pragati were developed by intervarietal hybridization. Interspecific hybridization is the go to method in okra specifically to transfer YVMV resistance from wild relatives. This resulted in development of several YVMV resistant cultivars such as Punjab Padmini and Parbhani Kranti, using *Abelmoschus manihot,* while Arka Anamika was derived from *A. tetraphyllus* cross. Inter-specific gene transfer in okra is hampered by various pre and post zygotic barriers. To address the frequently occurring F_1 sterility issue in wide hybridization polyploidy breeding (colchicine-induced amphidiploidization of F_1) is practiced. Through mutation breeding novel desirable variability was created using

gamma irradiation (MDU-1and Parbhani Tillu) and EMS treatment (Punjab-8). Heterosis is exploited to evolve hybrids that are very much popular due to high yield, earliness, stress tolerance and wide adoptability. Genic Male Sterility (GMS) system has also been used to economizing hybrid seed production. Trait targeted breeding in okra is been successful with identification of several lines and development of verities for processing, export and resistant to stresses. Despite high economic importance of okra, its genetic improvement is slow compared to other vegetable crops primarily due to limited application of advanced biotechnological tools in okra improvement. Complex genome architecture is the major limiting factor in utilization of genomics and molecular breeding in okra. Other challenges in okra breeding include frequent breakdown *Begomovirus* resistance. However, use of high throughput biotechnological tools, like chromosome engineering, RNA interference (RNAi), marker-assisted recurrent selection (MARS), genome-wide selection (GWS), targeted gene replacement, next generation sequencing (NGS) etc. may accelerate the pace of okra improvement in future.

◆◆◆◆◆◆

POSTER PRESENTATION

Effect of Gamma Radiation on Vegetative and Floral characters of Gladiolus (*Gladiolus hybrids Hort.*)

Daya Shanker[1], Prakhar Tripathi [1,2], Shweta Singh[1], Jibankumar S. Khuraijam[1,2] and Shri Krishna Tewari [1,2]

[\1]CSIR-National Botanical Research Institute, Lucknow-226001, (U.P.)

[2]Academy of Scientific and Innovative Research, Ghaziabad-201002, (U.P.)

ABSTRACT

Gladiolus corms of four varieties were exposed to five doses of gamma radiation from 2.5, 4.0, 6.0, 8.0 and 10.0 KR for induction of genetic variability most of the characteristics were stimulated till 4KR treatments but started to reduce at higher doses, where as treatment of 2.5 KR proved better over all treatments including control. The doses of 6KR, 8KR and 10 KR proved injuries corm sprouting, Plant height, numbers of leaves per plants as the number of florets and length of spike reduced drastically in cultivars American Beauty Pink, while plant remained stunted in cultivarsYellow stone, Snow princes and Tiger flame colour variation in florets and whole spike increase and decrease in the number of floral characters and their fascinations and spike bifurcation were observed from 6,8,10KR Treatments in all varieties. Four desirable colour mutants were obtained from four varieties. Four desirable colour mutants were obtained from four varieties and one mutant with bifurcated spike having all similar characters as originals except double number of florets. Treatments with 2.5, 4.0 and 6 KR were observed to be good for induction of mutants and a total of four mutants were isolated in second generation.

◆◆◆◆◆◆

Development of new varieties and DUS Testing in *Canna* L.

Prakhar Tripathi [1,2], Daya Shanker[1], Jibankumar S. Khuraijam[1,2] & S.K. Tewari[1,2]

[1]Botanic Garden Division, CSIR-National Botanical Research Institute, Lucknow - 226001, (U.P.)

[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad - 201002, (U.P.)

ABSTRACT

The work being carried out at Botanic Garden Division, CSIR-National Botanical Research Institute, Lucknow concerned with development of new varieties with improved floral traits for various ornamental plants and carries out varietal tests on Canna, Gladiolus and Bougainvillea under Protection of Plant Varieties and Farmer's Right Authority, Ministry of Agriculture and Farmers Welfare, Government of India and serves as Nodal DUS Test centre for same. DUS (Distinctness, Uniformity and Stability) testing of varieties is a necessary method for germplasm evaluation and identification of varieties. Canna is a popular ornamental garden plant belonging to the family Cannaceae is extensively grown in parks and gardens for its magnificent flowers. They are highly purposeful for landscaping, decorating large gardens, parks and are grown as a pot plant for decoration purposes. About 50 varieties such as the 'Bengal Tiger', 'Ambassador', 'Bangkok', 'Black Night', 'Tropical Sunrise', 'Cattleya', 'City of Portland, etc are maintained and propagated at 3000 square meter canna garden at CSIR-NBRI that serves as a reference centre and considered as 'National collection centre'. A study was conducted to characterize vegetative and flowering characteristics of Canna varieties based on forty-two morphological characteristics provided by the Protection of Plant Varieties & Farmers' Rights Authority (PPV&FRA). All characters were recorded as per DUS guidelines to develop identification keys of canna varieties and use these as reference varieties for protection of other new varieties under the PPV&FR Act,

2001. Moreover, three new varieties *i.e.* Canna 'Kanchan', 'Agnishikha' and 'Raktima' with improved floral traits were developed by exposing the existing varieties Canna 'Lucifer' and 'Cleopatra' by gamma irradiation at different doses. Present study focuses on germplasm collection, DUS testing procedures and mutant canna varieties developed using gamma irradiation at CSIR-NBRI with aims to benefit farmers researcher and ornamental plant growers concerning a selection of suitable varieties of their interest.

◆◆◆◆◆◆

Evaluation of Genetic Variability in Broad bean (*Viciafaba* L.)

Dilkush Meena, Deepa H. Dwivedi, Sunil Kumar
Department of horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh -226 025

ABSTRACT

Faba bean (*Viciafaba* L.) a nutritious leguminous cool tolerant crop, is widely cultivated throughout the world. This legume contains a high protein and a balanced amino acids profile, except for a low level of methionine and cysteine. It is also a rich source of beneficial nutrients including dietary fibers, minerals etc. The study on faba bean reported that winter cultivars have4-6 stems/plant and the spring cultivars have 1-2 stems/plant. Selecting genetically varied parents from a population with a wider adoptability and higher yield is dependent on genetic variability.As a result, the presence of sufficient genetic variety is a prerequisite for all crop enhancementprogrammes. Crop breeders may improve any crop by using the right breeding approach if theyknow how much variability and heritability is available in the germplasm. In the present study significant variability was observed for the following parameters: germination percent, plant height, number of branches per plant, days of first flowering, days to first fruit set, days taken to maturity, number of pods per plant, number of seeds per pod, pod length, number of seeds per plant,100 seed weight, seed yield per plant in broad bean.

◆◆◆◆◆◆

Assessment of Hybrid Vigour in Guava (*Psidium guajava*)

Shikha Jain[1], Rajesh Kumar[2], A. K. Singh[3], Satish Chand[4], Narendra Kumar Singh[5]
[1-4]Department of Horticulture, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, 263145, Uttarakhand.
[5]Department of Plant Breeding, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, 263145, Uttarakhand.

ABSTRACT

The Guava (*Psidium guajava* L.), native to tropical America is a member of the family Myrtaceae. One of the normal methods of crop improvement in guava is through exploitation of hybrid vigour. This investigation was carried out at Horticultural Research Centre, Pattharchatta, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand during the year 2019-20. A total of 15 hybrids were developed by crossing 10 parents. Hybrids were evaluated along with their parents for morphological parameters.Hissar Safeda × Lalit, Hissar Surkha × Local Germplasm, One Kg × Local Germplasm, Red Flesh × Local Germplasm had positive heterobeltiosis and positive average heterosis for all leaf parameters except for length to width ratio of leaves. Hissar Safeda × Lalit and Hissar Surkha × Local Germplasm had positive heterobeltiosis for all plant parameters except for internodal length. Sangareddy × Pant Prabhat had positive heterobeltiosis for all plant parameters. Hissar Surkha × Local Germplasm, Hissar Safeda × Pant Prabhat, Sangareddy × Pant Prabhat had positive average heterosis for all the plant parameters while Hissar Safeda × Lalit and Red Flesh × Local Germplasm had positive average heterosis for all plant parameters except for internodal length.The magnitude

of both average heterosis and heterobeltiosis was low to moderate in different F_1 hybrids of guava. Hissar Safeda × Pant Prabhat is the only hybrid amongst all 15 hybrids which showed both positive heterobeltiosis and average heterosis for all the leaf and plant parameters. This indicates that this hybrid is promising in terms of the plant and leaf parameters because of the heterotic expression. Further, this hybrid may show faster and better growth and early fruiting along with better quality of fruits.

◆◆◆◆◆◆

Marker assisted breeding for improvement in vegetable crops

Manish Kumar Singh, Kalyan Singh, Neetu, Himanshu Singh and Ajeet Singh
Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda-210001

ABSTRACT

Conventional breeding method have been used extensively to develop new cultivars of vegetables with desirable phenotypic characteristics, including resistance to different biotic and abiotic stresses, high yieldand an elevated bioactive compounds beneficial to human health. The technological progress since early 1980s has revolutionized our ability to study and manipulate genetic variation in crop plants. The development in genomics have provided new tools for discovering and tagging novel genes. These tools can enhance the efficiency of breeding program through marker assisted breeding (MAB). In this breeding program, selection of target traits can be achieved indirectly using molecular marker that are closely linked to underlines genes. The large number of quantitative trait loci (QTLs) mapping studies for diverse crops species have provided an abundance of DNA marker–trait associations. The genetic information provides basis for genomics and marker-assisted improvement of vegetable crops with the focus on tomato, pepper, eggplant, lettuce, spinach, cucumber and chicory. MAS could greatly assist plant breeders in reaching this goal although, to date, the impact on variety development has been minimal. For the potential of MAS to be realized, it is imperative that there should be a greater integration with breeding programmes and that current barriers be well understood and appropriate solutions developed. The exploitation of the advantages of MAS relative to conventional breeding could have a great impact on crop improvement. The high cost of MAS will continue to be a major obstacle for its adoption for some crop species and plant breeding in developing countries in the near future. Specific MAS strategies may need to be tailored to specific crops, traits. If the effectiveness of the new methods is validated and the equipment can be easily obtained, this should allow MAS to become more widely applicable for crop breeding programmes.

Keywords: MAS, QTL, DNA marker, genomics.

◆◆◆◆◆◆

P- Study of genetic divergence of different morphological and physio-chemical traits of tomato (*Solanum lycopersicum* L.) in Varanasi region

Dhaneshvari Arya, Akhilesh Kumar Pal, Nitin Yadav
Department of Horticulture, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi (221005), Uttar Pradesh, India

ABSTRACT

The genetic divergence determines the level of diversification and then calculates the proportionate contribution of each component characteristic to the overall divergence. Additionally, it provides a quantitative assessment of geographic and genetic diversification using gene-based distance.The experiment was conducted

during the Rabi season of 2020–21 at the Vegetable Research Farm of the Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi–221005. Three replications of the experiment were set up using the Randomized Block Design method. D^2-statistics revealed that fruit yield per plant contributed the maximum to genetic diversity, followed by Lycopene content, seed test weight, ascorbic acid and fruit weight. Fifteen genotypes with 18 traits of tomato were assessed and based on D^2 values of 18 yield related parameters the genotypes were grouped in to five clusters. The maximum number of genotypes (6) were found in cluster II (VRT-34, ToLCV-16, Kashi Amrit, VRT-30, ToLCV-28 and Navodya) whereas, cluster IV (VRT-19) and cluster V(VRT-13) weremonogenotypic clusters. The inter-cluster highest distance is present in Cluster 3 and Cluster 4, while Cluster 3 has the maximum intra-cluster distance followed by Cluster 2 and Cluster 1. Cluster mean for yield per plant and number of fruits per plant were observed in Cluster 3 which demonstrated that there is sufficient scope for improving the tomato yield through hybridization and selection.

◆◆◆◆◆◆

Study of Genetic divergence of different morphological and physio-chemical traits of tomato (*Solanum lycopersicum* L.) in Varanasi region

Dhaneshvari arya, Akhilesh Kumar Pal Nitin Yadav
Department of Horticulture, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi (221005), Uttar Pradesh, India

ABSTRACT

The genetic divergence determines the level of diversification and then calculates the proportionate contribution of each component characteristic to the overall divergence. Additionally, it provides a quantitative assessment of geographic and genetic diversification using gene-based distance.The experiment was conducted during the Rabi season of 2020–21 at the Vegetable Research Farm of the Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi–221005. Three replications of the experiment were set up using the Randomized Block Design method. D^2-statistics revealed that fruit yield per plant contributed the maximum to genetic diversity, followed by Lycopene content, seed test weight, ascorbic acid and fruit weight. Fifteen genotypes with 18 traits of tomato were assessed and based on D^2 values of 18 yield related parameters the genotypes were grouped in to five clusters. The maximum number of genotypes (6) were found in cluster II (VRT-34, ToLCV-16, Kashi Amrit, VRT-30, ToLCV-28 and Navodya) whereas, cluster IV (VRT-19) and cluster V(VRT-13) were monogenotypic clusters. The inter-cluster highest distance is present in Cluster 3 and Cluster 4, while Cluster 3 has the maximum intra-cluster distance followed by Cluster 2 and Cluster 1. Cluster mean for yield per plant and number of fruits per plant were observed in Cluster 3 which demonstrated that there is sufficient scope for improving the tomato yield through hybridization and selection.

Keywords: Genetic divergence,D^2-statistics, cluster, yield and genotypes.

◆◆◆◆◆◆

Evaluation of different genotypes of french marigold

Mrinali Sood, Jashandeep and Parminder Singh
Department of Floriculture and Landscaping, PAU, Ludhiana – 141004, India

ABSTRACT

Marigold is one of the most popular flowering annuals cultivated in India. The performance of any crop or variety largely depends on interaction between genotype and environment. As a result, cultivars that perform

well in one region may not perform well in other regions with different climatic conditions. Hence, it is critical to investigate morphological variation, the development of high yielding varieties and the selection of appropriate varieties for a specific region. Thus, the present investigation was conducted to study the relative performance of eleven genotypes of *T. patula* for their vegetative growth, floral and yield. The experiment wasconducted at the research farm of the Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, Punjab during winter season of 2020 to study the performance of eleven French marigold genotypes. Among the genotypes for various parameters like plant height, plant spread,duration of flowering, number of flowers per plantand flower yield per plant. 'Local Selection No.9' had the highest values. Also,early flower bud initiation was recorded in genotype 'Local Selection No.9'. Therefore, based on the present investigation, it may be concluded that the genotype 'Local Selection No.9' was found better in vegetative, floral and yield attributes compare to other French genotypes.

◆◆◆◆◆◆

Evaluate the performance of guava hybrids for different vegetative traits

Pushpendra Rajput and Rajesh Kumar
Department of Horticulture,
G. B. Pant University of Agricultural and Technology, Pantnagar, Uttarakhand 263145

ABSTRACT

The present investigation was carried out at Horticulture Research Centre, Patharchatta, GovindBallabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. About two-year-old total 15 F1 hybrids were evaluated against various vegetative attributes. The maximum plant height was obtained in the plants of hybrid Sangareddy × Arka Kiran (160.1 cm) followed by Sangareddy × Pant Prabhat (157. cm) however; it was recorded minimum in Red Fleshed × Local Germplasm (59.7 cm). In case of plant girth maximum in plants of KG-1 Guava × Local Germplasm (57.6 mm) and minimum in Red Fleshed × Pant Prabhat (25.5 cm). Leaf blade length was maximum in Hissar Safeda × L-49 (13.6 cm) while, minimum in Hissar Surkha × L-49 (9.8 cm). In case of leaf blade width was maximum 6.2 cm each in F_1 plants of Hissar Safeda × Lalit and Hissar Surkha × Local germplasm while, minimum 4.8 cm in Sangareddy × Pant Prabhat. In terms of plant spread and plant volume, highest plant spread was recorded in Red Fleshed × Local Germplasm (1.13 m) followed by KG-1 Guava × Local Germplasm (0.84 m) and highest plant volume were noted in KG-1 Guava × Local Germplasm (2.27 m^3) then Hissar Safeda × L-49 (1.80 m^3), while minimum plant spread and plant volume was recorded in plants of Hissar Safeda × Lalit (0.49 m and 0.59 m^3), followed by Hissar Surkha × Pant Prabhat (0.50 m and 0.66 m^3) respectably. The overall performance on various physical parameters was found better in Hissar Safeda × L-49 and Sangareddy × Arka Kiran.

◆◆◆◆◆◆

Chilling Unit Models used for Temperate fruits

Archana Mahida
Department of Horticulture, Central University of Tamil Nadu, Thiruvarur-6100005

ABSTRACT

Fruits are very important for human beings and also play an important role in religious practices, mythology and art. They are not only delicious but also how many nutrients which are necessary for human health. India is the second largest producer of fruits in the world. Fruit Production requires a lot of science and some basic

knowledge to grow them successfully. Temperate fruits are cultivated in the middle latitudes ranging from 30° to 50° N and S. The global warming caused loss of vigour, fruit bearing ability, reduction in size of fruits, less juice content, non attractive colour, reduced shelf-life and increasing attack of pests which affect the production. Chilling requirement define as a physiological requirement of low temperature for effective growth in normal spring. Chilling requirement is measured in terms of chill hours. Chilling temperature is essential prerequisite for effective and synchronous bud-break and flowering. Fruit Crops go through three stages during dormancy first is acclimation which means ability to adjust according to climate change. This stage start after the plant has ripened and growth has stopped. Second stage includes ability of plant to survive in particular adverse climate. This stage generally occurs from December through February. There are two distinct types of dormancy: endodormancy and eco-dormancy. Endo-dormancy is the period in which the plant is accumulating its chilling hours the most. Until the plant satisfies its need for cold, it will not break bud, even if temperatures warm. Once the chilling requirement for a plant has been satisfied, it enters into eco-dormancy (also called quiescence). Eco-dormancy occurs due to unfavourable environmental conditions. third stage is called deacclimation. Deacclimation is the process of breaking dormancy and readjusting to warmer temperatures. There are several chilling unit models to calculate the chilling accumulation required for particular crops through which we can predict the chilling requirement of crops and improve the production

Keywords: Eco-dormancy, Chilling requirement, Shelf-life and Chill Hours

◆◆◆◆◆◆

Morphological Characterization of F1 Guava (*Psidium guajava*) hybrids and varieties

Shikha Jain[1], Rajesh Kumar[2], Vijay Pratap Singh[3], Satish Chand[4] and Narendra Kumar Singh[5]

[1]Department of Horticulture, [5]Department of Plant Breeding
Govind Ballabh Pant University of Agriculture and Technology,
Pantnagar, Udham Singh Nagar, 263145, Uttarakhand.

ABSTRACT

Guava (*Psidium guajava* L.), a member of the Myrtaceae family, is one of the world's most important tropical and subtropical fruit crops, with basic chromosome no. x= 11 (2n= 2x= 22). The present investigation was carried out to characterize the guava (*Psidium guajava*) germplasm at morphological level and to identify the promising F_1 hybrid amongst 15 hybrids using morphological traits. Observations were recorded for different traits *viz*. leaf characters like length and width of leaf, length to width ratio of leaf, surface area of leaf, shape of leaf, shape of leaf apex and base, colour of leaves during winter, lamina thickness, pubescence, number of leaves, young leaf anthocyanin colouration, texture of leaves, colour of upper and lower surface and plant characters like plant height, stem girth and colour of young stem during winter season. Results revealed that significant variations were present with reference to various morphological characteristics amongst the 25 genotypes. On the basis of morphological description, the germplasm Hissar Safeda × Sardar was quite different and superior. Considering shape of leaf, shape of leaf apex and base and leaf colour during winters, these leaf morphological characters were quite informative and useful in characterizing these genotypes, as some genotypes could easily be identified using a combination of these characters.

Keywords: Anthocyanin, germplasm, hybrids, morphological, pubescence, texture

◆◆◆◆◆◆

Ascertaining an ideal ovule age for in-vitro embryo rescue in seedless grape genotypes under sub-tropical conditions

A. K. Jadhav and S. K. Singh
Division Of FHT, ICAR-IARI-New Delhi-110012

ABSTRACT

The experiment was conducted in 2019 involving early maturing seeded × seedless and seedless × seedless cross combinations for high plant recovery using soft seeded (Pearl-of-Csaba and Cardinal) and seedless (Beauty Seedless, Flame Seedless, Centennial Seedless, Perlette and Pusa Urvashi) genotypes for ascertaining ideal ovule stage (DAP) for in-ovulo embryo rescue using parameters like in vitro ovule growth (mm2), ovule maturity,days to callus initiation during maturation, days to embryo germination after inoculation and germination percentage. It is found that in seedless grape breeding, ovule age(post pollination) for embryo rescue varies with the grape genotypes.22 DAP (days after pollination) was found best for centennial seedless, 27 DAP for hybrid combination Beauty Seedless xPusa Urvashi and 32 DAP is best suited for genotypes like Perlette, Beauty Seedless, Pusa Urvashi, PusaTrishar, Pusa Aditi, Flame seedless, Cardinal and hybrid combination like Pusa Aditi x Beauty Seedless, Pearl of Casaba x Beauty Seedless, Pusa Urvashi x Perlette and Pusa Trishar x Perlette genotypes by recording maximum embryorescue and germination under sub-tropical conditions of Delhi.

Keywords: grape, In-ovulo embryo rescue. Days after pollination, germination

◆◆◆◆◆◆

Phenotypic and Biochemical Evaluation of Apple Cultivars in Kandi Region of Punjab

Swapnil Pandey, Urvi Sharmaand MJ Singh
Punjab Agricultural University-Dr D R Bhumbla Regional Research Station Ballowal Saunkhri

ABSTRACT

Low chill apple varieties are gaining popularity in view of their low chilling requirements for growth and production. The presence of these cultivars broadens their cultivation in the areas having mild climate. Keeping into view this aspect, the present experiment was conducted at the Fruit Research Farm, PAU- Dr D R BhumblaRegional Research Station, Ballowal Saunkhri, SBS Nagar, Punjab. In this experiment, 31 apple cultivars planted at a spacing of 6m x 4m in December 2016 were evaluated for their growth, production and quality parameters.The flowering and fruiting has been observed in two cultivars *viz*. Anna and Dorset Golden. The maximum fruit weight (92.13g), fruit length (58.24mm), fruit diameter (55.76 mm), TSS (12.23 %) and fruit yield (15.51 kg/tree) has been recorded from cultivar Anna, while, maximum fruit firmness (6.37 kg/cm^2) and minimum acidity (0.45%) has been observed in cultivar Dorset Golden. From the experiment, it can be concluded that in *kandi* region of Punjab, lying in the foothills of *Shiwalik* range, low chill apple cultivars can be successfully cultivated.

Keywords: Apple, *Kandi* region, Evaluation

◆◆◆◆◆◆

Status of Genomic Resources in Apple Fruit Quality Traits Improvement

Shikha Jain[1], Poonam Maurya[2], Shubham Jagga[3], Shikha Saini[4] and Raushan Kumar[5]
Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute,
New Delhi, India-110012.

ABSTRACT

The domesticated apple (*Malus* × *domestica* Borkh.) is the main fruit crop of temperate regions of the world.The purposeful genetic improvement of apple can be done through various techniques including introduction, selection, hybridization, mutation and molecular techniques (genomics). Genetic improvement of fruit quality includes external fruit appearance, such as color, shape and size, as well as internal traits such as aroma, texture, crispiness and juiciness. Genomic resources for apple have been developed over the past 10 years, culminating in the sequencing of the 'Golden Delicious' with genome size of 742.3Mbp. Genomics studies include structural, functional and comparative genomics. Although structural genomics was mainly based on microscopic research of chromosomes, it has now become a driving force in apple breeding research since the development of DNA marker technologies at the end of the 20th to the beginning of the 21st centuries. Many genomic resources like whole genome sequence, large number of ESTs, plenty of molecular markers and high-density genetic maps are now available for apple. These resources have been used for sequencing, quantitative trait loci (QTL) mapping and marker assisted selection (MAS). The availability of whole genome sequence has provided new opportunities to explore the genetic basis of fruit quality traits. Whole-genome sequences have also provided a reference for transcriptomic analysis, to identify functional genes that are differentially expressed among tissues, developmental stages, and/or under different environmental conditions. Transcriptomic analysis have been widely used to identify genes that affect various fruit quality traits, such as flavor, size and colour. The use of high-throughput proteomics and metabolomics approaches in apple research has increased exponentially during the last few years. With the development of metabolomics analysis, metabolite association analysis combined with genomic and transcriptomic analysis have also been used to study the mechanisms of apple fruit quality.Using these omics-based approaches to gain knowledge of the interrelationships between the Malus genome, transcriptome, proteome and metabolome will greatly enhance the understanding of biological processes and traits and ultimately assist breeders to better exploit apple germplasm resources for new variety development.

Keywords: Apple, fruit quality traits, genomic resources, metabolome, transcriptomic

◆◆◆◆◆◆

Assessment of correlation coefficients among the yield related traitsin tomato (*Solanumlycopersicum* L.) germplasm

Lokesh Yadav[1], G.C. Yadav, Shani Kumar[1], Lav Kumar[1]
Research Scholar [1,] Professor, Department of Vegetable Science,
Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, 224229
Ayodhya, Uttar Pradesh, India.

ABSTRACT

Present investigation was conducted 32 genotypes of tomato at the Main Experimental Station, Department of Vegetable Science, Acharya Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Ayodhya (U.P.) during *Rabi* 2020-21.The investigation was carried out in randomized block design with three replications *to find out correlation coefficient among*fourteen characters.In general, genotypic correlation coefficients were higher than the corresponding phenotypic correlation coefficients suggesting strong

inherent relationship in different pair of traits. The most important trait, total fruit yield per plant had significant and positive phenotypic correlation coefficient with marketable fruit yield per plant, average fruit weight, equatorial diameter of fruit, polar diameter of fruit and number of fruits per plant. The findings revealed that selection for these traits would be effective for yield improvement.

Keywords: Tomato, germplasms, correlation coefficients

◆◆◆◆◆◆

Characterization of Bhagwa Pomegranate Mutants on Morphological Basis

Mandeep Rawat[1]and V. P. Singh[2]
[1, 2] Department of Horticulture, G.B Pant University of Agriculture & Technology,
Pantnagar (263145), Uttarakhand

ABSTRACT

Mutation breeding is the deliberate induction of variability with the help of certain physical and chemical mutagens.It is an essential segment of genetic advancement of crop plants and also an essential component of worldwide food security as well as nutrition.The frequency of occurrence of mutation by the use of mutagen may as higher as 300 times than the occurrence of natural frequency. Gamma rays and EMS are considered as the powerful and the most result oriented mutagens, but excess of which might lead to death of the crop plant.The excellent examples of this are Pbhausa Nanha and PAU Kinnow 1 developed by using gamma rays of 150 Gy and 30 Gy respectively. So, using gamma rays and EMS, this experiment was conducted and morphological characterization of mutants was studied. The experiment was conducted in Department of Horticulture at Medicinal Plant Research and Development Center, GBPUAT, Pantnagar. The hardwood cuttings of pomegranate cv. Bhagwa were treated with five treatments of gamma rays (15Gy, 25 Gy, 35 Gy, 45 Gy, 50 Gy) and six treatments of EMS (25 Mm, 50mM, 75mM, 100 MM, 125mM, 150 mM) different treatments along with control. In case of gamma rays, tall plants were obtained with 15 Gy treatment whereas in case of EMS small and medium heighted plants were obtained with75 Mm and 150 Mm respectively. Apart from these various leaves shape and size were obtained with different mutagenic treatments. The higher dosages of both the mutagens show higher lethality while at lower dosage some morphological differences were observed.

Keywords: Mutation, EMS, gamma rays, pomegranate, Bhagwa

◆◆◆◆◆◆

Path coefficient analysis and genetic divergence studies in okra

Renu, S.K. Dhankharand Sudesh
Department of Vegetable Science
Chaudhary Charan Singh Haryana Agricultural University, Hisar-125004
Email-renufandan1995@gmail.com

ABSTRACT

A field experiment comprising of thirty genotypes was conducted at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *Kharif* 2021. The genotypes were planted in randomized block design with three replications. The data recorded were subjected to statistical analysis. Considerable amount of variability was noticed for qualitative and quantitative traits. Results from path coefficients analysis showed that highest positive direct effect towards yield per plant was contributed by fruit

length (0.76) followed by branches per plant (0.25) and fruits per plant (0.19). However, highest negative direct effect towards yield per plant was indicated by days taken to 50% flowering (-1.1) followed by plant height (-0.99), internodal length (-0.56), fruit weight (-0.41).The observations from analysis depicted that plant height had a positive indirect effect on yield per plant via days taken to 50% flowering (0.84), first fruit node (0.51) and negative indirect effect via branches per plant (-0.77), fruits per plant (-0.77), fruit length (-0.60) and fruit diameter (-0.56).The genetic divergence studies depicted that the maximum intra-cluster distance was recorded for cluster V (7.4) followed by Cluster I (6.7), cluster III (5.2). The maximum inter-cluster distance was recorded for cluster III and cluster V (16.7) followed by cluster II and cluster III (16.5), cluster IV and cluster V (12.5).Maximum fruit yield per plant was observed in Cluster III (285.3 g) and minimum in Cluster II (222.1g). Plant height had maximum value in Cluster 3 (100.7 cm) and minimum value in Cluster 2 (46.6 cm). Minimum days to 50% flowering were found in Cluster III (42.8) and maximum value in Cluster II (54.0).

◆◆◆◆◆◆

Divergence analysis of chickpea (*Cicer arietinum l.*) and its molecular characterization using microsatellitemarker

Rahul Anand[1] and Mithlesh Kumar[2]
[1]Department of Molecular Biology and Genetic Engineering, GBPUAT, Pantnagar, U.K., INDIA
[1,2]Department of Agricultural Biotechnology and Molecular Biology
Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar

ABSTRACT

Twenty four genotypes were chosen for morphological and eighteen genotypes for molecular characterization of chickpea. The highest inter-cluster distance was observed between cluster I and V on the basis of their genetic distances. Molecular markers generated a total of 77 shared and 50 unique allelic variants in the form of amplified products. The polymorphism information content values revealing allele diversity and frequency among the chickpea genotypes varied from 0.549 in H2A02 to 0.994 in H2E13. Eight SSR primers appeared to be highly polymorphic and informative. The polymorphism percent to be the maximum in the case of H2I01 (71.42%). By drawing the twenty-six phenon similarity units, the entries were basically divided into six groups. There was 16.66% similarity between pattern based on morphological and molecular characterization.

Keywords: Allelic variants, Cluster, Morphological, Molecular and Polymorphic

◆◆◆◆◆◆

Combining ability and heterosis studies in tomato *(Lycopersicon esculentum* Mill.)

Tejinder Singh [1] and Lila Bora [2]
[1] Department of Vegetable Science, CCSHAU Hisar-125004
[2] Regional Research Station, Uchani, Karnal-132001

ABSTRACT

Tomato is a major crop of protected cultivation due to its higher value, round the year cultivation and demand. The study was carried out at Regional Research Station Karnal, CCS Haryana Agricultural University, Hisarduring 2020-22. The experimental material was comprised of 13genotypes (10 as lines and 3 as testers) of tomato along with 30 cross combinations. The mean squares due to crosses, lines, testers and line x tester were significant for most of yield contributingtraits. This showed the existence of adequate amount of genetic variability in the research material. GCV, PCV and Heritability for all the traits were found high such as plantheight,

number of branches per plant, weight of marketable fruits per plant*etc.*The genotype KashiAman in lines and genotype KashiHemant in tester were found to be the best generalcombiner for yield and its attributing traits while for the quality traits ArkaVikas in lines and Selection 7 in testerwere found to be the best general combiners.The maximum average heterosis and heterobeltiosis for the yield per hectare was showed by the F1 genotype KashiAman xSelection 7 and KashiAman x KashiHemant, respectively. The maximum TSS content was recovered with the hybrid HT-4 x Selection 7.Total number of marketable fruits is strongly positive correlated with total number of fruits per plant.TSS is significantly negative correlated with plant height, 50% flowering, days to last picking,weight of marketable fruits, weight of unmarketable fruit and fruit yield.

Keywords: Tomato, line x tester, heterosis, heritability, GCV, PCV

◆◆◆◆◆◆

Evaluation of Tomato (*Solanumlycopersicum* L.) genotypes for growth, quality and yieldattributes under semiarid conditions of Haryana ,India

Lila Bora, S. K. Dhankhar, Rakesh Mehra, Maha Singh and Kiran Khokhar
CCS Haryana Agricultural University Hisar, Haryana

ABSTRACT

Tomato is an annual crop, a member of Solanaceaefamily,ranked first among preserved and processed vegetables. For its tremendous nutritional value, the tomato is commonly known as the poor man's orange. India is the world's second-largest tomato producer after China, with 0.83 million hectares under cultivation, 20.30 million metric tonnes of annual production and an overall average productivity of 24.44 tonnes per hectare (NHB Gurgaon 2019-20).

Ten advance lines of tomato developed by Vegetable Science, CCSHAU,Hisar along with check variety DVRT-1 (KashiAmrit) were evaluated in randomized block design in three replications at CCS HAU RRS Karnalduring winter season 2019-20,2020-2021 and 2021-22. Data was taken for fruit yield, number of fruits per plant, quality attributes (TSS, Ascorbic acid and acidity),tomato leaf curl virus (TLCV) disease, white fly and fruit borer infestation. On basis three years (2019-2021) mean value data, advance line HT-4 (1059.5 q/ha) and HT-5 (991.3 q/ha) produced 25.1 and 17.1 higher fruit yield than check DVRT-1 (846.8 q/ha). These advance lines (HT-4 and HT-5) were also early in days to first picking and were observed moderately resistant to Tomato leaf curl virus, resistant reaction to white fly and infestation of fruit bores (6.20% and 6.93 % respectively).

◆◆◆◆◆◆

Evaluation of different rejuvenated mango varieties/cultivars for yield and quality

A.K. Pandey,Khushbu A. Patel , Dev Raj[1], Tulsi Gurjar and Devang N. Khalasi
Department of Fruit Science
[1]Centre of Excellence on Post Harvest Technology
ASPEE College of Horticulture and Forestry, Navsari Agricultural University,
Navsari-396 450 (Gujarat), India

ABSTRACT

The research endeavour entitled Evaluation of rejuvenated mango cultivars for growth, yield and quality under South Gujarat regioninvolvingten different rejuvenatedmango cultivars namelyKesar,Rajapuri,Alphonso,Totapuri,Neelum,Langra,Sardar,Jamadar,Dadamio and Vanraj was conducted

in Randomized Block Design with five replications at Instructional Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India during 2019-20.The flowering characters, early flower bud initiation (December 13, 2018), early flowering (December 21, 2018), early full bloom (January 28, 2019) and early fruit set (February 05, 2019) were observed in cv. Vanraj. Highest number of fruits/tree (274.20) and yield (110.46 kg/tree) were obtained in cv. Neelum and Totapuri,respectively. Significantly maximum weight of fruit (617.39 g), width of fruit (10.94 cm), pulp weight (518.17 g) and pulp:peel ratio (7.96) were observed incv. Vanraj, whilemaximum fruit length (16.59 cm) and peel weight (68.43 g) were recorded in cv. Totapuri and Rajapuri,respectively.The highest total soluble solids (22 ºBrix), total sugars (15.40 %), reducing sugar (5.35 %) and lowest titratable acidity (0.15%) were observed in cv. Langra and maximum ascorbic acid was recorded in cv. Totapuri (30.27 mg/100 g).

◆◆◆◆◆◆

Diversity analysis in Valan Kakri (*Cucumis sativus var. utilissimus* L.) germplasm

[1]Sonali Agrawal, [2]R.A. Kaushik

[1]Research Scholar, Department of Horticulture, Rajasthan College of Agriculture

[2]Professor, Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur-313001, Rajasthan, India

ABSTRACT

Cucurbits are one of the important vegetable crops belonging to family Cucurbitaceae. Being the largest group of vegetables, they provide enormous scope to increase the overall production of vegetables to meet the growing challenges. Valan Kakri is one of the indigenous cucurbit, grown locally in various parts of Udaipur district. It has got tremendous potential for improvement through systematic approach. It is also a native of northern India. As it belongs to the cucumber group, it is having the same genus and species as cucumber. Valan kakri differs from the common cucumber with respect to size, length and keeping quality. The tender fruits can be consumed as a vegetable and also as salad ingredient. Mash cakes can be prepared from the pulp of the fruits. The fruit provides a number of benefits like it helps in weight loss, rehydration as it produces low calories and more fiber content. Different genotypes of Valan kakri were collected from various parts of Udaipur district. All the morphological data were analyzed by ANOVA using Completely Randomized Design. As Valan kakri is an underexploited crop, there is a need to explore its genetic diversity for crop improvement. Therefore, evaluation of genotypes for accessing the amount of genetic variability present in the existing species for the traits is pivotal for any successful plant breeding program.

Keywords: Genotypes, genetic diversity, genetic variability, plant breeding, crop improvement

◆◆◆◆◆◆

Dr. YSRHU-Shestha : A new photo-insensitive Dolichos bean Variety

Ravindra Babu. M, Omprasad J, Thomson. T and Ashok. P

Horticultural Research Station, Dr Y.S.R.Horticultural University, Venkataramannagudem-534101, Andhra Pradesh

ABSTRACT

Dolichos bean (*Lablab purpureus* L.) belongs to the family Fabaceae which was originated in India. It is one of the popular vegetable crops widely grown in India for its pods which are rich in proteins. In India it is

widely cultivated in Andhra Pradesh, Telangana, Tamil Nadu, Karnataka, Kerala, Maharastra and Madhya Pradesh. Dolichos bean is widely grown in homesteads in Andhra Pradesh. Being a photo-sensitive most of the cultivars requires short day conditions for initiation of flowering. Usually pole types are photo-sensitive and come to flowering during November and December in South Indian Conditions. A new variety of Dolichos bean which is pole type, purple poded and photo-insensitive was developed by pureline selection at Horticultural Research Station, Dr.Y.S.R.Horticultural University, Venkataramannagudem, Andhra Pradesh and was released as Dr.YSRHU-Shestha for cultivation in Andhra Pradesh. The plant is creeping vine with 3-5 primary branches and medium foliage. Plant comes to flowering in 60-65 days after sowing and first harvest starts after 80-85 days after sowing. It produces whitish purple flowers with 12- 18 flowers per panicle. The Pods are medium long, slightly thick, smooth, slightly curved and purple coloured. Crop duration is 140 to 160 days with an average pod yield of 19-20 t/ha. The pods are rich in anthocyanin (22-26 mg/100g). The variety is suitable for cultivation during both *kharif* and *rabi* seasons in Andhra Pradesh.

Key words : Dr YSRHU-Shestha,Dolichos bean, photo-insensitive, pole type, anthocyanin

◆◆◆◆◆◆

New Generation Technologies used for Crop Improvement in Recent Scenario

Pankaj
Department of Genetics and Plant Breeding
Chaudhary Charan Singh Haryana Agricultural University, Hisar Haryana
Corresponding authors; pankajdabi347@gmail.com

ABSTRACT

Now a day with increasing pace of human population throughout the world and to provide well nutritional diet for overall development, vegetables and fruits were the essential component of food. With the increasing high rate of human population and changing climatic conditions the conventional breeding methods not alone remain feasible respond to overcome the increasing food demand. So it is crucial time to use new biotechnological and molecular techniques for improvement of crop plants and these technologies have great potential to understand the mechanism of individual gene functionality. The new generation molecular technology includes Marker Assisted Selection, Plant Tissue Culture technique, Bioinformatics, Mutagenesis, Genomics, Next Generation Sequencing, Genome editing, Allele mining and RNA interference technology. These technologies have immense ability in crops improvement and breeding projects and also have high accuracy with less time consuming as compared with conventional crops improvement methods. In the present article we have discuses about the importance and applications of new generation technological tools in horticultural crops improvement and quoted some examples here *i. e.* genetically engineered "fortified potato" is essential for nutritional security, MAS used to identify the specific loci for selection, gene silencing technology product Flavr-Savr transgenic tomato with enhanced shelf life attribute, plant tissue culture used for vegetative propagation and micro propagation such as in banana, orchids etc. and modification of colour pattern in ornamental plants *i.e.* petunia, carnation and chrysanthemum through RNAi technology. Finally for development and improving new variety or genotypes or producing new product the combination of new biotechnological or molecular technology with conventional breeding methods is essential for stability.

Key words: Bioinformatics, Mutagenesis, Genomics, Next Generation Sequencing, Genome editing, Allele mining, RNAi technology

◆◆◆◆◆◆

Morpho-physiological characterization of French marigold cultivars under Punjab conditions

Ranjit Singh,Rakesh Kumar,Dixit Choudhary and Parmindar Singh
Punjab Agricultural University,Ludhiana,141004

ABSTRACT

A field experiment was conducted at experimental field of Department of Floriculture and Landscaping, PunjabAgricultural University, Ludhiana during July-November, 2022. The experiment was laid out in Randomized block design with five genotypes ('Pusa Deep','Pusa Arpita','JaffriYellow', 'JaffriMix' and 'French IR5-1') with three replications. As per the observations taken at vegetative stage, maximum plant height (110cm), flower weight (4.84 gm) and flower size (39.51 mm) were recorded in French IR5-1while plant spread (39 cm) and highest number of primary (23.05) and secondary branches (35.12) were recordedin the genotype 'Pusa Arpita'. However, minimum days for first bud appearance (81 days)were taken by the genotype 'Pusa Deep' and maximum days for bud initiation (102 days) were observed inthe genotype 'French IR5-1'. Maximum bud diameter (12.16 mm) and bud length (18.19 mm) was observed in 'French IR5-1'. Among all thegenotypes, minimumdays taken for 50 % flowering (95 days), maximum duration of flowering (37.12 days), maximum number of flowers per plant (54.23), flower weight (2.26 gm) and maximum loose flower yield per plant (312.12 gm /plant)was observed in 'Pusa Deep'.Among all genotypes,maximum chlorophyll content (2.16 mg/g) and carotenoids content (1.97 g/mg) was observed in the genotpe 'PusaDeep'. Maximum proline content (7.30 µmol/g) and Phenol content (349.49 µg/g) and Chlorophyll spad vale were non-significant to each other. The results of the study determined 'Pusa Deep' as the best variety for cultivation under Punjab conditions.

Keywords: Marigold, different genotypes

◆◆◆◆◆◆

Evaluation of ber (*Ziziphus mauritiana* L.) cultivars for yield and morphological attributes

Utpal Das
VAIAL, Vellore Institute of Technology, Vellore, Tamil Nadu-632014, India

ABSTRACT

The present experiment was conducted to assess the morphological and yield attributing characters of twelve Indian jujube (*Ziziphus mauritiana* L.) cultivars using randomized block design with three replications during the year 2017-18 and 2018-19 at University of Agricultural Sciences, Raichur-584104, Karnataka. A sum of seventeen morphological and yield attributes of shoot, leaf, flower, fruit and yield related parameters were studied. The results revealed significant variability across the ber cultivars for all the parameters. Among the cultivars, Sanaur-6 showed maximum canopy volume, highest number of productive shoots, widest leaf, longest fruit length and fruit width and fresh weight of fruit. Cultivar Manuki produced highest number of flowers per cluster and yield per hectare. Therefore, these identified cultivars could be considered as prominent for cultivation or to exploit as a source of desirable cultivars in future ber improvement programme.

Keywords: *Ziziphus mauritiana* L., *shoot, leaf, flower, fruit and fruit yield characters.*

◆◆◆◆◆◆

Identification of Gene Specific SNP Markers for the Development of Gynoecious Hybrids in Cucumber (*Cucumis sativa* L.)

Manikanda Boopathi N[1$], Shobhana VG[1], Praneetha S[2], RajasreeV[3], Kesavan M[4]

[1]Department of Plant Biotechnology, Centre for Plant Molecular Biology and Biotechnology, Tamil Nadu Agricultural University, Coimbatore, India.

[2]Department of Vegetable Crops, Horticultural College and Research Institute,

[3]Agricultural College and Research Institute, Karur, TamilNadu Agricultural University, Coimbatore, India.

[4]ONEOMICS PRIVATE LIMITED, Bharathidasan University Technology Park, Khajamalai Campus, Tiruchirappalli, TamilNadu, India.

Extended ABSTRACT

Cucumber, the humble salad vegetable ofthe tropical countries, is the 'model crop for sex differentiation' among thecucurbits. Despite of the information on economical and nutritious status as well as pan genomic information on 11 wild and cultivated accessions, only minimal genetic and genomic resources are available for cucumber in India. On the other hand, as the primary centre of origin for cucumber, India has the highest diversity ever recorded. But such diversity has gradually reduced due to selection pressure. Owing to this limited genetic diversity and crossability with fewer related species, no noticeable upsurge has been witnessed in the average yields of cucumbers during the past decade. In order to break the stagnation in yield and enhance the quality, the development of hybrid cucumbers with the help of gynoecious lines becomes inevitable. Gynoecious accessions are usually preferred in many countries as they produce predominantly female flowers and ensures huge returns through export. In order to increase the breeding efficiency of evolving novel and superior gynoecious cucumber hybrids for the domestic/global market, it is imperative to identify robust functional markers. Even though the genome sequence of cucumber is publicly available, there are only meagre genomic resources for the development of gynoecious hybrids that can be produced in India. As genotyping-by-sequencing (GBS) offer a cost-effective discovery of markers linked to any traits, an effort has been made to identify novel single nucleotide polymorphism (SNP)and Insertion and Deletions (InDels)present in the exonic regions of genes responsible for gynoecy. The study reported here was designed with the rationale to identify gene specific SNP markers that are related to gynoecy habit using three cucumber accessions comprising of gynoecious female parent (Pant-PC2), male parent (CBE-CS-33, a regional ecotype collected from Sathur, Tamil Nadu, India) and their F_1 hybrid (TNAU_PCH2) developed at this University using GBS. A total of 3.547 Gb raw data was obtained from three accessions (*viz.*, monoecious male parent, gynoecious female parent and hybrid) using GBS with a Q20 and Q30 scores of 93.19% and 83.50%, respectively. It was found that these lines have maximum of 35.80% GC content. Polymorphic analysis has helped to identify male and female parent specific SNPs (Figure 1) on the genes that are functionally related to female flower development. The most notable one was on chromosome 6which wason the gene,*1-amino 1-cyclopropane oxidase 1 (ACS1)*involved in the ethylene biosynthesis that promotes female flowers in plants. Besides there were several other InDels on flower specific genes, which will be discussed in detail during the conference presentation. Employing suchSNP alleles in male parents would act asreliablemarkers in the large-scale development ofgynoecious hybridswith considerable yields and higher fruit quality advantage. Upon validating thesemarkers for gynoecy habit in other gynoecious lines having such genes,these markers can also be employedin commercial hybrid developmentusing other cucumber parental lines.

◆◆◆◆◆◆

Potential of genetic resources of Okra [*Abelmoschus esculentus* (L.) Moench] in varietal improvement

Bhavana Mishra[1], Akhilesh Tiwari[2] and Meenakshi Ramgiri
Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, 482004 (M.P.)

ABSTRACT

A total of 27 genotypes of okra [*Abelmoschus esculentus* (L.) Moench], were characterized for 31 morphological characters (16 visual and 15 quantitative) as per DUS guidelines at JNKVV, Jabalpur. The genetic variability and its components are the genetic fractions of observed variability that provides measures of transmissibility of the variation and response to selection. Eight genotypes, *i.e.*, IC-034190A, IC-117202, IC-117235, IC-117238, IC-282294, Kashi Pragati, Punjab Padmini and BO-2 showed red stem colour while others have green stem colour. LAM-1 showed first flower at more than 8 nodes while EC-550848, IC-034190A, IC-117300, IC-117021, Gujrat okra-5 and Kashi Chaman had shown first flower at less than 5 nodes, whereas rest of genotypes showed first flower at 5-8 nodes. Genotypes Parbhani Kranti, Pusa Sawani and Punjab Padmini were early in flowering (Â35 days) while Arka Anamika, Punjab 8, Kashi Pragati, HRB 55, Kashi Chaman and Arka Abhay were medium (35-45 days), whereas other genotypes were late (Ã45 days) in flowering. Yellow petal colour of flower was exhibited in five genotypes, *viz*. Punjab Padmini, Parbhani Kranti, Pusa Sawani, IC-111478 and IC-522273, whereas rest of the genotypes showed cream petal colour. Green fruit colour was exhibited in Kashi Pragati, Gujrat Okra 5, Punjab-8, Kashi Chaman, Punjab Padmini, Kashi Kranti, HRB-55 and BO-2 while rest of the genotypes had shown light green fruit colour. Among 27 genotypes only EC-305616, EC-550848 and IC-034190A exhibited short plant height (Â90cm), whereas majority of the genotypes were classified under medium (90-120cm) and tall (Ã120) plant height group.

◆◆◆◆◆◆

Studies on correlation and path coefficient analysis in okra [*Abelmoschus esculentus* (L.) Moench]

Mritunjay Rai[1], R. K. Singh[2], Shweta Soni[3], A. C. Mishra[2]and S. V. Dwivedi[2]
[1]Ph.D. Scholar, Dept. of Vegetable Science, ANDUA&T, Ayodhya, 224 229, Uttar Pradesh [2]Professor &[3]Assistant professor, Dept. of Vegetable Science,BUAT, Banda 210 001, Uttar Pradesh

ABSTRACT

Okra [*Abelmoschus esculentus* (L) Moench] is an important vegetable crop widely grown in tropical and subtropical parts of the world. Okra is high yielding crop under a good cropping system. For improving okra through conventional breeding and selection, it is essential to have adequate knowledge of association that exists between yield and yield related characters for the identification of selection procedure. The knowledge of such mutual relationship between fruit yield and its contributing components can significantly improve the efficiency of a breeding programme through the use of appropriate selection indices. A study of correlation and path analysis was undertaken in 18 genotypes of okra for fruit yield and its component traits at Vegetable Research Centre, Banda University of Agriculture and Technology, Banda, (U.P) during summer and rainy season-2019. It was observed that during summer season fruit yield per plant was positively and significantly correlated number of primary branches per plant and number of fruits per plant and in rainy season plant height, number of nodes and number of fruits per plant showed positive and significant association with fruit yield per plant at genotypic and phenotypic level. During both the season it was observed that estimates of genotypic correlation

coefficients were in most cases higher than their corresponding phenotypic correlation coefficients. In the present studyduring both the season leaf area had maximum direct contribution towards fruit yield per plant followed by number of fruits per plant in summer season.The study suggested that the improvement in yield per plant will be efficient if the selection is based on leaf area, number of fruits per plant, plant height, number of branches per plant and number of nodes per plant.

Keywords: Okra, Genotypic correlation, Phenotypic correlation, Path coefficient, Yield

◆◆◆◆◆◆

Varietal evaluation of Dahlia (*Dahlia variabilis* L.) under tarai conditions of Uttarakhand

Ajay Dhyani, Dr. Anand Singh Rawat, Dr. Anju Pal, Dr. ShivaniDhyani
G.B Pant University of Agriculture and Technology, Pantnagar

ABSTRACT

The present investigation was carried out at the Model Floriculture Centre, (Pantnagar) during 2019- 20. The aim of the experiment was to evaluate ten different varieties of Dahlia on the basis of their growth and flowering parameters for genetic enrichment of Dahlia cultivars in *tarai* area. The experiment was laid out in complete randomized block design with three replications involving 10 genotypes. Present findings revealed that among all the varieties of Dahlia cultivar Jishu showed highest plant height (113.22cm), plant spread (62.67 cm) and internodal distance (15.12 cm) whereas maximum number of leaves was found in cultivar Sohini (135.44).Matungini cultivar of Dahlia has maximum number of primary branches (10.11), leaf diameter (11.78 cm) and number of flowers per plant (14.78). Maximum flower diameter was recorded in the cultivar 'Tenzin' *i.e.*, 19.44 cm whereas maximum fresh flower weight was observed in cultivar 'Jishu'(55.90 gm) andmaximum vase life was observed in the cultivar 'Shanti' (6.6 days).Therefore, it can be concluded from the experimental results that Jishu and Matungani variety were well suitable for cultivation in *tarai* regions of Uttarakhand during winter season and cultivar Kenya Yellow was found well suited for late flowering and pot culture purpose.

Keywords: Genotype, Pot culture, *tarai*

◆◆◆◆◆◆

Assessment of bottle gourd [*Lagenaria siceraria* (molina) standl.]Hybrids in relation with fruit yield and economic characters

Anuj Sohi[1], Vijay Bahadur[2], Balbir S Dogra[3]
[1]PhD Research Scholar, Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (173230)
[2]Professor, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. (211007)
[3]Professor, Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (173230)

ABSTRACT

Bottle gourd [Lagenaria siceraria (Mol.) Standl.] belongs to the Cucurbitaceae family with chromosome number 2n = 22 and is one of the most important cucurbitaceous vegetable crop cultivated in India. *A trial for characterization and evaluation of presently available bottle gourd hybrid was carried out in order to*

*identify the potential cultivar for different horticultural characters*in the year 2020 at Vegetable Research Farm, Department of Horticulture, SHUATS, Allahabad, (U.P.). The experiment comprised of 17 hybrids of bottle gourd replicated thrice in a Randomized Block Design in 7.5 x 3 m^2 plot size. Yield parameters of bottle gourd, *viz*. fruit weight (gm), fruit length(cm), fruit diameter(cm), days to first harvest, number of fruits $vine^{-1}$, fruit yield $plant^{-1}$(kg), fruit yield $hybrid^{-1}$(q/ha) were generally found to be higher in T_2, followed by T_{15}.The maximum gross returns $hectare^{-1}$were calculated in T_2 (INR 3,60,147) followed by T_{15} (INR 3,36,621). The maximum net returns $hectare^{-1}$ were also obtained inT_2 (INR 2,80,047) followed by the T_{15} (INR 2,56,771). The maximum benefit: cost ratio was thus observed in T_2 (1:3.50) followed by T_{15} (1:3.22). Hence it can be concluded that BG HYB 18-2 (T_2) emerged as the best bottle gourd hybrid, closely followed by Chandan hybrid (T_{15}).

Keywords : Bottle gourd; hybrid; yield; economic; returns

◆◆◆◆◆◆

Genetic Variability, Correlation and Path Analysis Study of Some Brinjal (*Solanum melongena* L.) Genotypes

Amit Kumar Singh and Joydip Mandal
Ph.D(Vegetable Science)- Indian Agricultural Research Institute, New Delhi
Associate Professor- Department of HPHT, Visva Bharati, West Bengal
Department of Horticulture and Post Harvest Technology,Institute of Agriculture, Visva-Bharati (A Central University), Sriniketan (West Bengal) – 731236, India

ABSTRACT

West Bengal in India has the largest area and production of brinjal. However, it recorded low productivity as a result of the cultivation of different local landraces and cultivars, each of which has a limited yield potential. To increase the overall productivity of brinjal, it is necessary to identify novel genotypes with good yield potential, quality and tolerance/resistance to numerous diseases and pests. In accordance with the aforementioned fact, during the 2018 and 2019, 19 brinjal genotypes were collected and evaluated for their production potential, variability, correlation and path analysis following randomized block design with three replications at Horticulture Farm, Sriniketan, West Bengal. Considerable variability has been recorded among the genotypes for different studied characters. The PCV was greater than GCV and the highest PCV and GCV were found for the number of fruits per plant. High heritability coupled with genetic advance was also recorded for number of fruits per plant and correlation study showed that total yield was significantly and positively correlated with number of fruits per plant. Path coefficient analysis revealed that the number of fruits per plant had the highest direct positive effect towards yield. So, we concluded that Utkal Anushree and Brinjal Blue Star had good productivity, which can be suggested to the local farmers of Red and Laterite Zone of West Bengal.

◆◆◆◆◆◆

Genetic variability for horticultural traits in Bell pepper (*Capsicum annuum* L. var grossum)

Gandikota Brahmani, S K Jindal and Sayeed AH Patel
Department of Vegetable Science, Punjab Agricultural University,Ludhiana, Punjab, India, 141 004.

ABSTRACT

Bell pepper (*Capsicum annuum* L. var *grossum*) belongs toSolanaceae family, with genome 2n=2x=24. Morphological characterization is a prerequisite in any crop improvement. Hencethe experimental study was

conducted at Vegetable research farm, Punjab Agricultural University, Ludhiana to evaluate fifty bell pepper genotypes for various horticultural traits againstthe standard check PSM-1. The experiment was conducted in randomized complete block designwith three replications. Characterization of genotypeswas done for plant descriptors that includes plant height, fruit length, fruit diameter, number of lobes/fruits, pericarp thickness, number of fruits/plants, average fruit weight and fruit yield.Biochemical observations comprise of dry matter, capsaicin, ascorbic acid, chlorophyll-a and bcontent. In the germplasm plant descriptors range for plant height: 38.54-99.35 cm (PAU SM-71, PAU SM-105), fruit length: 4.25-13.47 cm (PAU SM-43, PAU SM-42), fruit width: 3.025-7.86cm (PAU SM-41, PAU SM-38), pericarp thickness: 1.42-5.41mm (PAU SM-51, PAU SM-94), fruit weight: 14.5-122.25 gm (PAU SM-105, PAU SM-89), number of fruits/plant: 18-40 (PAU SM-89, PAU SM-26,105),fruit yield/plant: 580-2760g (PAU SM-105, PAU SM-92), number of lobes/fruit-3. For biochemical parameters, thedry matter contentranges between 2.506- 7.204%(PAU SM-56, PAU SM-61), ascorbic acid: 1.884-15.072 mg/100 g (PAU SM-58, PAU SM-102), chlorophyll a: 0.0024-0.0183 mg/g (PAU SM-93, PAU SM-103), chlorophyll b: 0.0017-0.0178 mg/g (PAU SM-93, PAU SM-104), Capsaicin: 0.040625-0.46315 % (PAU SM-105,PAU SM-79).It is concluded that the available germplasm possesses sufficient genetic variability which can be successfully utilized for bell pepper crop improvement.

Keywords: bellpepper,horticultural traits, crop improvement, variability

◆◆◆◆◆◆

Speed breeding approaches for increasing genetic gain in potato

RP Kaur[1], Raj Kumar[1], Salej Sood[2], Sugani Devi[1], Vinay Bhardwaj[2] and Vinod Kumar[2]

[1]ICAR-Central Potato Research Institute, Regional Station Jalandhar, Punjab-144003

[2]ICAR-Central Potato Research Institute, Shimla, Himachal Pradesh-171 001

ABSTRACT

The vegetative mode of propagation in potato, entails fixation of heterosis in first filial generation itself. However, its low multiplication rates, high heterogeneity, hybridization barriers, difficult identification of few heterotic progenies and polyploid nature lengthen breeding cycle to more than 10 years, which is similar to sexually propagated crops, where heterosis needs to be fixed over several breeding generations. Thus, prolonging conventional breeding programmes and delaying introduction of superior varieties causing both food scarcity as well as economic losses on various research accounts. These issues can be suitably addressed through speed breeding which increases genetic gain, ensuring food security in the face of rapidly increasing human population. Speed breeding involves rapid advancement of generations along with other advanced technologies like genomic selection for improving selection efficiency. In potato, speed breeding can be undertaken using approaches involving planting more than one generation in a year and rapid multiplication of potato tubers either through direct tuber-based methods of through tissue culture or photoautotrophic micropropagation based methods like aeroponics technology, apical rooted cuttings, net house/ field multiplication etc. Using these approaches two different strategies were devised for undertaking speed breeding. Firstly, controlled conditions were used to advance two generations in the same year as hybridization. In this strategy true potato seed could be tuberized under *in vitro* conditions and grown subsequently, in the same cropping season, yielding a multiplication rate of average 12.5 tubers per plant, while allowing a small degree of selection based on tuber characters for shape. Similarly, a novel method for rapid multiplication of tubers using sprout plants was developed, wherein an estimated 616 and 351 tubers per indexed tuber of variety KufriHimalini and KufriPukhraj could be developed, although, achieved multiplication rates were lower due to non-survival of sprout plants, which can be improved. Speed breeding strategies along with genomic selection, efficient phenotyping and use of efficient data management and analysis tools in potato breeding programmes would contribute towards achieving rapid genetic gain allowing

conduct of replicated/ multilocation trials in an earlier breeding generation and early introduction of better varieties at farmers field after release.

Keywords: Potato, speed breeding, rapid advancement of generation, tuber multiplication rate, *in vitro* tuberization

◆◆◆◆◆◆

Morpho-Biochemical characterizationof cherry tomato (*Solanum lycopersicum* (L.) var. cerasiforme Mill) germplasm

Arman Thakur, Sayeed A.H. Patel, Salesh K. Jindal and Neena Chawla
Department of Vegetable Science, Punjab Agricultural University, Ludhiana

ABSTRACT

Cherry tomato, belongs to family Solanaceae, is a potential crop have comparatively smaller size and mostly used for salad or fresh consumption. It is a high value crop with great potential and fetch good market price especially in metropolitan cities. An experiment was conducted at Vegetable Research Farm, PAU for evaluation of genotypes of cherry tomatoes. Morphological and biochemical performance of 68germplasm including three checkswereevaluated in three replicates underRandomised Complete Block Design.Analyzed data for all traits except number of locules showed that the studiedgermplasm hassignificant statistical difference.The germplasm observed contained 45 red, 12 yellow, 8 orange and 3 green coloured varieties. There was a wide variability in shapes *i.e.* round, oval, pear shaped, oblong and elongated. Among quantitative traits, the yield per plant was recorded in a range of 730 to 4020g. The range of yield contributing traits *i.e.* no. of fruit per plant (48-352), average fruit weight (4.49-28.37 g), fruit length (1.51-6.8 cm), fruit diameter (1.9-3.6 cm) and pericarp thickness (1.26-6.1 mm). Among biochemical traits, TSS of the fruits ranged between 3.83-9.67°Brix. While ascorbic acid content was ranged between 20.7-64.9-mg/100g. The titrable acidity lies between 0.32 to 1.15 mg/ 100ml. The coloring compound *viz.*, lycopene content was recorded from 0.07-2.91mg/100g whereas carotenoid content was observed in a range of 0.23 to 23.39 mg/100g.Such variation for yield and its contributing traits can be a reservoir pool to a breeder for specific traits to achieve economical and nutritional security for doubling farmers income andtackling malnutrition, respectively.

◆◆◆◆◆◆

Variability among different yield and yield contributing traits of Okra (*Abelmoschus esculentus* L. Moench) genotypes

Aman Deep Ranga[1], Sourav Kumar[2] and Mayur S. Darvhankar[3]
[1]Department of Vegetable Science, College of Horticulture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India 173230
[2]Division of Genetics, Collaboration Outstation Research Centre (CORC), ICAR- Indian Agricultural Research Institute, Rakhra, Patiala, Punjab India 147001
[3]Department of Genetics and Plant Breeding, School of Agriculture, Lovely Professional University, Phagwara, Punjab, India 144411

ABSTRACT

An investigation was undertaken during *rabi* season of 2018 to evaluate fifteen okra genotypes for agro-morphological traits. Variability parameters indicated high GCV and PCV values for the number of fruits per plant, yield per plant and 100 seed weight and the narrow differences between GCV and PCV determine that traits under study had negligible environmental influence. High values of heritability coupled with high

genetic advance were recorded for all the traits studied. Fruit length and the number of fruits per plant had a positive and significant correlation with yield per plant. The number of fruits per plant had the highest positive and direct effect on yield per plant. The first four principal components (PC1 to PC4) gave eigenvalues > 1 and cumulatively expressed 84.28 per cent of the total variation. Cluster analysis suggested that the hybridization of cluster I with cluster II will be favourable for developing varieties under multiple environmental conditions in India. Therefore, these quantitative traits in these clusters can be selected to enhance yield potential as they will be beneficial in developing promising varieties under diverse climatic conditions throughout India.

Keywords: Cluster analysis, Genetic advance, Heritability, Principal component.

◆◆◆◆◆◆

Potential of Underexploited Vegetables for Nutritional Security and Economic Prosperity of Bundelkhand Region

Ajeet Singh, Himanshu Singh, M.K. Singh, Ashutosh Rai, A.C. Mishra, R. K. Singh and S.V. Dwivedi

Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda-210001

India's diverse climate ensures the availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetable production in the world, after China. Bundelkhand region of Uttar Pradesh is low in productivity with limited choices of crops because of its too hot and semi humid climate. In spite of the scarcity of water the region possess a rich diversity of many species of vegetables crops e.g. ivy gourd, kachri, spine gourd, purslane, pointed gourd etc. which are used as vegetable by the people of rural communities. Cultivation of most of these crops is restricted to small farms, backyards or marginal land. Being wild, most of these vegetables possess high nutritional quality. An additional feature of these crops is that these can grow well in harsh climates and on the marginal lands without any special care. These crops have the potential to contribute not merely to agriculture biodiversity but most importantly to the livelihood of poor and generating income.Bundelkhand contains a wide variety of underused vegetables that are rich in nutrients and have medicinal benefits, as well as the ability to withstand harsh climatic conditions. The underutilised vegetables are still neglected due to its incomplete knowledge of their package and practices, a lack of planting materials, technical know how about production systems and marketability etc.To ensure future food and nutritional security, it is vital to boot up a programme on genetic resource investigation, management, nutritional profiling, usage and enhancement of these underutilised vegetable crops. Additionally, the cultivation of underutilised vegetables will address the lack of per capita consumption availability, addressing the nutritional gap, while also creating jobs, raising rural residents' incomes and possibly even boosting the country's economy.

◆◆◆◆◆◆

Investigation stage-wise application of N, P & K on growth, yield & quality of *Sapota* (*Manilkara achras* L.) Var. Kalipatti

Chukkamettu Anusha and S.N. Patil

Department ofFruit Science, University of horticultural sciences, Bagalkot, Karnataka,India,591306

ABSTRACT

Nitrogen, phosphorus and potassium, being the essential major elements, are required by plants for maximizing physiological activities of the plant and for plant, water and soil relationships, but under tropical

conditions, soil nutrients are lost rapidly due to various factors. Therefore, it is important to apply nutrients at the critical stages of crop growth in small doses, at shorter intervals, to minimize loss of nutrients and cost of production and to increase the productivity. The present study entitled "Investigation on stage-wise application of N, P and K on growth, yield & quality of sapota (*Manilkara acharus* L.) var. Kalipatti during the year 2018-2019 at department of Fruit Science, KRCCH, Arabhavi was undertaken. The experiment was laid out in randomised block design. The study revealed that the stage-wise application of nutrients in T_3 at four different growth stages. *viz*. vegetative flush (July), 20-80-20, flowering stage (September) 20-0-20, fruit development stage (November) 20-0-20 and fruit development stage (February) 20-0-20 NPK (g) resulted reproductive parameters *viz,* minimum number of days taken forbud initiation (33.66), flowering to fruit set (237.00), fruit set to final harvest (216.00), per cent of fruit set (18.56), per cent of fruits reached to final harvest (83.78), highest yield (12.40 t/ha) was recorded in T_3. The high TSS (24.50 °B) and low acidity (0.16%), good shelf life (12.65 days) were recorded in treatment T_3.Increasing the number of spilt applications at different growth stages of sapota would obtain optimum yield of quality fruits in sapota orchard.

◆◆◆◆◆◆

Genetic diversity, population structure and SSR marker-trait associations of edible *Brassica oleracea* Gp. Acephala germplasm indigenous to India

Geetika Malik, Asma Jabeen, JI Mir and OC Sharma
ICAR-Central Institute of Temperate Horticulture, Srinagar
(Old Airfield, Rangreth, Srinagar, J&K-191132)

ABSTRACT

There is considerable phenological diversity among collard and kale varieties within Acephala group of *Brassica oleracea* in India, particularly Kashmir. However, genomic studies of these traditional crops, despite having exceptionally been acknowledged for their nutritional potential in recent past, are limited. In this study, genomic characterization of 62 morphologically diverse collard and kale collections was done with 75 *B. oleracea* SSRs. The accessions included Kashmiri landraces, exotic introduction and some cultivars in addition to collections from different districts of Kashmir. The markers amplified 269 alleles (Na) with an average of 4.07 alleles per locus. Expected heterozygosity (He) ranged from 0.00 to 1.887 averaging 0.392. Polymorphic information content (PIC) ranged from 0.00078 to 0.953 with an average of 0.407. Similarly, effective multiplex ratio (EMR), mean heterozygosity (H_{av}), marker index (M), discriminatory power (D) and resolving power (R) ranged from 0.0007 to 3.403, 0.00 to 2.483, 0.00 to 2.451, 0.00 to 2.064 and 0.00 to 3.484, respectively. The population structure analysis and neighbor joining tree clustering categorized the germplasm into 3 sub-populations. AMOVA revealed 67.73% of variation to exist within populations. The MLM revealed six marker-trait relationships including five SSR markers, with a significance level of P 0.001/0.0001. In mixed model, we report significant marker-trait associations of economic importance where two loci were associated with plant height and one locus with siliqua length, seed weight, flowering period and petiole diameter. This study has established first linkage disequilibrium pattern in collard and kale germplasm of India that will be useful in selecting markers for future genome wide association studies.

Keywords: Collards, kales, *Brassica oleracea*gp Acephala, diversity, population structure, linkage disequilibrium, marker-trait associations

◆◆◆◆◆◆

Studies on Stionic Combination in Pear Under Sub-Temperate Zone of North-Western Himalayan Regions of India

Antima Sharma[1], J S Chandel[2], Uday Raj Patial[3]

[1,3] Department of Fruit Science, Punjab Agricultural University, Ludhiana, Punjab-141004, [2]Department of Fruit Science, COH, Dr Y S Parmar UHF NauniSolan (H.P.) – 173230

ABSTRACT

The current Investigation was carried out in order to study the influence of different stionic combination in pear at experimental farm in the Department of Fruit Science at Dr. Y. S. Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during the year 2019-2020. The experiment consisted of 16 treatment combinations comprising of four pear rootstock treatments *viz.*, Kainth, Quince A, Quince C and BA 29 and four pear scion cultivar treatments *viz.*, Carmen, Concorde, Packham's Triumph and Red Bartlett replicated thrice in randomized block design (factorial). Cultivar Carmen grafted on Kainth and Quince A rootstocks was found to be the most vigorous among all the stionic combinations with the highest graft take success (100%), plant height (95.15 cm), shoot length (74.96 cm), rootstock diameter (10.34 mm), total plant biomass (46.85 g DW), number of internodes (35.87) and bark thickness of 2.02 mm and wood thickness of 7.27 mm was recorded in plants of Carmen grafted on Quince A rootstock. However, the plants grafted on Quince C rootstock attained intact plant stature, reflecting its potential to use as rootstock for above-mentioned cultivars under high density plantation. All the cultivars were found to be compatible with Quince A, BA 29, Quince C and Kainth rootstocks as no overgrowth above and below the graft union was observed in any of the stionic combinations.

◆◆◆◆◆◆

Potential of genetic resources of Okra [*Abelmoschus esculentus* (L.) Moench] in varietal improvement

Bhavana Mishra[1] , Akhilesh Tiwari[2] and Meenakshi Ramgiri[3]

[1] Research Scholar , [2] Professor , [3]Technical Assistant

Department of Horticulture, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, 482004 (M.P.)

ABSTRACT

A total of 27 genotypes of okra [*Abelmoschus esculentus* (L.) Moench], were characterized for 31 morphological characters (16 visual and 15 quantitative) as per DUS guidelines at JNKVV, Jabalpur. The genetic variability and its components are the genetic fractions of observed variability that provides measures of transmissibility of the variation and response to selection. Eight genotypes, *i.e.*, IC-034190A, IC-117202, IC-117235, IC-117238, IC-282294, Kashi Pragati, Punjab Padmini and BO-2 showed red stem colour while others have green stem colour. LAM-1 showed first flower at more than 8 nodes while EC-550848, IC-034190A, IC-117300, IC-117021, Gujrat okra-5 and Kashi Chaman had shown first flower at less than 5 nodes, whereas rest of genotypes showed first flower at 5-8 nodes. Genotypes Parbhani Kranti, Pusa Sawani and Punjab Padmini were early in flowering (Â35 days) while Arka Anamika, Punjab 8, Kashi Pragati, HRB 55, Kashi Chaman and Arka Abhay were medium (35-45 days), whereas other genotypes were late (Ã45 days) in flowering. Yellow petal colour of flower was exhibited in five genotypes, *viz.* Punjab Padmini, Parbhani Kranti, Pusa Sawani, IC-111478 and IC-522273, whereas rest of the genotypes showed cream petal colour. Green fruit colour was exhibited in Kashi Pragati, Gujrat Okra 5, Punjab-8, Kashi Chaman, Punjab Padmini, Kashi Kranti, HRB-55 and BO-2 while rest of the genotypes had shown light green fruit colour. Among 27 genotypes only EC-305616, EC-

550848 and IC-034190A exhibited short plant height (Â90cm), whereas majority of the genotypes were classified under medium (90-120cm) and tall (Ã120) plant height group.

◆◆◆◆◆◆

Chilling Unit Models used for Temperate fruits

Archana Mahida
Ph.D. Scholar, Department of Horticulture, Central University of Tamil Nadu, Thiruvarur-6100005

ABSTRACT

Fruits are very important for human beings and also play an important role in religious practices, mythology and art. They are not only delicious but also how many nutrients which are necessary for human health. India is the second largest producer of fruits in the world. Fruit Production requires a lot of science and some basic knowledge to grow them successfully. Temperate fruits are cultivated in the middle latitudes ranging from 30° to 50° N and S. The global warming caused loss of vigour, fruit bearing ability, reduction in size of fruits, less juice content, non attractive colour, reduced shelf-life and increasing attack of pests which affect the production. Chilling requirement define as a physiological requirement of low temperature for effective growth in normal spring. Chilling requirement is measured in terms of chill hours. Chilling temperature is essential prerequisite for effective and synchronous bud-break and flowering. Fruit Crops go through three stages during dormancy first is acclimation which means ability to adjust according to climate change. This stage start after the plant has ripened and growth has stopped. Second stage includes ability of plant to survive in particular adverse climate. This stage generally occurs from December through February. There are two distinct types of dormancy: endodormancy and eco-dormancy. Endo-dormancy is the period in which the plant is accumulating its chilling hours the most. Until the plant satisfies its need for cold, it will not break bud, even if temperatures warm. Once the chilling requirement for a plant has been satisfied, it enters into eco-dormancy (also called quiescence). Eco-dormancy occurs due to unfavourable environmental conditions. third stage is called deacclimation. Deacclimation is the process of breaking dormancy and readjusting to warmer temperatures. There are several chilling unit models to calculate the chilling accumulation required for particular crops through which we can predict the chilling requirement of crops and improve the production

Keywords: Eco-dormancy, Chilling requirement, Shelf-life and Chill Hours

◆◆◆◆◆◆

Varietal evaluation of Ber (*Zizyphus mauritiana Lamk.*) for yield and fruits quality attributes

Om Prakash[1], Dharmendra Kumar[2] and Siddharth Kumar[3]
[1, 2 & 3]Department of Fruit Science, College of Horticulture,
Banda University of Agriculture and Technology, Banda, U.P.

ABSTRACT

The experiment of Ber varieties was conducted at Instruction farm, College of Horticulture, Banda University of Agriculture and Technology, Banda (U.P.) during the year 2021-22. Evaluated varieties were studied yield and fruits quality attributes. The trail consisting of Ten treatments (T_1 -Thai Ber, T_2 -Umran, T_3 -Banarasi Karaka, T_4 -Seb, T_5 -Gola, T_6 -Chhuhara, T_7 -Kaithali, T_8 -Mundia, T_9 -Elaichi and T_{10}–Rashmi). The variability was recorded in fruit shape (ovate oblong, oblong, ovate and round), fruit colour (green, yellow green, golden yellow and green) and pulp colour (creamy white and creamy). The yield attributes variability was observed in fruit length (3.40-5.72 cm),

fruit width (2.13-4.20 cm), fruit weight (20.27-48.33 g), fruit volume (21.21-49.25 cc), stone length (1.59-2.80 cm), stone width (0.86-2.07 cm), stone weight (1.41-2.83 g), pulp weight (16.22-44.24 g), pulp and stone ratio (11.31-15.61) and specific gravity (0.95-0.98). The quality attributes parameter also showed wide range of variation *i.e.*, *TSS (10.61-16.62* ^{0}Brix), ascorbic acid (80.5-115.33 mg/100g), reducing sugars (4.05-7.11 %), non-reducing sugars (3.90-4.75 %), total sugars (7.95-11.86 %), acidity (0.32-0.75 %), protein (0.40-0.70 %) and pH (3.0-5.0). Therefore, on the basis of quality attribute among the different evaluation; the variety T_7 (Kaithali), T_2 (Umran) and T_3 (Banarasi Karaka) found to be superior. These promising varieties can be recommended for commercial cultivation at farmer's field.

◆◆◆◆◆◆

Performance of Different Genotypes of Pumpkin in Bundelkhand region

Neha, Ajeet Singh, Rehan anjum, Akansha Rai, M.K.Singh, A.C.Mishra and R.K.Singh
Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda-210001

ABSTRACT

Pumpkin (*Cucurbita moschata* Duch. ex. Poir) is an economically important cucurbitaceous vegetable. It is a monoecious and highly cross pollinated in nature. It occupies a prominent position due its high productivity, nutritive values, good storability, better transport quality and extensive cultivation in sub-tropical and tropical regions of the globe.The name pumpkin originated from Greek word 'Pepon'used for long melon (Bahadur and Singh,2014). Pumpkin provides a valuable source of carotenoids that have a major role in nutrition in the form of pro-vitamin-A. Pumpkin is cultivated in most of the countries of the world but China and India lead the world production.Total pumpkin cultivated area is 0.106 mha. with the production of 2.205 million ton and productivity 20.80 MT (2020-2021, Ministry of Agriculture ,GOI, New Delhi).

The present trial was laid out in Randomized Block Design with three replications during kharif 2022 at instructional farm of Department of Vegetable Science, College of Horticulture, BUAT, Banda.The geographical location of the research farm is having a latitude of 25.52º and longitude of 80.35º.The trial location experiences a warm tropical climate.It comprised of 18 genotype of Pumpkin taken from different sources.Each plot consisted of single row of 7 plants and the spacing was 2m x 1m.The cultural and management practices were adopted according to the recommended package of practices.Five plants were selected for recording the observation.On the basis of "variability and character association for yield and its attribute"three lines which give very high yield and perform better here are VRPK-310, VRPK-07-02 and Arka chandan. All these genotypes have immense potential in Bundelkhand region.

◆◆◆◆◆◆

Present status and future prospects of cucurbitaceous vegetable crop breeding in India

Shashank Shekhar Singh and Ranjan Kumar Singh
Krishi Vigyan Kendra (K.V.K.), Nawada, Bihar-805106

ABSTRACT

The Cucurbitaceae consists of about 118 genera and 825 spices. Although most of them originated in old world, many species originated in the new world and at least seven genera in both the hemispheres. There is tremendous genetic diversity within the family and the range of adaption for cucurbit spices includes tropical and

subtropical region, arid deserts and temperate regions. Among the cucurbits, cucumber originated in India and wax gourd (*Benincasa hispida*) is from Southeast Asia. Considerable amount of genetic diversity in wild and cultivated species of *Luffa, Momordica, Citrullus, Cucumis, Coccinia*, *Cucurbita* and *Trichosanthes* is found in India. *Luffa acutangula var. amara* is usually found in peninsular India and *Luffa echinata* in the westerns Himalayan belt, central India and upper gangetic plains. Another important species, *Luffa graveolens* (considered to be wild progenitor of *Luffa hermaphrodita*) can be spotted in Bihar, Sikkim, Tamil Nadu and *Luffa umbellate* is confined to eastern coast. Similarly, *Momordica balsamina* extensively occurs in semi-dry North –Western plains and sporadically in upper gangetic regions and in northern parts of Western and Eastern Ghats. *Momordica dioica* and *Momordica cochinchinensis* occurs in wild, semi wild forms in the Gangetic plains. *Trichosanthes* has 21 species in India and the major zones of its concentrated distribution *i.e.* along the Malabar Coast in Western Ghats and low and medium elevation zones in Eastern Ghats and North- Eastern region. Citrullus colocynthis exhibits much variation in North- Western plains. In cucumis, C. hardwicki (progenitor of cultivated cucumber) and C. Trigonus are distributed in Himalayan belt with considerable diversity.

Due to intensive breeding efforts, particularly with cucumber, Bottle gourd, Bitter gourd *Luffa and melons,* numerous new cultivars have been developed which have diversity in nutritive value, multiple disease resistant and extended shelf life from the traditional forms.

◆◆◆◆◆◆

Water spinach: A potential leafy vegetable for Bundelkhand region

Ajeet Singh, Himanshu Singh, M.K. Singh, Ashutosh Rai, A.C. Mishra, R. K. Singh and S.V. Dwivedi

Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda-210001

ABSTRACT

Vegetables are the key component of balanced human diet and the main drivers in achieving global nutritional security by providing nutrients, vitamins and minerals. Compared to basic foods like grains, leafy vegetables are higher in minerals like calcium and iron. The plant has a high concentration of nutrients, including carotenoids, chlorophyll, vital amino acids, vitamins A, C and iron, as well as polyphenols. Water spinach, a green vegetable with a strong endurance to heat and moisture, is a product of tropical climates. There are numerous options in Bundelkhand to grow vegetables that are well suited to the topography of the region, hardy in the heat and yield good results. This plant, like many others, is regarded as a food with medicinal properties. *Ipomoea aquatica* is advised for piles, "in some neurotic conditions with restlessness and headache," and is also used as a laxative. The young plant's entire body is typically edible, though the tender shoots are liked more—much like spinach—because the rigid stems take a little longer to cook than the leaves. The leaves have a slick texture and a very nice, mild, sweet flavour. After stir frying, it's best to only use water spinach. For cattle feed, the tough stems and leaves are frequently employed. water spinach can also be propagated through stem cutting, however it is typically propagated by seed. Based on the performance in Banda region, water spinach can be grown in assured irrigated fields as well as the bank of natural water sources. Besides this water spinach on large scale under upland field condition could makesignificant contribution towards economic upliftment of the society along with ensuring nutritional security.

◆◆◆◆◆◆

Performance of guava F1 hybrids under field condition for quantitative traits

Pushpendra Rajput, Rajesh Kumar, D. C. Dimri, V. P. Singh, Satish Chand, Poonam[1] and Rajat Sharma

Department of Horticulture, G. B. Pant University of Agricultural and Technology, Pantnagar, Uttarakhand 263145

[1]Department of Horticulture, RajmataVijayarajeScindia Agricultural University, Gwalior, Madhya Pradesh - 474002

ABSTRACT

The present study was conducted at Horticulture Research Centre, Patharchatta, GovindBallabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, during the years 2019-22. One year-old total 25 genotypes (15 F1 hybrids and 10 parents) were evaluated for different quantitative traits 30, 60 and 90 days after transplanting in the field condition. The performance of genotypes for different characters at 90 days after planting, the maximum plant height was found in Red Fleshed × L-49 (114.27 cm) then Red Fleshed × Local Germplasm (113.37 cm) and minimum inseedlings ofHissarSurkha (81.80 cm). The range of the plant girth varies from highest in KG-1 Guava × Local Germplasm (14.04 mm) and lowest in seedlings of Lalit (10.69 mm) were recorded. In case of internodal length and No. of internodes, the highest internodal length and minimum no. of internodes were recorded in plants of Sangareddy (4.19 cm and 27.0) respectably. Number of the leaves were recorded highest in Red Fleshed × Local Germplasm (69.0) fallowed by Red Fleshed × L-49 (62.56) while minimum in plants of Sangareddy (45.0).In terms of leaf blade length maximum in Hissar Safeda × L-49 (15.03 cm) andHissarSafeda × Lalit (15.0 cm) and minimum inplants of Sangareddy(10.02 cm) were noted, while range of leaf blade width and leaf area index varies highest in Hissar Safeda × L-49 (7.02 cm and 100.48 cm^2) while lowest in seedlings of Local Germplasm (4.53 cm and 42.60 cm^2) respectably. Ratio of leaf blade length to width was highest in seedlings of Lalit (2.43) than in HisarSafeda× Lalit (2.26) but lowest in the plants of Sangareddy× L-49 (1.84) were found. The range of the chlorophyll content in terms of SPAD units varies highest in the seedlings of Local Germplasm (448.4) to minimum in Sangareddy × L-49 (242.2).

Keywords: Quantitative, Leaf area, SPAD unit**,** Plant girth, Chlorophyll, Hybrids

◆◆◆◆◆◆

Cashew Research in India

J. DinakaraAdiga and Veena, G.L.

ICAR-Directorate of Cashew Research, Puttur-574202, Karnataka

ABSTRACT

The cashew, is an important horticultural crop introduced to India from Brazil by Portuguese travellers during 16th century. Cashew was utilised to mitigate soil erosion along the coastal areas in west coast. In India, cashew is cultivated on a wide range of soil types such as sandy to sandy loam, laterite soil, loam and red latosols. Due its drought hardiness, cashew is widely cultivated in degraded hillocks and slopy lands, where profitable production of other crops is not possible. The potential of cashew was first realized by India during early 1900s through export of kernels. Since beginning India dominated the cashew production and trade. In the current scenario there is a huge demand for cashew kernels both from domestic and international markets. India imports raw cashew nuts from other countries to meet the demand of processing industries. Of late, the import possibility from many of the other countries is dwindling. The research in cashew has made it possible to address the problem of low productivity. Many improved varieties *viz.,* Vengurla-4, Vengurla-7, Bhaskara, Nethra Ganga,

Nethra, Jumbo-1, BPP10, BPP11, Balabhadra etc with bunch bearing habit, high kernel recovery, medium to big size nuts with export quality, precocity in bearing, high percentage of fruit set and / or better nut retentionwere released. High density planting with a spacing of 4m x 4m instead of 7.5m x 7.5m made it possible to accommodate morenumber of plants per hectare and increase in yield by 2.5 folds in the initial decade of plantation. The ultra-high-density planting technique with 1111 or 1600 plants per hectare with a spacing of 2.5 m x 2.5m with an ability to realize a potential yieldof 1.5 kg/plant from the second year of planting itself, by following the relevant agro -techniques was also standardised.Nutrient management, drip irrigation, intercropping, soil and water conservation practices and canopy management through top working or rejuvenation of old senile orchardsto increase the productivity are some of other technologies developed. The phenological studies were carried out in cashew for the first time at global level by using BBCH scale and seven important principal growth stages and 37 secondary stages were identified in cashew according to BBCH scale.The biotechnological interventions like draft genome sequence assembly, *de novo* assembly of shoot transcriptome, novel genic SSRs microsatellite markers paved a way for advanced research in cashew with the potential for reducing period of breeding cycle. The biological control of cashew stem and root borers using EPN has been standardized at ICAR-DCR, Puttur. The stem nesting bees were successfully conserved using simple cost-effective artificial nesting sites or trap nests designed at ICAR-DCR, Puttur for enhancing pollination in cashew. Protocols have been standardised for preparation of diversified value-added products from cashew apple and kernels and sprouted kernels,which are helpful to enhance the income of growers. Mechanization related to processing of cashew nut as well as cashew apple are standardized and commercialized at ICAR-DCR, Puttur. Mechanizationof harvesting, applications of drone and proper phytosanitary measurements to control major pests and diseases will contribute to realizing higher cashew productivity in India. Various mobile apps and software have been developed to facilitate the transfer of technology in cashew.

Keywords: Nethra Jumbo-1, Ultra high density, Draft genome sequence, Mechanization

◆◆◆◆◆◆

Protein profiling in different cherry tomato (*Solanum lycopersicum* L. var. cerasiforme) cultivars

Krishna Jat, Deepa H.Deivedi and Dhanpat Singh
Department of horticulture, Babasaheb Bhimrao Ambedkar University,
Lucknow, Uttar Pradesh-226025,India

ABSTRACT

Cherry tomato (*Solanum lycopersicum L.var.cerasiforme*) belong to family solanaceae nowadays cultivation is gaining popularity with Indian growers for its high nutritive value and use as salad purpose or as a snack packs. It have efficient quality for fresh market ,high TSS content and low acidity the major factors considered for manufacturing of processed product. Cherry tomatoes are source of germplasm for providing disease resistance and adaptability to cool and hot season. Research indicates that proteins profiles for cherry tomato varieties showing different bands and molecular weights (KDa) in 8 genotypes through SDS –PAGE (Sodium Dodecylsulfate Poly Acryl amide Gel Electrophoresis) method. Polyacrylamide is used to form a gel, a matrix of pores which allow the molecules migrate at different rates. Research show the highest number of protein bands (10) were recorded from germplasm G1(DIBER-Sel.) followed by G8(2016/TOCV var-4)and minimum (6) protein bands were recorded from G4(2015/CT var.Yellow).However , the maximum band size (205 KDa) was recorded from G5,and dendogram was prepared on the basis of banding pattern of protein profiling of different cherry tomato cultivars. In present study the SDS-PAGE have proved to be useful for analysing the diversity of cherry tomato grnotypes. The knowledge of the diversity of these genotypes will

facilitate its use in breeding programmes and improved the management of large collections of the species .the result may be offer scope for breeding programme aimed to generate new improved cultivars of cherry tomato in future.

◆◆◆◆◆◆

Genetic diversity analysis in fennel (*Foeniculum vulgare Mill.*)

Jaswant Prajapati, SwetaSoni, A.C. Mishra, R.K. Singh, M.K. Singh, Neetu and Sunil Kumar
Department of Vegetable Science, College of Horticulture
Banda University of Agriculture and Technology, Banda- 210001.

ABSTRACT

The present investigation was conducted to study divergence analysis for 12 characters in Augmented Block Design of seventy-five genotypes with three checks in fennel (*Foeniculum vulgare* Mill.) and it was carried out in *Rabi* season, 2020-21 at MES of department of vegetable sciencein ANDUA&T, Kumarganj, Ayodhya.The study of genetic divergence among the seventy-eightgenotypes of fennel was carried out by using D^2 statistics (Beale, 1969 and Spark, 1973). All the genotypes were grouped into six clusters. ClusterIII and V are overlapping to each other. Cluster II (19) had highest number of genotypes followed by cluster IV (14), cluster III and cluster V (13), cluster VI (11) and cluster I had 8 genotypes.The intra cluster D^2values ranged from 10.72 (cluster V) to 22.86 (cluster VI). The maximum intra- cluster distance was obtained in cluster VI (22.86). The maximum inter-cluster distance was observed between clusters I and VI (42.95) which revealed that members of these two clusters (I and VI) are genetically much diverse to each other. The inter-cluster values between cluster V and cluster VI (30.07) and cluster IV and VI (29.11) were very high. The minimum inter-cluster D^2value was recorded between cluster IV and cluster V (16.58).Cluster means for different characters indicated considerable differences between the clusters. The higher inter-cluster distance indicated greater genetic divergence between the genotypes of those clusters. Whereas, lower inter-cluster values between the clusters suggested that genotypes of the clusters were not much genetically diverse from each other.There is an immense need to collect geographically diverse genotypes of fennel to strengthen the ongoing improvement programmes on fennel.

Keywords: fennel, Augmented Block Design, genetic divergence, intra- cluster and inter-cluster.

◆◆◆◆◆◆

Estimates of genetic variability and scope of improvement in yield and quality traits of brinjal (*Solanum melongena* L.)

Akhil Kumar Chaudhary[1], C. N. Ram[2], Bhavana Singh[3],Nimit Singh[4]Rupesh Singh[5]
Department of Vegetable Science([1,4,5]Ph.d Student, [2]Professor)
Department of Vegetable Science ([3]P.G Student)
Acharya Narendra Deva University of Agriculture & Technology Kumarganj, 224229Ayodhya(UP)

ABSTRACT

The analysis of variance revealed that mean sum of squares due to genotypes was highly significant for all the traits indicating ample variation among the genotypes. Based on mean performance most promising genotypes were NDB-126, 2018/BRLVAR-11 and NDB-125 which produced significantly higher yield per plant over the best check Punjab Sadabahar. The estimates of the phenotypic coefficients of variation (PCV) were higher than the genotypic coefficients of variation (GCV) for all the traits. The highest phenotypic and genotypic

coefficient of variation was observed for number of fruit per plant followed by total marketable fruit yield per plant, total fruit yield per plant, average fruit weight, fruit circumference, fruit length, number of primary branches number, plant height. While days to 50% flowering and days to first fruit harvest exhibited low value of variability. The heritability estimates for different characters ranged from 40.30 (days to first harvest) to 98.70 (total fruits yield per plant) per cent. High heritability was recorded for all the characters except days to first fruit harvest. Genetic advance in per cent of mean ranged from 5.12 per cent (days to first fruit harvest) to 73.67 per cent (number of fruit per plant) and it was low (<10) in days to 50% flowering (9.42), days to first fruit harvest (5.12). While it was high (>20) in number of primary branches (28.53), fruit length (41.15), fruit circumference (45.71), average fruit weight (65.82), total fruit yield per plant (69.36), marketable fruit yield per plant (72.27) and number of fruit per plant (73.67) high. High heritability coupled with high genetic advance were recorded for the traits *viz*. total fruit yield per plant, marketable fruit yield per plant, average fruit weight and number of primary branches,fruit length andfruit circumference. Thus, there exists ample genetic variability and as consequence scope of improvement in the available germplasm of brinjal.

Key word- Genetic variability, PCV, GCV, heritability, genetic advance.

◆◆◆◆◆◆

Development of Industrially valued trait in chilli for ready to process

P. S. Ajjappalavara, Maheswarappa H.P., Shantappa T., Allolli, T.B., Hegde L.N., Mastiholi A. Ravikumar B. Vinay kumar M.M., Satish D., S.G. Gollagi and Pallavi H.M.

Horticultural research and Extension Center, Devihosur, Haveri-581 110, Karanataka
University of Horticultural Sciences, Bagalkot, Karanataka

ABSTRACT

During 2012-13 a mutation breeding experiment was conducted to enhance the variability in 'GPM-120-S-1' ('Byadgi Dabbi' segment, a popoular dry chilli cultivar in Karnataka state, India) a pre-breeding for resistance, particularly for biotic stresses using Ethyl Methane Sulfonate (EMS). The mutagen, EMS solution of 0.1 % to 0.9 % for five hours was treated for mutagenizing the seeds to produce first population (M_1). The M_1 seeds were grown and seeds were harvested to develop M_2 population. During 2014-15 *kharif,* 0.4% of EMS treated M_3 population had a soft fruited with deciduous fruit character plant and that plant was identified and their seeds were used to grow a larger number of individuals in M_4 generation in 2014-15 *rabi* to break the linkage of soft fruitiness' and deciduous character in chilli. As expected, in the M_4 population two kinds of plants, soft flesh (NPC-4) and normal flesh (erect (NPC-3) and pendent (NPC-5) bearing) with deciduous fruits and these segregants were selected with pure line selection method and carried forwarded to next generation until they reaches to the homozygosity. The three homozygous lines were evaluated for four years for yield and trait (2017-18, 2018-19, 2019-20 and 2020-21) the performance of lines over the four years NPC-3 yielded 0.63 t/ha to 2.28 t ha in different years and average over four years was 1.44 t/ha, NPC-4 yielded 0.43 t/ha to 2.15 t/ha and average over four years was 1.27 t/ha and NPC-5 yielded 0.58 t/ha to 2.68 t/ha whereas, over four years 1.48 t/ha. These lines were shown stability for the trait of deciduous fruits and yielded highest over the seasons and over the checks. The genotype NPC-3 was shown moderately resistance for the chilli leaf curl, good capsaicin content of 19217 SHU and having good red colour count of 138.5 ASTA. Whereas, the NPC-5 was recorded resistance for the chilli leaf curl and high yield.

Keywords: Chilli, Mutation, Mutagen, stalk less, deciduous

◆◆◆◆◆◆

Speed Breeding: A Potent Way of Crop Improvement

Sudheer Kumar Yadav[1], Ajay Kumar[2], Poonam Maurya[3] andDeepa H Dwivedi[1]
[1]Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Luck now, Uttar Pradesh-226025.
[2]Division of Fruit Crops, ICAR-Indian Institute of Horticultural Research, Hessarghatta, Bengaluru (Karnataka)-560089
[3]Division of Fruit and Horticultural Technology, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi-110012.

ABSTRACT

Speed breeding which shortens breeding cycles for food and industrial crop development, is a potential strategy for achieving nutritional security and sustainable agriculture. Speed breeding is a technique that allows plant breeders to increase crop production through altering temperature, light duration and intensity to promote plant development.It uses an artificial source of light, which is kept on continuously, to activate the photosynthetic process, which leads to growth and reproduction much earlier than normal.This can be done using a variety of technologies, including genotyping, marker-assisted selection, high throughput phenotyping, gene editing, genomic selection and re-domestication, all of which can be combined with speed breeding to help plant breeders keep up with a changing climate and expanding human population in the future.

Keywords: *Speed breeding, breeding cycles, nutritional security, photosynthetic*

◆◆◆◆◆◆

Agronomic characterization using DUS descriptor for genetic improvement of interspecific hybrids crossed from *Citrus maxima* and *Citrus sinensis*

Raushan Kumar[1], Nimisha Sharma[1], Anil Kumar Dubey[1], Radha Mohan Sharma[1] and Shruti Sethi[2]
[1]Division of Fruits and Horticultural Technology, [2]Division of Post Harvest and technology, ICAR-Indian Agricultural Research Institute, New Delhi, 110012, India

ABSTRACT

The genus *Citrus* belongs to the order of the Geraniales, family Rutaceae, subfamily Aurantioideae. The Rutaceae family includes about 160 genera and 1,650 species consisting of trees and shrubs. Diploid plants belonging to the genus *Citrus* have a haploid genome of about 367 Mb and 2n = 18 chromosomes. Their commercial importance is enormous and their fruits, very rich in vitamin C, are not only consumed fresh but also transformed into juices, wedges, preserves, jellies and jams, as well as providing by-products for cosmetic and medicinal uses. Annually, India is producing 14,150 thousand metric tonnes (MT) of citrus (Mandarin,Lime/ Lemon,Sweet Orange and other citrus) from an area of 1,091 thousand hectares with a productivity level of 12.96 MT/ha (Ministry of Agriculture Farmers Welfare-First Advance Estimates,2021-22). The world needs to increase crop productivity through the development of desirable varieties to sustain production under changing environmental and biological challenges. The first and most significant step in the description and characterization of hybrids is the morphological characterization of trees and fruits. Present work comprises various morphological traits for characterization of interspecific hybrids crossed from *Citrus maxima* and *Citrus sinensis*. Therefore, characterization of citrus hybrids using DUS test guidelines will aid in the selection of parents for breeding programes to increase the production of citrus as well as help in distinguishing varieties.

Keywords: *Citrus maxima* and *Citrus sinensis,*Characterization,DUS test,Interspecific hybrids

◆◆◆◆◆◆

Estimates of genetic variability and scope of improvement in yield and quality traits of chilli (*Capsicum annuum* L.)

Dharmendra Bahadur Singh[1], Gulab Chand Yadav[2], Akhil Kumar Chaudhary[3], Prasant[4], Nitesh Kumar Singh[5]
Department of Vegetable Science
Acharya Narendra Deva University of Agriculture & Technology Kumarganj, 224229 Ayodhya(UP)

ABSTRACT

Fourtydiverse chilli (Capsicum annuum L.) genotypes were evaluated in as field study to assess genetic variability, heritability and genetic advance. The highest PCV were recorded for number of fruit plant-1 (42.0), dry fruit yield plant-1 (29.34), seed yield plant-1 (27.94), fruit weight of dry chilli (23.38), number of primary branches plant-1 at 30 DAT (21.88) and fruit width (21.0). While, highest GCV was observed for number of fruit plant-1 (41.67), dry fruit yield plant-1 (29.61), seed yield plant-1 (28.67) and fruit weight of dry chilli (21.77), The value of heritability (h2bs) was found to be very high for fruit yield plant-1 (97.91), seed yield plant-1 (95.82), dry fruit yield plant-1 (95.24), days to first picking (94.78), fruit length (92.30), fruit weight of green chilli (93.26), fruit yield plot-1 (92.91), fruit yield ha-1 (91.90) and fruit width (92.02). The highest estimates of genetic advance as percentage of mean was recorded for number of fruit plant-1 (45.59), fruit weight of dry chilli (41.38), fruit width (39.82), dry fruit yield plant-1 (39.52), seed yield plant-1 (38.70), fruit weight of green chilli (38.10), fruit yield plant-1 (37.33) and fruit length (36.78) were observed for these all the above characters, imply the potential for crop improvement in chilli through selection.

Keywords: Genetic variability, Heritability, Genetic advance, Pod yield.

◆◆◆◆◆◆

Phytochemicals Evaluation of hydroponically grown medicinal and aromatic herbs

Harendra Kumar, Ankur Agarwal, Devi Sahay, Pradeep Kr. Yadav, Om Prakash, H. S. Meena Devkanta Pahad Singh

ABSTRACT

Phytochemicals are those compounds which found naturally in plants and play an important role in plant metabolic activity and act as human health supplement. Hydroponics system for crop production has shown its potential to increase productivity and maintain quality. Globally, hydroponics technology has been acceptedas sustainable technology to tackle all issues being reported in conventional system specially related to residual toxicity. Hydroponics not only offers safe food but also ensures vertical utilization of space with higher water and nutrient use efficiency, cropping intensity, protection from soil borne diseases, early yield. Himalayan Seasoning Allium or Strachey's Chive (*Allium stracheyi)*is a member of Amaryllidaceae family which is enlisted as Vulnerable in the Red Data Book of Indian Plants and is also categorized as Vulnerable in the western Himalayan states of Jammu & Kashmir, Himachal Pradesh,Uttarakhand.One popular culinary herb is sweet basil *(Ocimumbasilicum L.)* also known as Babauitulsi. Among various Ocimum species, *O. basilicum* is commercially and extensively cultivated for essential oil production. Its oil is employed for flavouring of food stuffs, confectionery, condiments, perfumery industry (**ICAR- DMAPR, 2014)**. Mint is the aromatic, herbaceous plant used for menthol extraction it belongs to the family lamiaceae. This experiment was conducted during 2021-22 at DIBER, DRDO, Haldwani, Nainital(Uttarakhand). The objective of this study was to evaluate the Phytochemical properties of different medicinal and aromatic herbs under different growing conditions. The Nursery of crop plants

transplanted under Vertical hydroponics unit which made from PVC pipe, soilless bucket and soil growing conditions. pH was maintained from 6 to 7 during entire growth stage of crop. The nutrient solution was applied uniformly to all growing conditions. The resultsrevealed that the phytochemicals compounds ofall herbs differed significantly.Among different growing conditions, Jambu exhibited the highest tannin and total phenolic under soil growing condition (235.42 mg/g, 638.66 mg/g, respectively)as compared to other growing conditions whereas the flavonoid content was the highest(10.51 mg/g) under hydroponic growing condition.In sweet basil, tannin content was found highest (301.11 mg/g) under hydroponic growing condition, whereas flavonoids were found highest (19.39 mg/g) under soilless growing condition. On the other hand, the total phenols were found highest (5.74 mg/g)under soil growing condition. In mint, tannins werethe highest(198.49 mg/g) under hydroponic growing conditions whereas the total phenolic and flavonoidswere recorded highest(25.87 mg/g., 644.89 mg/g respectively) under soilless growing conditions.

◆◆◆◆◆◆

Studies on Different Varietal Evaluation of Jamun (*Syzygium cumini* L. Skeels) for Establishment under Ayodhya Agro Climatic Condition

Shubham Jain, Dr. Bhanu Pratap , Rahmat Gul Hassanzai
Department of Horticulture Acharya Narendra Deva University Of Agriculture And Technology, Kumarganj, Ayodhya

ABSTRACT

The present experiment was carried out during 2020 in Central horticulture research farm of Department of Horticulture ANDUAT Kumarganj. The experiment was conducted in Randomized Block Design with 7 Variety (treatment) replicated thrice. The treatments wereV1Narendra Jamun -6, V2 Ra-Jamun, V3 Rajendra Jamun-1, V4 Jomrul, V5Bahadoli, V6 Farida, V7 Goma Priyanka From the present investigation it is found thatV2 Ra-Jamun was found superior in terms of Plant height, Plant spread, number of leaves, plant girth, number of branches per plant, plant spread (E-W and N-S), leaf area and chlorophyllcontent.

Keywords: varieties, growth, survival (%),Jamun (Syzygium cumini L. Skeels) establishment

◆◆◆◆◆◆

Assessment of Genetic Variability among Different Genotypes of Okra [*Abelmoschus esculentus* (L.) Moench]

Sudheer Kumar Yadav[1], Ajay Kumar[1], Udit Kumar[1], K. Prasad[2], Poonam Maurya[1]and Deepa H Dwivedi[4]
[1]Department of Horticulture, PGCA, [2]Department of Horticulture, TCA Dholi, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar-848125
[4]Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh- 226025

ABSTRACT

A field experiment was conducted and comprising the twenty five genotypes of okra in randomized block design with three replications. The analysis of variance was exhibited highly significant among the genotype for all the traits.The maximum variability (σ^2_p and σ^2_g) was reported for fruit yield per plant (1039.70 and 445.95) followed by plant height (203.26 and 119.82), YVMV incidence (104.31 and 94.90), number of fruits/plant (6.21 and 3.75) indicated the presence of maximum degree of genetic variability hence offering ample scope for selection based on these traits.The high PCV was recorded for the characters *viz.*, YVMV incidence (37.2636), number of seeds perfruit (20.3281) while the high GCV was observed for the characters *viz.*, YVMV incidence

(35.5416)respectively.High heritability in broad sense was recorded for number of primary branches per plant (71.49), number of seeds per fruit (81.40) and YVMV incidence (90.97) respectively. The high genetic advance as per cent of mean were recorded for number of primary branches per plant (27.57), number of seeds per fruit (34.08) and YVMV incidence (69.83) exhibited the involvement of additive gene action suggesting that selection based on these traits will be effective.

Key ward:- Variability, heritability**,** genetic advance**,** additive gene action and crop improvement

◆◆◆◆◆◆

Study about the different genetic resources of fruit crops

Divyansh Mishra, Sujeet Kumar Patel, Vipin Kumar, Abhishek Pratap Singh
Acharya Narendra Deva University of Agriculture & Technolohy, Kumarganj,
Ayodhya 224229 (U.P.)

ABSTRACT

Genotype of particular species, collected from different sources and geographical origin for use in plant breeding to develop new cultivars.Any genetic material of plant origin of actual or potential value for the food and agriculture, e.g. seeds, mature plants etc. It represents the entire genetic variability, consists of land races, modern cultivars, obsolete cultivars, wild forms and wild species, includes both cultivated and wild species and relatives of crop plants, collected from centre of diversity, farmer's fields and from seed companies etc.and basic material for launching a crop improvement programmed. It may be indigenous or exotic.plant genetic resources include land races, primitive cultivars, wild and weedy relatives, farmer's varieties, released varieties and genetic stocks.

Key words: Genotype, land races, primitive cultivars, wild and weedy relatives, farmer's varieties, released varieties and genetic stocks.

◆◆◆◆◆◆

Genetic Diversity Analysis for Seed Yield and its Attributes in Coriander (*Coriandrum sativum* L.)

Hardikkumar R. Patel, V. L. Parmar, A. I. Patel, R. K. Patel and G. D. Vadodariya
Department of Genetics and Plant Breeding, N.M. College of Agriculture, Navsari Agricultural University,
Navsari-396450, India

ABSTRACT

Genetic variability forms the basis for crop improvement, hence detailed appraisal of the accessions for different morphological, agronomic and quality traits is necessary in order to identify useful traits either for direct or indirect use in improvement programs. The present experiment was carried out to assess genetic diversity using forty diverse genotypes of coriander grown in Randomized Block Design at Navsari. There was sufficient amount of variability present among studied genotypes of coriander. High heritability coupled with high genetic advance were found in total oil content, yield per plant, secondary branches per plant, seed yield per plot, umbels per plant, test weight, seeds per umbel, primary branches per plant and days to 50 % flowering indicated that these traits were governed by additive gene action. Seed yield per plot showed significant and positive correlation with seeds per umbel, days to maturity, yield per plant, test weight and harvest index at both the genotypic as well as phenotypic levels. While, it was significant and positive correlation with primary branches per plant and

secondary branches per plant at genotypic level. Thus, selection practiced for the improvement in one character will automatically results in the improvement of other. Path analysis revealed the direct and positive effect depicted by yield per plant, umbels per plant, test weight, seeds per umbel, days to 50 % flowering and plant height on seed yield per plot. Thus, a significant improvement in seed yield per plot can be expected through selection in the component traits having high positive direct effects.

◆◆◆◆◆◆

Flavonoids: Recent Advances and Application on Crop Breeding

Monika Kumari Meena
Department of Fruit Science, College of Horticulture and Forestry Jhalawar, 326023
Agriculture University Kota, Rajasthan

ABSTRACT

Flavonoids are secondary metabolites that perform a wide range of roles in plants. These include their involvement in plant growth, pigmentation and UV protection, to a variety of defense and signaling activities. Flavonoids such a chalcones, flavones, flavanols, anthocyanins and proanthocyanins are widely distributed in the plant kingdom. The metabolic routes of the flavonoids are exploited extensively using several biotech approaches to enhance the crop variety and incorporate varied nutritional benefits. Many flavonoids are key components of medicinal plants and possess nutritional Significance. Specific mutation in flavonoid-related gene is typically responsible for the diversity in flavonoid, resulting in quantitative and qualitative variations in metabolic profiles. Thereby numerous attempts have been made to increase flavonoid content in agronomically important species. Flavonoid are also employed in the regulation of inflammation, in arthritis and in cancer prevention strategies, due to their ubiquity in the human diet. Advances in the comprehension of flavonoid biosynthesis and modulation have promoted a surge in researches aiming at modifying the flavonoid pathway to improve nutritional value, plant defenses against infections and the feeding value of livestock. The varied role of flavonoids, their biosynthesis and their distribution over the plant Kingdom. Furthermore, it exclusively highlights the several biotech-based trending pieces of research based on introducing flavonoid biosynthesis in commercial crops.

Key words: Biosynthesis, crop breeding, Flavonoids, Genetic engineering.

◆◆◆◆◆◆

Estimates of variability, heritability and advance in brinjal (*Solanum melongena* L.)

Prashant[1], Gulab Chand Yadav[2], Dharmendra Bahadur Singh[3], Akhil Kumar Chaudhary[4], Nitesh Kumar Singh[5]
Department of Vegetable Science
Acharya Narendra Deva University of Agriculture & Technology Kumarganj, 224229 Ayodhya(UP)

ABSTRACT

Highly significant differences were observed among the 27 diverse brinjal genotypes for different characters. Average fruit weight showed the highest phenotypic and genotypic coefficient of variation closely followed by number of fruits per plant. The lowest values were recorded for days to first fruit set followed by days to first flowering. All the characters exhibited less difference between GCV and PCV values and traits like average fruit weight, days to first fruit harvest, fruit index and yield/plant showed nearly equal GCV and PCV values indicating least influence of environment on their expression. The heritability estimates were high (above 85%) for all the characters. The maximum heritability was observed for average fruit weight closely followed by

fruit index and yield/plant. The genetic advance as percentage of mean was high for average fruit weight, number of fruits/plant and yield/plant. High heritability coupled with high genetic advance was observed for number of fruits/plant, average fruit weight and yield/plant indicating that they are governed by additive genes and could be effectively improved through selection.

Key words : Variability, heritability, genetic advance, brinjal.

◆◆◆◆◆◆

Studies on Genetic Variability, Path Analysis and Genetic Divergence in Vegetable Pea (*Pisum sativum var. hortense* L.) in Mid Hills of Uttarakhand"

Neelima Rawat[1] and S.S Bisht[2]

[1] Department of Vegetable Science, [2] Department of Basic and Social Sciences, V.C.S.G College of Horticulture and Forestry, Bharsar, Pauri Garhwal,Uttrakhand

ABSTRACT

The present investigation entitled "Studies on Genetic Variability, Path Analysis and Genetic Divergence in Vegetable Pea (*Pisum sativum* var. *hortense* L.) in Mid Hills of Uttarakhand"was carried out at the Vegetable Research and Demonstration Block, College of Horticulture, Veer Chandra Singh Garhwali, Uttarakhand University of Horticulture and Forestry, Bharsar during February, 2020 to evaluate diverse germplasm of vegetable pea under mid hill conditions. The experiment was laid out in RCBD with three replications. In this study, twenty genotypes including one check cultivar Arkel were evaluated for different horticultural traits. Fourteen genotypes *viz.,* Pant Pea- 153, Pant Pea- 157, Arka Ajit, Pant Pea- 25, Lincoln, PB- 89, Pant Pea- 243, Pant Pea- 14, PSM-3, Early Giant, PH- 1204, PH- 1205, Pusa Pragati and Palam Priya recorded higher yield and also performed better for other yield attributing traits than check cultivar. These genotypes need further testing to be released as a substitute of already existing vegetable pea varieties or they can be involved in further breeding programme for development of superior varieties in vegetable pea. Genetic analysis indicated that phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) in all the attributes studied. The phenotypic coefficients of variation (PCV) and the genotypic coefficients of variation (GCV) were found high in plant height, the least was found in 100 seed weight. High heritability estimates coupled with high genetic gain were found highest for the character plant height and lowest for days to 50% germination, indicated that these traits are under additive gene effects and are more reliable for effective selection. The correlation analysis showed that number of pods per plant, pod length, number of seeds per pod and 100 seed weight were significantly and positively associated with yield both at genotypic and phenotypic level. The genotypic path coefficient analysis showed that the highest positive direct effect with regards to yield per plant was found for yield per plot, pod length, days to first harvesting, number of pods per plant, number of branches per plant, 100 seeds weight and plant height. Further, on the basis of D^2 analysis the twenty genotypes were grouped into four divergent and hybridization between cluster IV and II can be utilized for getting the superior recombinants in segregating generations by crossing between the genotypes of these clusters.

Keywords: Genetic Divergence, Heritability, GCV, PCV, Variability

◆◆◆◆◆◆

Effect of Plant Growth Regulators on Hastening in ovulo Embryo Maturation for Shortening the Breeding Cycle in Papaya

Bhupendra Sagore[1], Kanhaiya Singh[2], Jai Prakash[3], Sanjay Kumar Singh[4], Vartika Srivastava[5],Vignesh M[6]

[1-4]Division of Fruits and Horticultural Technology, ICAR-Indian Agriculture Research Institute, New Delhi, India-110012.

[5]Scientist at ICAR-National Bureau of Plant Genetic Resources, Tissue Culture and Cryopreservation Unit (TCCU),Pusa Campus, New Delhi, India-110012.

[6]Scientistat ICAR-Indian Agriculture Research Institute,Division of Genetics, Pusa campus, New Delhi, India- 110012.

ABSTRACT

Papaya (*Carica papaya* L.) is a highly cross-pollinated crop of tropical and sub-tropical regions of the world. For the varietal improvement work, approximately 7-8 generations (15-16 years) are required to release a variety. The period from fruit set to fruit harvest may be shortened by culturing embryos *in vitro*. In the present study, seven treatments comprising of different plant growth regulators, *viz.* ethrel (100, 120 ppm), abscisic acid (10^{-6}, 10^{-4} M) and MeJA (10^{-5}, 10^{-3} M) including a control, were applied at 75-day-old fruits [(DOF) (60 DOF plus 15 days of PGR treatment (DPT)] and 90 DOF (75 DOF plus 15 DPT) to study the effect on hastening the embryo maturity in developing fruitlets for the shortening of the breeding cycle of dioecious papaya var. PusaNanha. Among all the treatments, ethrel 120 and 100 ppm at 90 DOF were found effective for improving the seed length (6.46 mm), seed colour (light brown), embryo formation (85%) and embryo colour (pure white), embryo size (2.93 mm), germination (85%), rapid shoot emergence (5.67 days), earliest radicle emergence (2.67 days), plantlet weight (83.67 mg) and plantlet regeneration (86.67%) of papaya. The treatment of MeJA (10^{-5} M) was also found significant for the maximum number of roots (5.13), root length (63.33 cm), plantlet length (7.56 cm) and regeneration (75.50%). The breeding cycle of papaya could be shortened for *in-ovulo*embryo culture employing sprays of ethrel and MeJA s, *i.e.*, the period (usually 6–9 months) from pollination to seedling establishment could be lowered to 3 month by adopting the above method.

◆◆◆◆◆◆

Habituated embryogenic callus culture of outer integument and its mediated synchronized indirect somatic embryogenesis system in Kinnow mandarin

Theivanai, M., O. P. Awasthi, Shalini Gaur Rudra, Gautam Chawla and Amolkumar U. Solanke

ABSTRACT

Kinnow (*Citrus nobilis* L. × *Citrus deliciosa* T.) a potential crop of north western India needs genetic improvement for traits like reduced number of seeds to enhance the juice processing utility. Attempt to develop seedless mutants through bud wood irradiation and chemical mutagens have slowed down due to occurrence of chimera and its further purification. Since single cell regeneration can curtails chimera problem as well as reduce the generation cycle, a systematic investigation of *in vitro* germination during different seed maturity stages with various culture inoculation methods was carried out. Results revealed that non desiccated fully matured seeds during its conversion to desiccation stage have a natural tendency to form embryogenic callus from outer integument (21.33% on MS + Activated Charcoal 200 mg/l) when incision is given at chalazal end. Further habituation of embryogenic callus for a period of six month on plant bio regulators (PBR) free medium in 150 ml conical flask and its subsequent transfer to liquid suspension system without PBR resulted in synchronized somatic embryogenesis

(92.00%) within 20.81 days after second subculture. Although maturation and germination of somatic embryos took longer time (108.97 days on DKW + Kinetin 5 mg/l + ME 1000 mg/l) nearly 88.67% germination was achieved. Plantlet establishment frequency was 87.00 % on liquid paper bridge system. Histological, molecular and microscopic studies revealed the single cell origin of embryos hence this high frequency system can be a beneficial tool for induction of solid mutant, somaclonal variation as well as other biotechnological application.

◆◆◆◆◆◆

Genetic Diversity Studies in Brinjal(*Solanumm elongena* L.)

Alka Verma, Kavya Chandra, HitaishiKuriyal[c], ShivaniBisht[a] and YaminiBisht[a]
Department of Vegetable Science, College of Agriculture, GBPUAT, Pantnagar, U. S. Nagar, Uttarakhand

ABSTRACT

Genetic diversity was studied in seventy genotypes of brinjal collected from different sources at Vegetable Research Centre, Pantnagar for fifteen traits in kharif season of 2021 using augmented block design II. The qualitative observations were recorded on descriptors following the International Board for Plant Genetic Resources (IBPGR) descriptors for brinjal. Significant differences were observed for all quantitative characters except for fruit diameter. High values for GCV and PCV were seen for fruit diameter, number of fruits per plant, average fruit weight, fruit yield per plant and total fruit yield. Even the differences between the values of GCV and PCV was also quite low which indicated the traits under study were less influenced by environment. High estimates of heritability coupled with high genetic advance were observed for all the characters suggesting direct selection for these traits would prove useful. Genotypes were grouped into four clusters based on D^2 statistics. Out of total four clusters formed, cluster I comprised maximum number of genotypes followed by IV, II and III. The maximum inter-cluster distance was found between cluster I and III;thus it is evident from the present investigation that genotypes in these clusters can be used as parents in hybridization programme. Among the characters, fruit yield per plant showed maximum contribution towards diversity followed by total fruit yield, fruit diameter and number of primary branches *i.e.* these should be given more importance during hybridization and selection in the segregating generations.

◆◆◆◆◆◆

Analysis of geneticcomponents in snapdragon (*Antirrhinum majus* L.) for determining breeding strategy for vegetative, flowering and seed parameters

Shiva Jauhari[1], A.K. Singh and H.S. Baweja
State Horticulture Consultant, Dept of Horticulture & Food Processing, Uttarakhand-248003
Professor, Department of Horticulture, Institute ofAgricultural Sciences, BHU, Varanasi-221 005,
Director, Dept of Horticulture & Food Processing, Uttarakhand—248003

ABSTRACT

An experiment was conducted to elucidate the genetical components for determining the appropriate breeding strategy for various vegetative, flowering and seedcharacters of Snapdragon (*Antirrhinum majus* L.) throughVr-Wr graphical analysis. The study involved10 inbreds and 45 hybrids developed through half diallel mating system excluding reciprocals. The F_1s were evaluated during 2004-05 and 2005-06 for some of the floricultural important traits. Analysis showed that parents AG-2, AG-3, Vilmorin, SA-1, Ag-5, Sant-22 and Ag-6 exhibited presence of balanced proportion of dominant as well as recessive alleles for plant height can be used to generate variability and better progenies can be selected from the segregating generation. Complete dominant gene action was found for the number of primary branches and water uptake by the spike.The traits like days to

flowering, duration of flowering, length of spike, rachis length, diameter of spike, percent opening of florets, number of seeds /pod and weight of seeds per plant were governed by partial dominant gene action whereas the traits like vase life, weight loss of spike and number of florets per spike were governed by over dominance gene action. As dominant gene action was found predominant therefore these characters could be improved by utilizing heterosis.The result from the present study could be used for suggesting most appropriate breeding strategy for the improvement of *Antirrhinum* lines and making various hybridsfrom these improved lines for different classes of Antirrhinum as pot plant for bedding or for cut flower purposes.

Key words: Snapdragon (*Antirrhinum majus* L.), Genetic components, Breeding strategy,Vegetative, Flowering, Seed parameters

◆◆◆◆◆◆

Role Transgenic Approach in Fruit Crops Improvement

Dharmendra Kumar Gautam[1]; Om Prakash[2]
[1]**P G Research scholar, Department** of Fruit Sciences, College of Horticulture. Banda University of Agriculture and Technology, Banda, U.P.-210001
[2]Assistant professor, Department of Fruit Sciences,College of Horticulture. Banda University of Agriculture and Technology, Banda, U.P.-210001

ABSTRACT

Presently, fruits have well been established in world trade networks, their culture allows continuous supply throughout the year and also enhanced their production and productivity. Transgenic technologies also becoming part of breeding strategies for fruit crop cultivation. Several biotechnological methods are applied to have better ones in the process of fruit breeding. Genetic engineering helps in gene alteration and integration of desirable characteristics into existing genomes in fruit plants. Transfer of desirable gene into a fruit plant's genome enhances resistivity against fungal, biotic and abiotic stress. Different gene transfer methods have been employed in fruit species. Recently, direct and indirect transformation and modern genome editing methods have been used in plant science. Development and commercial introduction of novel fruits developed through genetic engineering such as virus-resistant papaya and banana were commercialized 25 years ago, whereas insect-resistant non-browning apple and pink-fleshed pineapple has been approved for commercialization within the last 6 years and production continues to increase every year. Advances in the new wave of genome editing technologies, provide opportunities to develop new fruit cultivars more rapidly. It also emphasizes the socioeconomic impact of current commercial fruit cultivars developed by genetic engineering and the potential impact of genome editing on the development of improved cultivars at an accelerated rate.

Keywords: Transgenic technologies, Genetical engineering, gene alteration, gene transfer, virus-resistant, insect-resistant.

◆◆◆◆◆◆

Pomegranate production in arid region through effective nutrient management

Sheetal Rawat, R. S. Rathore and P. K. Yadav
Department of Horticulture, S.K. Rajasthan Agricultural University, Bikaner, Rajasthan

ABSTRACT

Pomegranate (*Punica granatum* L.) is an important fruit crop of arid and semiarid regions of world. Exquisite fruit quality, enriched nutritional values, enormous medicinal values, huge demand in domestic and

international market, besides extended shelf life enables it to emerge as an eminent fruit crop of recent times. The adaptability of the crop to extremes of temperature (-12 to +44°C), suitability to marginal lands with poor fertility pave the way for its potential production in arid soil. The use of fertiliser in such soils must be balanced and cautious. Therefore, plants of 5 years age in mrig bahar were selected for the investigation. Plants either sprayed or soil applied or treated by both the method with Zn, Fe, Mg and B according to the treatments to fulfil the nutrient requirement of crop. The soil application and first spray was done in second week of july, followed by one month after the first spray. The application of Zn, Fe, Mg and B increased the leaf concentrations of all the nutrients, reflecting the improvements in tree nutrient status. There is a significant increase in growth and yield on all treatments compare to the control. Plants treated with combination of soil and foliar application of $ZnSO_4$ @ 50 g + $FeSO_4$ @ 50 g + $MgSO_4$ @ 50 g + Boric acid @ 25g + $ZnSO_4$ @ 0.2 % +$FeSO_4$ @ 0.2 % + $MgSO_4$ @ 0.2 % + Boric acid @ 0.1 % found most effective to increase production among the other treatments. It might be concluded that application of some nutrients $ZnSO_4$, $FeSO_4$, $MgSO_4$ and Boric acid had a positive influence growth and yield of pomegranate fruits.

Keywords: Nutrient management, Pomegranate, Micro nutrients

◆◆◆◆◆◆

Effect of PGPR producing ACC deaminase in reducing the negative effects of salt stress in *Pisum sativum* by modifying the antioxidants machinery

Neelam Pathak [1] and Anmol Gupta [2]

[1] Department of Biochemistry, Dr. Rammanohar Lohia Avadh University, Ayodhya, Uttar Pradesh, 224001, India

[2] Department of Biosciences, Faculty of Sciences, Integral University, Lucknow, Uttar Pradesh, 226026, India

ABSTRACT

Salinity stress inducesethylene production resulting in ROS production which inhibits agricultural productivity. In this study 250 bacterial isolates from rhizospheric soil from 25 districts in the states of UP, Bihar and Jharkhand were used and then screened for their PGPR attributes. Out of these 250 strains, 40 isolates had characteristics that encouraged plant growth and development. Bacteria with ACC deaminase (ACCD) prevent the overproduction of ethylene by utilizing ACC as a nitrogen source and regulating the ROS. Further, the ACCD activity of rhizobacterial strains was examined in DF minimal salt medium supplemented with 5 mM ACC (as N-source). Among them, 28 isolates of *Bacillus* and *Pseudomonas* sp. were revealed to have $acdS^+$ PGPR. The strains *viz*. CHR JH_203, BST YS1_42, MBD 133 and GKP KS2_7 produce the most ACCD. Additionalninhydrin and 2,4- dinitrophenyl hydrazine assay, molecular and FTIR methods were used to establish their ACCD activity. The capacity of the $acdS^+$ isolates to survive in induced saline soil was demonstrated by their optimal growth at 3% w/v (NaCl). The $acdS^+$ strain administrated to *Pisum sativum* plants has been shown to be effective in lowering salt stress by improving the levels of antioxidant enzymes, plant biomass, carbohydrates, protein, chlorophylls, flavonoids and phenols. Additionally, the expression of defense, cell rescue genes and ROS scavenging geneswere examined and inoculated plants showed increased gene expression and salt tolerance. Our findings suggest that inoculating crops with these strains might be a useful way to prevent the detrimental effects of soil salinity and promote the sustainable growth of crops.

Keywords: Enzymatic antioxidants, Gene expression, PGPR, acdSgene, Pisum sativum, Salinity stress

◆◆◆◆◆◆

Evaluation of Tulip (*Tulipahybrida* L.) Cultivars for Growth and Flowering Under Mid Hill Conditions of Himachal Pradesh

Nepu Rana, Puja Sharma, S R Dhiman,Bharatikashyap and Poonam Sharma
Department of Floriculture and Landscaping Architecture, Dr. YSPUHF Nauni, Solan-141004, Himachal Pradesh, India

ABSTRACT

The present investigation titled, "Evaluation of Tulip (*Tulipahybrida* L.) Cultivars for Growth and Flowering under Mid Hill Conditions of Himachal Pradesh" was carried out at the experimental farm of Department of Floriculture and Landscape Architecture, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, (HP) during 2018-19 and 2019-20. The experiment was laid out in a randomized block design with five replications, consisting of thirty-eight genotypes of tulip, which were evaluated for two successive years to compare the potential of tulipgenotypes for growth and flower production in the mid hill conditions of Himachal Pradesh. Results indicated that genotypes; 'Red Impression' followed by 'Avignon', 'Apeldoorn's Elite', 'Golden Parade', 'Jumbo Pink', 'Kung Fu', 'La Courtine', 'Laptop', 'Negrita', 'Niigata', 'Parade', 'Purssma', 'Tulip Collection 7', 'Tulip Collection 8' and 'Tulip Collection 12' were found to be the best for earliness to flowering, plant height, scape length and recorded maximum vase life and can be used as cut flower. Overall longer duration of flowering was exhibited in most of the varieties and hence all the genotypes can be recommended for landscaping and some for value addition purpose.

◆◆◆◆◆◆

Assessment of Bottle Gourd [*Lagenaria siceraria* (Molina) Standl.] Hybrids In Relation With Fruit Yield And Economic Characters

Anuj Sohi[1], Vijay Bahadur[2], Balbir S Dogra[3]
[1]&3Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (173230)
[2]Professor, Department of Horticulture, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, U.P. (211007)

ABSTRACT

Bottle gourd [Lagenaria siceraria (Mol.) Standl.] belongs to the Cucurbitaceae family with chromosome number 2n = 22 and is one of the most important cucurbitaceous vegetable crop cultivated in India. *A trial for characterization and evaluation of presently available bottle gourd hybrid was carried out in order to identify the potential cultivar for different horticultural characters*in the year 2020 at Vegetable Research Farm, Department of Horticulture, SHUATS, Allahabad, (U.P.). The experiment comprised of 17 hybrids of bottle gourd replicated thrice in a Randomized Block Design in 7.5 x 3 m^2 plot size. Yield parameters of bottle gourd, *viz*. fruit weight (gm), fruit length(cm), fruit diameter(cm), days to first harvest, number of fruits $vine^{-1}$, fruit yield $plant^{-1}$(kg), fruit yield $hybrid^{-1}$(q/ha) were generally found to be higher in T_2, followed by T_{15}. The maximum gross returns $hectare^{-1}$ were calculated in T_2 (INR 3,60,147) followed by T_{15} (INR 3,36,621). The maximum net returns $hectare^{-1}$ were also obtained in T_2 (INR 2,80,047) followed by the T_{15} (INR 2,56,771). The maximum benefit: cost ratio was thus observed in T_2 (1:3.50) followed by T_{15} (1:3.22). Hence it can be concluded that BG HYB 18-2 (T_2) emerged as the best bottle gourd hybrid, closely followed by Chandan hybrid (T_{15}).

Keywords : Bottle gourd; hybrid; yield; economic; returns

◆◆◆◆◆◆

Doubled haploids in genetic improvement of vegetatively propagated cut flower crops

Saipriya Panigrahi, Gunjeet Kumar, Girish P.M., Shantesh Ramesh Kamath
Division of Floriculture & Landscaping
Indian Agricultural Research Institute, New Delhi-110012, India

ABSTRACT

Ornamental species are an important group of plants produced mainly for aesthetic value and to enhance both our indoor and outdoor environments. Development of new germplasm with enhanced colours, fragrances, or longevity is an important aspect of plant breeding programmes. Tissue culture methods have been utilized to propagate favourable genotypes. In recent years, haploidization techniques based on plant tissue culture are commonly used in ornamental plant breeding in order to overcome disadvantages of conventional methods. They can occur either spontaneously or can be induced by modified pollination methods *in-vivo*, or *in-vitro* culture of immature male or female gametophytes. These methods have been established in many of the important vegetatively propagated cut flowers, such as gerbera, anthurium, chrysanthemum, iris etc. The factors that influence haploid induction mainly include plant genotype, the surrounding environment of parental plants, components of culture medium, the developmental stage of initial gametophytic cells, physical treatments (cold pre-treatment, heat shock) of cultured gametophytic cells and application of different additives and plant growth regulators. Doubled haploid techniques provide many advantages comparing to conventional techniques in plant breeding programs. One of the most important advantages of doubled haploidy in plant breeding is to facilitate obtaining complete homozygosity in short time. Haploids and doubled haploid protocols can be used for both practical application, as in breeding, mutagenesis and genetic transformation, as well as basic research (*i.e.* biochemical, physiological and genomic studies). Hence, doubled haploid method has immense potentialities and prospect in future plant biotechnology especially for the improvement of different plant species and varieties having high economic values.

Keywords: Ornamental plant, haploid, doubled haploid, mutagenesis, genetic transformation.

◆◆◆◆◆◆

Collection and evaluation of local turf grass germplasm of the South Gujarat region

M.A. Patel, S.L. Chawla and Dipal S. Bhatt
ASPEE College of Horticulture
Navsari Agricultural University, Navsari - 396 450, Gujarat

ABSTRACT

Turf is one of the blessing of nature and considered as the soul of garden, because the lush green lawn provides a great satisfaction to the owner and becomes a center of the garden for major activities and also widely used for many sports. There is an immense scope for the collection and exploitation of local turf grasses around the South Gujarat regions. Keeping in view the importance of collection and evaluation of turf grasses, an investigation was carried out during 2017-2020 at Floriculture Research Farm, NAU, Navsari to exploit the local turf grass genotypes for their different uses. Total 09 (nine) local genotypes were collected from different areas and evaluated along with the *Cynodon dactylon* L. cv. Selection 1 which is widely used for sports as well as utility turf in India. The experiment was laid out in Randomized Block Design with three replications. Among the 10 genotypes,G_{9} (*Cynodon dactylon* L.) showed the superior result and was at par with the Selection 1 for the

salient characters *viz.,* turfing ability, aesthetic appearance and turf intensity. The local genotype G_9also showed the excellent performance with higherestablishment rate (minimum days taken for 90% coverage) along with higher root depth, lowest shoot root ratio as compared to Selection 1. Thus, it can be further explored to use under water scarcity area.

◆◆◆◆◆◆

Genetic Studies in Spinach Beet (*Beta vulgaris* L. var. bengalensis Roxb.)

Abhishek and Shiv Pratap Singh

ABSTRACT

The present study entitled "Genetic Studies in Spinach Beet (Beta vulgaris L. var bengalensis Roxb.)" was conducted during rabi season of 2020 at the Experimental Research Farm, Department of Vegetable Science, College of Horticulture and Forestry, Neri, Hamirpur (HP). 15 genotypes of spinach beet including check "Pusa Harit" were evaluated in Randomized Complete Block Design to assess the extent of genetic variability and work out heritability, genetic advance, correlation and path coefficient analysis with respect to different horticultural characters including yield. The Analysis of variance for all the above quantitative traits suggested sufficient variability for different quantitative traits; besides this variability was also found for the qualitative traits *viz.* leaf shape and leaf color. The best genotype in terms of total yield per plant was P-COHF-NERI-11 (95.53) which was however, statistically at par to the genotypes *viz.* P-COHF-NERI-4 (85.13), P-COHF-NERI-3 (84.06), P-COHF-NERI-1 (81.46) and P-COHF-NERI-2 (80.20). High GCV and PCV values were expressed by the traits *viz.* fresh weight of leaves, dry weight of leaves and ascorbic acid content. Highest heritability was shown by the trait ascorbic acid content. Whereas, highest genetic advance as percentage of mean was seen for the trait dry weight of leaves. The highest significant genotypic correlation was seen in the characters leaf length and leaf area on the total yield per plant. Path analysis studies showed that the direct selection through the independent trait leaf area could bring maximum improvement in total yield per plant.

◆◆◆◆◆◆

Advances in the exploitation of xenia and metaxenia in fruit and nut crops

Shikha Saini, Shikha Jain, Bhupendra Sagore and Poonam Maurya
Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute,
New Delhi, India-110012.

ABSTRACT

The xenia effect refers to the phenomenon whereby the pollen genotypes directly affect seed and fruit development from fertilization to seed germination, leading to different characteristics in phenotypic traits. The xenia effect can create differences in the endosperm and embryo formed after double fertilization and can also alter various fruit parameters, such as the fruit ripening period; the fruit shape, size and colour; the flavour quality, such as sugars and acids; as well as the nutrient quality, such as anthocyanins. Currently, xenia is classified into two types: xenia and metaxenia. In the former, the direct effect of pollen genotype in the syngamous tissues (embryo and endosperm), while in the latter, the effect of pollen genotypes exhibited in the maternal tissues. The xenia effect manifests in various ways, playing an important role in increasing the yield of fruits and nut trees, improving fruit appearance and internal quality. Xenia and metaxenia have been described in many fruits, such as apples, datepalm, blueberries, almond, walnut, chestnut, macadamia nut, pomegranate and kiwifruit *etc*. In earlier studies, pollen parent effects on hormone contents, or enzyme activities and mRNA action hypothesis have been suggested to be included among the mechanisms of observed cases of metaxenia. However, recent

research has demonstrated that enhancing the photosynthetic capacity of exocarp is the primary contributor to the differences in fruit enlargement in C*arya cathayensis*. The upregulation of a novel cytochrome P450 78A7 gene (*CitLO1)* was responsible for the increased production of volatile compounds in controlled pollinated pummelo fruits. Thus, achievements in molecular and cell biology over the past century have provided new approaches for studying the mechanism of xenia. Lack of knowledge about pollen source and mechanism responsible for xenia effect limits its exploitation. Further, in some fruit crops, there is non-synchronization of flowering and thus, controlled pollination in vigorous trees is cumbersome and requires time, labour and resources, which increases the cost of production. Our understanding of xenia and metaxenia is still in its infancy. Research is needed to investigate pollen parent effects, suitable female/pollen-parent combinations and their mode of action in all fruit and nut crops that will utilize these beneficial xenic effects.

Keywords: Xenia, metaxenia, embryo, endosperm, double fertilization

◆◆◆◆◆◆

Advancement in Molecular Approaches for the Improvement of Seasonal Flowers

Girsh P M, Sapna Panwar, Saipriya Panigrahi, Shantesh Ramesh Kamath
Division of Floriculture and Landscaping
ICAR- Indian Agricultural Research Institute, New Delhi-110012

ABSTRACT

Artificial plant selection has been used by humans for the past 10,000 years for selecting and breeding plants. Conventional breeding techniques involved selection of superior plants based on the phenotype, which are now inadequate for plant genome enhancement to develop new plant varieties. Due to the progress in molecular biology, new techniques in molecular breeding have been developed which can overcome the obstacles of conventional plant breeding practices. Molecular breeding is use of genetic manipulation performed at DNA molecular levels to improve characters of interest (Marker Assisted Selection + Genetically Modified Organisms). These approaches are also known as precision breeding techniques since they are trait specific improvements. Seasonal flowers, the development of genetic and molecular tools for breeding has been slow because of the large number of ornamental species, many of which are genetically complicated for breeding, being outbreeding crops, polyploid, and/or having a large genome. Significant improvements have been made in seasonal flowers by these approaches as whole genome sequencing of few species like Petunia, Snapdragon and Japanese Morning Glory is completed. Although GMO's are not legally allowed for commercialization, major breeding work is being done in this field as novel phenotypes are obtained. The first ornamental plant genetically modified for flower color was an orange petunia variety. Advanced approaches include gene editing and gene silencing which have been used successfully in cereals and other horticultural crops while in seasonal flowers they are used in model plants to study the functional analysis. Though these methods are advantageous in terms of specificity, efficiency and speed of breeding, there exist few drawbacks regarding cost and availability of technology.

Keywords: MAS, GMO, Genome Sequencing and transgenic

◆◆◆◆◆◆

Evaluation of coloured mango (*Mangifera indica* L.) cultivars under Bihar Condition

Roopendra Kumar, Ravindra Kumar, M. Feza Ahmed, Ankur Kumar Rai, Suman Kumari and Nandita Kumari

Department of Horticulture (Fruit and Fruit Technology), Bihar Agricultural University, Sabour, Bihar-813210, India

ABSTRACT

An experiment was conducted on 15 coloured mango cultivars at Bihar Agricultural University, Sabour,Bihar, to identify suitable coloured cultivars for Bihar condition during the year 2020-2021. During experiment, Arunika and Kingphon were found early in panicle emergence and onset of flowering. The maximum panicle length was measured in Kingphon (43.22cm), whereas the minimum was observed in Sabri (17.76cm). The minimum flowering duration was observed in Kent (9.20days); it was at par with Sensation and Osteen. Maya had maximum (86.50%) flowering intensity, which was statistically similar with Kensington (72.50%). The maximum number of fruits set per panicle at the pea stage was counted in Tommy Atkins (21.10), which was at par with Sensation (20.60). Early fruit maturity and highest number of fruits were noted at maturity in Pusa Pratibha. The highest weight, volume, pulp percentages and pulp/stone ratio were observed in Osteen (505.71g, 500.05ml, 73.40% and 6.98 respectively). Pusa Pitambar yielded the maximum fruits (2.34) per m^3 of canopy volume; it was statistically at par with Kent (1.77). The maximum TSS/Acid blend was assessed in Sensation (99.25). The total sugar content (16.48%) was found in Pusa Pratibha, which was at par with Pusa Surya (15.90%) and Sabri (15.47%). The total carotenoid content was estimated at maximum in Pusa Pitambar (7.19mg 100^{-1} g FW). In Ambika, the highest ascorbic acid was estimated (55.00mg100^{-1} g pulp). The cultivars like Pusa Shrestha, Pusa Pratibha, Pusa Surya, Lily, Ambika and Arunika have shown delightful colour and maximum yield, especially in Pusa Pitambar.

Keywords: Canopy volume, experiment, flowering intensity, cultivars.

◆◆◆◆◆◆

Characterization of primary germplasmsof mango through morphological andbiochemical traits under Tarai region of Uttarakhand

Jitendra Singh Shivran[1], A.K. Singh[1], D.C. Dimri[1] and N.K. Singh[2]

[1]Department of Horticulture, [2]Department of Genetics and Plant Breeding, College of Agriculture, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand (India)

ABSTRACT

An experiment was conducted during the year 2021 and 2022 at Horticulture Research Centre (HRC), Patharchatta,Pantnagar (Uttarakhand) with thirty mango (*Mangifera indica* L.) genotypes to assess the performance and their suitability as a parent for the future breeding program. The observations were recorded on various fruit quantitative and biochemical parameters. From the observations made, it was found that the mango genotypes expressed the variations from genotype to genotype.PMGC-51 produced significantly higher number of fruits (250.17 $tree^{-1}$) on the basis of pooled data of two years. The fruit weight of PMGC-19 was significantly higher (422.22 g) among all the genotypes.The maximum fruit length (15.16cm) was recorded inPMSS-31, whereas, the maximum fruit diameter (9.01cm) in PMGC-20.Although, the maximum yield efficiency (0.62 kg/m^3) was observed in PMSS-18 followed by PMSS-1 (0.61 kg/m^3) and Dashehari (0.60 kg/m^3).Better fruit quality like, higher total soluble solids (22.45°B), total sugar (15.95%) & non-reducing sugar (11.65%) and

lower titratable acidity (0.17%) were recorded in PMGC-48, while, the maximum reducing sugar (5.94%) was observed in PMSS-7. The maximum ascorbic acid (63.22 mg /100 g FW), total carotenoid (7.08 mg /100 g FW) and flavonoid content (42.60 mg QE/100 g FW) were recorded in Langra, while, the higher total phenols (94.39 mg GAE/100 g FW) and antioxidant activity (257.71 mg TE/100 g FW) were recorded in PMSS-11.Information generated through this investigation will facilitate characterization, conservation and breeding for genetic improvement of mango fruit crop.

Keywords: *Mangifera indica*;Morphological; Biochemical; Genotype; Yield Efficiency, Genetic Improvement

◆◆◆◆◆◆

Studies on genetic divergence (D2) for fruit yield and its related traits in pumpkin (*Cucurbita moschata* Duch. ex. Poir)

Aniket Kumar Verma, A.C. Mishra

ABSTRACT

An experiment was conducted at Main Experiment Station of Department of Vegetable Science at Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P). The experimental material consisted of 28 pumpkin genotypes including three standard checks *viz.*, ArkaChandan, Azad Kaddu and PusaVikash was conducted in a Randomized Block Design with three replications. Analysis of variance studies indicated significant differences among all the genotypes for all the characters under study. Genetic diversity was worked out using Mahalanobis D^2statistic. Based on D^2analysis, the genotypes were grouped into 7 distinct non-overlapping clusters. Cluster I, II and III had 6 genotypes in each clusters. Cluster IV, V and VI also had 3 genotypes and cluster VII had presented only one genotype. The maximum intra-cluster distance was in cluster V (139.09) and minimum intra-cluster distance was found for cluster VII (0.00). Clustering pattern revealed that geographical diversity was not associated with genetic diversity of genotypes. The maximum inter-cluster distance was observed between clusters III to cluster VII (503.329), which suggested that members of these two clusters are genetically very diverse to each other. The inter-cluster values between cluster I to cluster VII (398.733), V to VII (325.792), II to VII (315.975), V to VI (312.753) and I to V (309.983) were also high. The minimum inter-cluster D^2 value was recorded in case of cluster III to cluster IV (174.606). The wider genetic diversity were observed in cluster clusters I to VII, V to VII, II to VII, V to VI and I to V, which indicated the potentiality of these diverse genotypes collection for providing basic material for future breeding programmes.

Keywords:*Divergence, Cluster, Breeding, Cucurbita and Genotype*

◆◆◆◆◆◆

Phenotypic diversity for fruit quality traits and bioactive compounds in red-fleshed guava

D.S. Mishra[1], A.K. Singh[1], V.V. Appa Rao[1] and D. K. Samadia[2]
[1]ICAR-Central Horticultural Experiment Station, Vejalpur-389340, Panchmahals, Gujarat
[2]ICAR-Central Institute for Arid Horticulture,Beechwal, Bikaner-334006, Rajasthan

ABSTRACT

Precise characterization of genetic resources is critically important for developinghigh yielding and nutrition rich guava cultivars. This study aimed to delineate phenotypic diversity for fruit yield, quality and

bioactive compounds in the newly developed red-fleshed guava selections and hybrids. Analysis of Variance (ANOVA) and the associated effect-size estimates revealed a high degree of phenotypic diversity for most of the tree growth and fruit quality attributes, pulp minerals and bioactive compounds in the guava accessions analyzed. Principal Component Analysis efficiently discerned key trends in data: the first and second Principal Components were representative of nutritional and bioactive compounds and fruit yield attributes, respectively. The grouping of guava accessions into separate k-means clusters evinced a fairly high genetic divergence. Correlation and network analyses revealed that total antioxidant activity of the fruits was strongly and positively regulated by total phenol (TP), β-carotene (β-car) and flavonoid (Flav) contents. Gradient Boosting and Random Forest regression models also confirmed the overarching influence of TP, β-car and Flav in determining the total antioxidant activity. Our findings are expected to assist the guava breeders in selecting suitable parental combinations for future hybridization programs. Some of the promising accessions identified in this study broadly meet the needs for fresh consumption and for use in food processing industries.

Keywords: Bioactive compounds, genotypic variation, guava, fruit quality, machine learning regression

◆◆◆◆◆◆

Effect of NAA and BA on in vitro callus induction of Calla lily (*Zantedeschia aethiopica* L.)

Chanchal Tiwari, S. S. Bisht and Priyanka Kakkar
Department of Floriculture and Landscaping, College of Horticulture
VCSG Uttarakhand University of Horticulture and Forestry
Bharsar, Pauri Garhwal, Uttarakhand

ABSTRACT

Thisexperiment was directed to establish a protocol for induction of callus fromdifferent explants (leaf, petiole and tuber) of Calla lily in the Plant Tissue Culture Laboratory of College of Horticulture, VCSG, Uttarakhand University of Horticulture and Forestry, Bharsar, Uttarakhand during 2019-2021. *Zantedeschia aethiopica* L. is an important commercial ornamental plantbelonging to the Araceae family. It is gaining popularity worldwide for its unique flowers and have the potential to become a new major crop in floriculture industry. Traditionally it was propagated through tubers but the traditional reproduction method resulted in low propagation coefficient. Specifically the plant will hurt during division propagation and causes the wound which can easily be infected by several fungal and bacterial infections during the cultivation practice.So the propagation through *in vitro* technique is used to reduce the cost of production and improve the quality of flower and planting material. Through callus induction in calla lily (*Zantedeschia aethiopica* L.)in MS media supplemented with different concentrations of NAA and BA under light and dark photoperiod @ 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5 and 4.0 mgL^{-1} it was found that the best explant (leaf) for callus induction in 34 days was noticed in treatment T_4 (NAA: BA @ 0.5: 2.0 mgL^{-1}) under light photoperiod on the basis of the quality of callus produced, best response of callus induction in tuber was also visualised in T_5 (NAA : BA @ 1.0 : 2.5 mgL^{-1}) in 64 days under dark condition. Whereas,the best response of callus induction in petiole was observed in treatment T_5 (NAA : BA @ 1.5 : 2.5 mgL^{-1}) in 38 days under dark condition. Leaf explant also showed best response for callus induction in 36 days in treatment T_2 (NAA : BA @ 2.0 : 1.0 mgL^{-1}). The best explant was petiole for callus induction in 37 days was noticed in treatment T_4(NAA : BA @ 2.5 : 2.0 mgL^{-1}).

◆◆◆◆◆◆

Vegetable Crop Improvement for Alleviating Micronutrient Malnutrition

Anjali Kumari Jha
Department of Horticulture (Vegetable &Floriculture), Bihar Agricultural University, Sabour-813 21

ABSTRACT

Micronutrient malnutrition is known to impact more than half of the world's population and is regarded as one of humanity's severest worldwide problems. Maintaining global food security is a major challenge that requires novel strategies for crop improvement. Biofortification, the practice of breeding nutrients into food crops, provides a very affordable, sustainable and long-term method of giving more micronutrients and it plays an important role in crop improvement. Biofortification of vegetables with vitamins and micronutrients is a necessity for developing nations to combat several health difficulties in the present day. Currently, agronomic traditional plant breeding, genetic modification and biofortification are the three most prevalent methods for vegetable crop biofortification. Conventional breeding approaches have been cumbersome and ineffective; however, new advancements in molecular and biochemical diagnostic tools and methodologies have shown promise for enhancing the nutraceutical content and other quality features. There is significant potential for molecular markers, next-generation sequencing, RNA interference (RNAi) and genetic engineering to reduce the time and expense associated with quality breeding.Numerous target trait-specific genes are accessible, allowing for the enhancement of micronutrient content in vegetables.Genome-editing technologies, such as transgenic, RNA interference, Transcriptomics and CRISPR/Cas9, have the ability to enrich vegetables with health-promoting elements and also for removal of anti nutritional factors. These methods can be extremely useful for multiplying the levels of minerals and vitamins in various crops.

Keywords: Biofortification, Vegetable Crops, Molecular Markers, Micronutrients, Malnutrition

◆◆◆◆◆◆

Per se performance of different ajowan (*Trachyspermum ammi* L.) genotypes for growth and seed yield characters

Subramaniyan, P., L. Jeeva Jothi, K. Sundharaiya, N. Shoba and S. Murugesan

ABSTRACT

An investigation was carried out to study the *Per se* performance of ajowan (*Trachyspermum ammi* L.) genotypes for growth and seed yield attributes at the Department of Spices and Plantation Crops, Horticultural College and Research Institute, TNAU, Periyakulam. Totally twenty genotypes of ajowan collected from different parts of India were evaluated under field condition. The experiment was laid out in Randomized Block Design (RBD) with three replications. The result of the present study, to identification of superior genotypes exhibited significant variations for biometrical and yield characters which offer scope for selection of high yielding genotypes. Based on the *per se* performance the ajowan genotypes *viz.*, Acc. No.3 (38.83g), LTa-26 (35.21g), LS-1(32.61g) and GA-1(32.54g) were identified as superior for the traits with higher seed yield per plant which were due to the contributing parameters *viz.*, plant height, number of primary branches, number of secondary branches, days taken to first flowering, days taken for 50 per cent flowering, number of umbellets per umbel, number of umbels per plant, number of flowers per umbellet, number of flowers per umbel, fruit set percentage, number of seeds per umbellet, number of seeds per umbel, seed yield per plant, 1000 seed weight. Therefore, the above ajowan genotypes could be well exploited in future breeding programmes and selection of varieties for the respective traits.

Keywords: Ajowan, *Per se,* Seed yield, *Trachyspermum ammi* L. and Umbel.

◆◆◆◆◆◆

Assessment of genetic variability and genetic advance in *Solanumlycopersicum* L.

Sudesh, Lila Bora, D. S. Duhan and Renu Fandan
Department of Vegetable Science. CCSHAU, HISAR

ABSTRACT

The experimental study was conducted to access the relative performance and genetic variability among fruit yield and its attributing traits. The experimental materials comprised of thirty genotypes of tomato, which were collected from NBPGR, RS, Bangalore and various public sector institutes. The crop was sown under Randomized Block Design (RBD) with three replications at Regional Research Station, Karnal, Chaudhary Charan Singh Haryana Agricultural University, during the *Autumn Winter* season of 2021-22. The observations were recordedfor threeparameters days to first picking,fruit yield per plantand total soluble solids content pertaining to the morphological, fruit yield and quality traits in tomato. Analysis of variance showed substantial differences among the genotypes unveiling the plausible presence of significant genetic variability within the selected genotypes. The cynosure of this investigation was yield per plant (kg) which observed moderate GCV (18.61%), high PCV (22.60%) and moderate heritability (67.82%) coupled with high genetic advance (31.58%). Moderate GCV (10.46%), PCV (11.02%)and high heritability(90.07%) coupled with high genetic advance(20.45%) was observed for total soluble solids content. Low GCV (8.65%), PCV (8.91%) and high heritability (94.36%) and moderate genetic advance (17.31%) was observed fordays to first picking. Wide difference among PCV and GCV indicates high susceptibility of that character towards environmental fluctuations.Thegenotypes namely EC-631357 (2.069kg) and EC-631457 (1.926 kg)were found superior in terms of both overall yield and quality, whereas, Selection 7 took the least number of days which was immediately followed by EC-631351 and Pusa Ruby.

◆◆◆◆◆◆

Guesstimate of Thymoquinone by HPTLC technique and physicochemical diversity of Indian Nigella (*Nigella sativa* L.) Germplasm

RaviY[1&2], Irene Vethamoni P.[1], Saxena S.N.[2], Velmurugan S.[1], SantanakrishnanV.P.[3], Raveendran M[3],
[1]HC & RI, Tamil Nadu Agricultural University, Coimbatore, 641 003, India.
[2]ICAR-National Research Centre on Seed Spices, Ajmer, Rajasthan, 305 206, India.
[3]Centre for Plant Molecular Biology and Biotechnology, Tamil Nadu Agricultural University, Coimbatore, 641 003, India.

ABSTRACT

The constituents of Nigella have the competence to cure many biological ailments including, asthma, diabetes, digestive diseases, inflammatory diseases and rheumatoid arthritis. Thymoquinone (TQ) is a valuable metabolite derived from the Nigella sativa L. seeds and has a variety of therapeutic properties. TQ was estimated using n-hexane: ethyl acetate (8:2, v/v) green solvent system and computed at a wavelength of 254 nm using the high-performance thin-layer chromatography (HPTLC) densitometry method in distinct varieties and genotypes congregated from different geographical regions. Genotype Ajmer Nigella-13 has the paramount thymoquinone content (247.60µg/100mg seed) followed by Ajmer Nigella 19 (244.5µg/100mg seed) while the lowest amount of thymoquinone was recorded in the genotype Ajmer Nigella-6 (42.88µg/100mg seed). The Hierarchical Cluster Analysis found that the collected genotypes and elite varieties were classified into four broad clusters, and the identified chemotypes with elevated thymoquinoneproportion positioned in cluster D. Significant genotypic variation in thymoquinone content is available, that can be used in exploiting pharmaceutical applications of Nigella sativaL. as well as breeding programme for quality improvement.

Keywords: Hierarchical clustering,pharmacological,thymoquinone, HPLC, quantification,

◆◆◆◆◆◆

Session-2

Seed, Planting Material & Nursery Management

INVITED LECTURE

I-1 Horticulture in the Indian Himalayas

Rahul Dev, NK Hedau and Lakshmi Kant
ICAR-Vivekananda Paravatiya Krishi AnusandhanSansthan, Almora

The Himalayan region is inhabitant of 39 million people (~4% of the total population), a large percentage (~75%) is of the hill farming communities. Therefore, the development of mountain peoples is primarily linked to the development of agriculture and its allied activities. The Indian Himalayas cover an area of 53.7 Mha, which is ~17% of the total geographical area of the country. The availability of land for cultivation in the hilly region of Himalaya is just ~ 0.17 ha per capita and it continues to shrink further.Irrigated farmlands occupying only 15.8 per cent of the total area of the Himalayas. After land and water, the third ecological driver of change is the increasing domination of wild animals over the farmers, which is presently increasing its disruptive value to mountain agriculture in all the northwest Himalayan states. The climate in Uttarakhand is characterized by vagaries of weather. Unpredictable climate events (dry spells/aridity, natural calamities) have already affected the productivity of major cereal crops. Due to its over-dependency on seasonal rains, the impacts of climate change on crop production and farmers' livelihoods are considered to be very high. Additionally, current crop profile of state does not suffice the daily nutritional requirement of hilly farming communities. A large number of populations are out-migrating along with families from the hill regions for alternative employment and to eke out their livelihoods.Promotion of potential horticultural crops and their value addition for the development of ready-to-use products can be a strategy to sustain the livelihoods of rural communities and stop out-migration. Traditional food grains and cereals, pulses and local vegetables are being abandoned or have already been abandoned by many farmers. The climatic conditions in the Himalayas, range from subtropical (low-lying river valleys) to Alpine and cold (highly elevated regions) and are suited for diverse fruit/ vegetables cultivation. Horticulture has its advantage in the Himalayan ecosystem due to its particular ecologicalcondition and numerous micro-situations. The percentage share of horticultural crops in the total agricultural income of mountain farmers is increasing in the Himalayan states. Presently, variety of fruits are in cultivation in this basin, ranges from mango-guava, papaya and citrus (lemon, orange, malta, kinnow) to apple, pear, walnut, kiwi, pomegranate, plums, peach and apricot in the different elevations. Vegetable (tomato, cauliflower, cabbage, beans, potato, capsicum, cucumber and pumpkins) cultivation is also carried out on the slopes of the hilly basin at different altitudes. These potential horticultural crops are rich in nutritional and nutraceutical properties along with the ability to grow in harsher agro-climatic conditions. Moreover, their cultivation is also easy and does not require much care. Still, sufficient progress is not achieved so far, due to certain inhibiting factors, especially poor transportation and marketing, that hinder the rapid growth of the horticulture sector in these hilly regions. The state of Himalayan farming highlights the fact that business as usual cannot continue. For economic upliftment of the rural community inhabiting Himalayan regions, proper land use planning has to be done with different horticultural crops. This region faces several sectoral, institutional and policy challenges which need to be addressed systematically, if the potential is to be realized and translated into a sustainable development impact. To meet the purpose, significant research, improvement and development efforts are needed which will be discussed.

◆◆◆◆◆◆

I-2 Advancement of Rootstock Research in India

O. P. Awasthi, Theivanai, M. and Kripa Shankar
Division of Fruits & Horticultural Technology
ICAR–Indian Agricultural Research Institute, New Delhi-110012

Rootstocksareinextricably linked with the success or failure of orcharding enterprise because plant's first line of defense against abiotic stress is in its roots. More than twenty horticultural characteristics are reported to be influenced by the rootstock. Certain species of rootstock and ecotypes seem to have a combination of key genes, quantitative trait loci and molecular networks that mediate plant responses to drought, salinity, heat, freeze tolerance and other abiotic stresses. Therefore, use of suitable rootstock that would induce tolerance to abiotic stresses or enable exclusion of uptake of toxic chemicals by the roots would be useful to prevent or reduce economic losses. Purposefully selected rootstocks enables the scion variety to express its genetic potential in terms of tolerance to various abiotic stress, fruit quality and achieving real yield, modify architecture of plants. Climate change on the other hand is projected to have significant impacts on conditions affecting fruit industry which is substantiated by the facts like declining apple productivity, erratic flowering in mango, damage due to frost and chilling injury in aonla and ber. Salinization is one of the most serious problems confronting citriculture and guava industry in India. All these situations are compelling the orchardist towards a gradual shift to other crops. Such uncalled situations are not only a threat to nutritional security but also a hindrance for healthy economic growth of the country. To circumvent such crisis and to enhance fruit productivity, development of newer and responsive rootstock (s), use of wild relatives to various abiotic stresses combined with the advances in rootstock technologies to achieve the targeted production for the future is the need of the hour. This paper is an attempt to provide a brief review of the advances in rootstock research and the role they can play in mitigating the abiotic stress in some of the major tropical, subtropical, temperate and arid fruits of the hot and cold region.

◆◆◆◆◆◆

I-3 Hort Technologies for Tripura

Biswajit Das, H. Lembisana Devi, Bapi Das, Pradip Sarkar, Vinay Singh, AsitChakraborti, Lopamudra Sahoo, Ashima S. Baidya, Rajib Deb, Mujammil Abedin and Prithvijit Das
ICAR Research Complex for NEH Region,
Tripura Centre, Lembucherra- 799210, Tripura

The north eastern state Tripura has diverged range of topography, communities, endemic flora and fauna. Topography comprises plain low land and hilly terrains with altitudinal range of 15-940 m amsl.The climate of Tripura is Tropical to sub-tropical in nature. Summer is hot (17.0-39.0^{0}C) and very much humid (75-80% RH), rainy season (June-September) experience maximum precipitation as monsoon rainfall, pre and post monsoon rain fall occurs during April-May and September-October with average annual rainfall around 2500 mm, respectively, autumn season is also hot as well as humid (October-November) and winter is mild (5.0-26.0 ^{0}C) with scattered rainfall (December- February). Tripura falls in agro-climatic zone1 Eastern Himalayan region. The soil types of Tripura can be classified under five major groups, red loam and sandy loam soil occupies43.07% the total area, reddish yellow brown sandy soils 33.06%, other three types are older alluvial soil (9.7%), younger alluvial soil 99.3%) & lateritic soil (5%). Distribution of 5 types of soil orders are inceptisols (80.6%), entisols (8.1%), ultisols (6.6%), alfisols (4.5%) and histosols(0.25). Soil is acidic (4.0-5.5 pH). Cropping Intensity is 191 % (All India – 142%), average size of holding is 0.49 ha (All India – 1.15 ha) and small & marginal farmers are 96% (All India – 85%). Net sown area is about 2.56 lakh ha (24% of the total area) out of which 66.6 thousand ha is under fruit and 39.1 thousand ha is under vegetable farming. The agro-climatic condition of the state is very much suitable for cultivation of majority of the tropical and sub-tropical fruit crops, winter and summer vegetables as well as some specialized cut flowers.

Salient hort-technologies are:

1. Introduction and performance evaluation of Mango Variety Amrapali and Mosambi and standardization of quality planting materials production of these varieties under Tripura condition.
2. Weed mat technology for pineapple cultivation and off season fruiting by staggering and flower regulation.
3. Dragon fruit cultivation technology under integrated nutrient management (INM)
4. Standardization of rejuvenation techniques of old mango trees.
5. Fruit quality improvement of Litchi var. Shahi through shoot pruning and foliar feeding.
6. Standardization of HYV of vegetable based annual cropping sequence.
7. Standardization of multi-storeyed vegetable cultivation model for upland conditions of Tripura
9. Demonstration of Hortibased Integrated Framing System
10. Evaluation of Onion varieties under Tripura conditions.
11. Production technology of gladiolus for Tripura condition.

Considering the agro-climatic suitability, pineapple, jack fruit, citrus fruits are the major crops for Tripura. Mango, banana, litchi, ber, papaya and other minor tropical fruits are also grown. Adoption of improved production technology and scientific management of the orchards are very much essential for production of quality fruits. Vegetable cultivation is very much profitable and farmers have adopted cultivation of HYV vegetables in annual cropping sequence. Farmers are advised to adopt INM and IPM for better production. Among the cut flowers, marigold, gladiolus, anthurium, gerbera and Dendrobium orchid cultivation have been widely adopted by the farmers. Future potential crops namely, dragon fruits and avocado have been introduced and are being popularized among the farmers.

◆◆◆◆◆◆

I-4 Bioreactor Mediated Micropropagation of Horticultural Crops

Maneesh Mishra
ICAR-Central Institute for Subtropical Horticulture
Rehmankhera, P.O. Kakori, Lucknow (UP)-227107

Temporary immersion systems bioreactors for micropropagation of fruit crops have emerged as most suitable choice due to reduced production cost, high biomass in lesser time, substantially high rate of multiplication, non occurrence of problem of hyperhydricity in plants due to better gas exchange and automation. Several TIS such as RITA, SETIS, Plantform, Twin glass airlift etc have been utilized to propagate crops such as banana, date palm, strawberry, papaya, Citrus, grape, pineapple, apple, pear, plum, chestnut, pistachio nut, apricot, sweet cherry and almond. There is need for improvement in various bioreactors developed over a period of time. The space utilization was found highest with Plantform system (80 %) while it was lowest in Twin Flask system (26 %). Higher head space provides better plant growth and lesser fogging on the walls of bioreactor. Most of the bioreactors have not been designed to facilitate better root production under *in vitro*. Roots gets coiled and cluttered which needs improvement in design. Provision of illumination in each tank will facilitate better morphogenesis. India is far behind in development of indigenous TIB system for horticultural crops. ICAR-NRC-Banana, Tirichy has developed and commercialized 250 ml glass tank TIS having provision of 2-minute medium immersion after 6 hours which was found effective for shoot proliferation and rooting in banana. Recently, efforts have been made to develop plastic tank TIB system for micropropagation of banana and papaya at ICAR-CISH, Lucknow. Plastic tank TIB with immersion frequency of 3 minutes at an interval of 4 hours gives higher biomass and proliferation in both banana and papaya. This technology offers higher biomass production in comparatively less time, saving of cost of gelling agent, minimal human foot print and ease of control of operation. Contrast to conventional tissue culture system (Semi solid tissue culture), this system allows for more surface area of explants in contact with nutrient medium leading to more biomass production. Efficient input utilization leads to reduced cost of production rendering it to most cost effective micropropagation system.

◆◆◆◆◆◆

I-5 Challenges, Opportunities & issues in Horticultural nurseries

Anil Kumar Dubey, Nimisha Sharma, Lal Chand and Mukesh Shivran
Division of Fruits and Horticultural Technology,
ICAR-Indian Agricultural Research Institute, New Delhi-110012 (India)

The diverse agro-ecological region of India has enormous potential for the production of all types of horticultural crops like fruits, vegetables and medicinal plants in different parts of the country. Hence, the horticulture sector especially the fruit industry has arisen as a key sector in agriculture, which is highly Technology driven coupled with hi-tech interventions. The horticulture sector is contributing more than 30 percent to the agricultural GDP and sustained a growth rate of more than 5% in the last two decades with a current production estimate of 341.63 million tonnes during year 2021-22. Even though agriculture production is in an upward trend, the increase in population, inflation and climate uncertainty warrant efforts toward sustainable agriculture. The greenhouse gas emission and their alarming consequences imply the need for carbon sequestration mechanisms while the carbon credit mechanism urges for a green economy. At this juncture, perennials offer the possibility of climate change mitigation with the additional advantage of products for consumption. On the other hand, India has only 23.81% forest cover, which is far below the recommended 33% of our National Forest Policy, 1988. Increasing the area under natural forests has negligible scope, while Trees Outside Forests (TOFs) offer tremendous opportunities for productivity augmentation and sustainability. Furthermore, this sector has presented opportunities for entrepreneurship development and the creation of direct jobs in public and private nursery sectors as nursery managers, skilled young professionals, propagators and field supervisors, as well as indirect jobs in transportation and in the marketing chain. However, some specific challenges which slow the growth of the nursery sector are skill development, credit support, infrastructure development for propagation, quality control, transportation, marketing; implementation of quality control and domestic quarantine, which have to be addressed. Therefore, there is a high and sustained demand for quality planting material for the growth of this sector.Demand for seeds and seedlings of horticulture has been increasing over the years. At present, only 30-40% demand for planting material is being met by the existing registered nurseries; the rest is met from the unorganized sectors, implying the need for establishing more nurseries in the organized sector. The availability of quality seedlings at lower cost offers ample scope for large-scale planting.Although, various initiatives are being taken by several organizations like ICAR, NHB, NABARD and state departments for the development of the nursery sector. The guidelines made for licensing, accreditation; star rating of horticultural nurseries by NHB are being implemented by ICAR institutes and SAUs for accreditation of nurseries with star rating. The technical specification for the production of horticulture plants made by ICAR is also helping in the production of quality planting material. A big initiative had been taken under the Indo-Israel mission, which led to the development of thirty-fourCenter of Excellence (CoE) during 2008 to 2022 on various fruits and horticultural crops. These are involved in the development of production technologies, the production of high quality planting material and also involved in knowledge transfer and skill development. Under National Horticulture Mission, initiatives were taken for the development of specific Infrastructure required for setting up Model Horticulture Nursery, etc. The government of India had constituted a model nursery regulation act long back in 1954. In this line, several state governments enacted their own Horticulture Nurseries (Regulation) Act. With these initiatives, the country has made quantum progress in the production of quality plants through the public and private sectors. However, some issues inthe nursery sector like availability of land, cost of land, availability of quality water, maintenance of disease-free mother plants and the emergence of new pestsand diseases under changing climatic scenariosposea hindrance to the growth of the nursery sector, needs the attention of policymakers and researchers.

◆◆◆◆◆◆

ORAL PRESENTATION

Bioreactor: A novel approach for production of elite planting material in horticulture crops

Bhandari, N.S.,
School of Agriculture, Graphic Era Hill University, Bhimtal campus, Uttarakhand, India, 263136

ABSTRACT

Plant tissue culture, an ecofriendly technology includes micropropagation which leads to mass propagation of true to type, high quality planting material of ornamentals, medicinal crops plantation crops, fruit and forest trees etc. within a limited period. It has provided challenging opportunities in global trading of tissue culture saplings as well as cut flowers for export as well as for domestic use in developing countries like India. Conventional micropropagation with solid or semi solid media is a typically labor-intensive technique of propagating elite clones of commercial horticulture crops and also limited because to high labor costs. Other disadvantages are costly devices, low proliferation rate, long multiplication cycle before hardening and transplanting and higher mortality resulting from pathogens. At present application of Bioreactors is limited in micropropagation of horticulture crops in India, however it can be utilized as an efficient tool for the production of elite planting material. The liquid medium allows the close contact with the tissue which stimulates and facilitates the uptake of nutrients and phytohormones, leading to better shoot and root growth. Bioreactor not only facilitates optimum growth conditionsbut also offers many advantages to achieve both maximum yield and high quality of propagules, or to bring down the production costs as low as possible. Now, this technology gaining popularity in developing countries among private companies to commercialized micropropagation via thin cell layer, meristem culture, organogenesis and somatic embryogenesis. The primary application of micropropagation has been to produce elite planting material irrespective of season or crop, which in turn leads to increased productivity in agriculture as well as better economy to developing nations like India.

Keywords: Bioreactor, *In vitro* propagation, Phyto-hormones, Liquid culture and Horticulture crops

◆◆◆◆◆◆

Container gardening of fruits for meeting the nutritional needs of city dwellers

K.K. Srivastava and P.L. Saroj
ICAR- Central Institute for Subtropical Horticulture, Rehmankhera, P.O. - Kakori,
Lucknow 227 101

ABSTRACT

Problem of malnutrition among the urban and semi-urban areas pose the serious health issues. Growing fruits (perennial plants) in the container always been a challenging task, accordingly ICAR-CISH, Lucknow, initiated research with the financial support of UPCST, Govt of UP, Lucknow, on standardization of container size, growing media type and type of fruit plant and their varieties for successful containerized fruit culture. It can be helpful for fruits growing on the roof top. The results obtained from the experiment conducted revealed that canopy spread (60-75 cm) recorded in different containerized fruit plants with canopy height (70-125 cm).The fruit plants propagated through air layering always been ideal for container gardening purpose in view of branching pattern and bearing potential. In guava 0.14-0.52 m^3, pomegranate 0.15-0.51 m^3 and in citrus 0.21-0.42m^3 canopy volumes recorded after 3 years. Higher canopy growth recorded in larger containers; however, yield and quality attributes did not vary in different container sizes. In Citrus, 'Kagazilime' variety 'Sriganganagar Lime-

1', Jaffa (Sweet orange) and Navel Orange (Sweet orange) and 'Kinnow' performed best in container. Maximum canopy spread (79.30 cm) was noted in Sriganganagar Lime-1 grown in 30x45 cm container which was on par to 45x60 cm, 45x45 cm container size. Pomegranate variety Mridula was found most suitable for growing in the container. In case of guava 'Shweta', 'Lalit' cultivars were found most suitable for container farming. Maximum canopy volume recorded in 'Lalit' variety grown in 45x60 cm container size with average canopy spread 64.48 cm. Growing substrate or media (M1) which comprise garden soil, sand, FYM and vermicompost, neem cake, cocopeat, bone meal mixed in definite proportion has been found light in weight and are suitable for most of the fruited plants. Phenological parameters showed that different fruits grown in container have 4-7 days' advance in flowering and fruit maturity than field condition. In guava, 4-5 kg fruits, pomegranate 2-3 kg and in citrus group fruit 3-4 kg fruits per containerized plants were harvested in 3rd years. Water requirements vary according to season, containers size and type of fruit plants. Maximum ET and water requirement was recorded in guava, followed by pomegranate and citrus. During summer approximately 1.80-3.50 liter water/ container/day needed in guava while during winter 0.30-0.60 Liter /container/day water required in guava, citrus and pomegranate. The B: C ratio for production of fruited containerized plants is 4:1. The containerized fruited plants along with media are in great demand and are being sold costly(600-800/potted plants)

◆◆◆◆◆◆

Studies on growth of tomato seedlings in different growing media combinations in portrays

Ravindra Babu. M, Nissi Flora G, Thomson. T and Ashok. P
Horticultural Research Station, Dr Y.S.R.Horticultural University, Venkataramannagudem-534101, Andhra Pradesh

ABSTRACT

A study was carried out to explore the effect of different growing media combinations on seed germination and seedling growth in tomato cv. Arka Vikas at. Four types of media in different combinations were studiedCentre of Excellence for Research and Training in Protected Cultivation, Horticultural Research Station, Dr.Y.S.R.Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh. The experiment was laid out in Completely Randomized Design, with twelve treatment combinations and three replications. Results showed that the percentage of germination was highest in Vermicompost alone (85.86 %), height of the seedlings was also highest in Vermicompost (19.30cm). Highest root length was recorded in treatment combination Vermicompost : Perlite : Vermiculite (2:1:1) (18.64 cm) which was on par with Vermicompost : Cocopeat: Perlite : Vermiculite (3:1:1:1) (17.73cm). Highest leaf area (43.96 cm^2) and Fresh weight of shoot (14.12g/plant) were recorded whenVermicompost alone is used as growing media, whereas highest fresh weight of root(10.10g/plant) was recorded in media combination of Vermicompost : Perlite : Vermiculite (2:1:1). Dry weight of shoot was highest in the treatment combination of Vermicompost : Perlite : Vermiculite (2:1:1)(1.00g) and highest dry root weight was recorded in Vermicompost alone (0.6 g). Among all the treatments percentage of seedlings established in the main filed was highest in Cocopeat : Vermiculite : Perlite : Vermicompost (3:1:1:1) (100 %). Even though vermicompost alone produced good vegetative growth, the treatment combination of Cocopeat : Vermiculite : Perlite : Vermicompost (3:1:1:1) with highest root : shoot ratio (1.23) and 100 % field establishment was found good for raising tomato seedlings in portrays.

Key words : Tomato seedlings, growing media, protrays

◆◆◆◆◆◆

Production of quality planting material in coconut

Suvarna[1],P. P. Bhalerao[2]and Vasantha. S. V[3]
[1]Dept. of Plantation, Spices, Medicinal and Aromatic Crops, ACHF, NAU, Navsari
[2]Dept. PSMA, ACHF,NAU, Navsari, [3]Dept. PHT, ACHF, NAU, Navsari

ABSTRACT

Coconut (*Cocos nucifera*) is a perennial, cross pollinated plant and popularly known as "*Kalpavriksha"*or "Tree of life" or "Nature's supermarket", which has considerable global significance as a versatile tree crop providing essential needs of human life. Commercial propagation of coconut is through seeds. Being the foundation for successful coconut production, the quality of planting material largely determines the ultimate returns from coconut. Coconut is cultivated in 2.1 million ha land in India. The average requirement of coconut seedlings is estimated to be 15 million/annum. However, production and supply of coconut seedlings by the public sector is only 5.5 million seedlings per year and it is projected that another 4 million seedlings comes from private nurseries and farmers.There is an enormous gap of 5 million seedlings annually in the country. So, long-term as well as short-term strategies are required to overcome the challenges in production and distribution of quality coconut seedlings to meet the demand of coconut growers. It is possible to produce quality seedlings through adoption of refined nursery techniques and series of selections at different stages.Nursery techniques to produce quality seedlings have been standardized, which involves several steps, *viz.* selection of seed garden and mother palms, collection of seed nuts, storage of seed nuts, site selection and raising of nursery with proper care and management,as well as selection of seedlings. Polybag nursery technique with bio-priming of bio-fertilizer formulations helps in production of superior quality seedlings of coconut.

Keywords: Coconut, Seedlings, Nursery techniques

◆◆◆◆◆◆

Correlating molecular and physical screening of tomato rootstocks for grafting of nematode resistant tomatoes for infested conditions

Indu Arora[1], Vinod K. Batra[1], Anil Kumar[2], Pooja Pahal[1], Kalpana Yadav[1] and Shikha Yashveer[3]
[1]Deptt. of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004
[2]Deptt. of Nematology, CCS Haryana Agricultural University, Hisar-125004
[3]Deptt. of Biotechology, CCS Haryana Agricultural University, Hisar-125004

ABSTRACT

An experiment was conducted on "Molecular and Physical screening of brinjal rootstocks for grafting of nematode resistant greenhouse tomatoes" in the Screen-house of Nematology and Research farm, Department of Vegetable Science,CCS HAU, Hisar in winter 2021-22. Among the 20 tomato genotypes screened, G8 was found highly resistant against root knot nematode with no egg masses and RKI of 1.00. Rootstocks screened in nematology sick plots for Root knot Indexing were also screened using 8 molecular markers viz.2 CAPS,3 CAPS,4 CAPS,7 RAPD, 8 SCAR, 9 SCAR, 10 SCAR, 11 SCAR for presence and absence of Mi gene. G8 tomato genotype which was found highly resistant in screening for nematode resistance under screen house conditions, indicated similar results based on presence of allele 2CAPS, 3CAPS,7 RAPD, 8 SCAR & 10 SCAR.Screened rootstock G8 was used in grafting of tomatoes with three different scions viz.Hisar Arun, ArkaRakshak and Pusa Rohini which were studied for growth, yield and quality characters in nematode infested conditions and gave better results than non-grafted plants.

◆◆◆◆◆◆

Effect of planting dates on growth, flowering and bulb production of *Narcissus tazetta* cv. 'paperwhite'

Ranjit Singh[1], Dixit Chaudhary[2] and Rakesh Kumar[3]
Department of Floriculture & Landscaping, Punjab Agricultural University,
Ludhiana (Punjab) 141004

ABSTRACT

A field experiment was conducted during winter season of 2020-21 at the Research Farm of Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana to investigatethe effect of different planting dates ongrowth, flowering and bulb production of *Narcissus tazetta*cv. 'Paperwhite'. The bulbs were planted at five different planting dates *viz.*, 15thSeptember (T_1), 15thOctober (T_2), 15th November (T_3), 15thDecember (T_4) and 15th January (T_5)laid out in Randomized block design with five replications. Maximum plant height (40.14 cm), highest number of sprouts per plant (33.00) and maximum width of leaves (12.19 mm) were recorded in T_1. However, maximum flower size(33.56 mm) was recorded in T_3. The maximum number of flowers (7.18) were recorded in T_1 and minimum number of flowers (4.16)were recorded in T_5. Among various bulb production parameters, maximum number of bulbs(9.30), size of bulb (43.79 mm) and weight of bulb (66.09 gm)was recorded in T_1*i.e.*, planting of bulbs on 15th September while the minimum value of the same parameters was recorded in T_5*i.e.,* 15th January planting.

The results of the study determined that the most suitable date for planting of *Narcissus tazett*a cv. 'Paperwhite' is September 15th (T_1) under sub-tropical conditions of Punjab.

Keywords: Narcissus, bulbs, planting dates, growth, flowering

◆◆◆◆◆◆

Role of living green walls to improve and enhance the microclimate of urban and suburban areas

R.K. Dubey, Murali Krishna Ulli, Simrat Singh, Madhubala, Kamal Kishor Nagar, Ravi deepika
Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana.
Ludhiana-1414004, India.

ABSTRACT

"Liveable city" concept has emerged as a new urban approach in 21st century as an innovative way to integrate nature into our new expanding cities. Vertical green walls are becoming one of the important aspects in improving the environment by reducing heat island effect and enhancing the air quality. The experiment was conducted on a vertical wall,planted with *Syngonium* and *Scindapsus* spp. in two different directions (North-East & South-West)and open conditions without plants as controlat Landscape nursery PAU. Study investigates the effect of temperature and relative humidity on green walls in all the three seasons (summer, rainy & winter). Temperature and relative humidity of experimental area with plants obtained better results when compared to control. During summer months the lowest average temperature (37.0^{o}C) were recorded at North-East, followed by South-West (41.1^{o}C) and highest recorded in control without plants (45.5^{o}C). In winter season lowest average temperature (17.6^{o}C) were noticed at North-East, followed by South-West (21.4^{o}C) and highest was recorded in control (26.4^{o}C). In winter season highest average relative humidity was (81%) at North-East, (75%) at South-West and open in conditions was (70%) recorded respectively. In summer, average relative humidity were (22%) at North-East, (19%) at South-West and (17%) at open conditions. Thermal performance of the vertical

green wall has positive effect on reducing the temperature inside the building and maintaining the microclimate. Among the two directions of vertical garden North-East green wall performed better due to minimal exposure to high temperatures.

Keywords: Living green walls, microclimate, thermalperformance.

◆◆◆◆◆◆

Technology for the vertical expansion of Nursery Under protected conditions using soilless rooting medium.

Wasim H RajaSajad Un Nabi, O C Sharma, J.I. Mir and M Abbas
ICAR-CITH, Old Airfield Rangreth Srinagar J&K, 191132

ABSTRACT

Experiment on the vertical expansion of the nursery was started during the year 2020, in order to utilize the available space in the greenhouse and to exploit the vertical growth of plants. Firstly the Success was achieved in apple clonal rootstock MM-106.Thentrial on air layering wascarriedoutfor other clonal rootstocks including (M9, Pajam, T337, T339, MB-9, P-22 and M-27) by using this technique. Those plants having a diameter of (5 mm and above) at 30 cm (1.0 ft) above ground level were selected and wounding/incision has been given by sharp knife/blade and rooting hormones IBA (2500 ppm) was applied to the wounded portion. The wounding is done to the targeted region to expose the inner stem for applying the rooting compound. The operation was started from the second week of June till the last week of August. Small polybags filled with rooting medium have been fastened at the points where rooting needs to be initiated. A lightweight substrate (Cocopeat) having high water holding capacity was used. Staking was done with the help of bamboo sticks to hold the bags in a proper position. Watering at regular intervals was done to keep the rooting media moist. Sufficient rooting has been recorded in all the rootstocks. From the data, it can be revealed that the maximum plant height (134.3cm) was recorded in rootstock MM-106 and minimum (89.17cm) in rootstock M9-Pajam. Maximum plant dia (8.77mm) was recorded in rootstock in MM-106 and minimum (6.49mm) in rootstock P- 22. The highest no. of plants per rootstock (3.9) was recorded in MM-106 whereas the minimum no. of plants per rootstock (2.1) was recorded in rootstock M-27. Maximum root length (15.83cm) was recorded in rootstock M9-Pajam and minimum (9.67cm) in rootstock M9-T339. Maximum root dia (2.39mm) was recorded in rootstock MM-106 and minimum (1.10mm) in rootstock B-9. The highest no. of adventitious roots (5.9) per plant was recorded in rootstock MM-106 whereas the lowest no. of adventitious roots (2.1) was recorded in rootstock P-22. The highest root fresh weight (4.0g) was recorded rootstock M-106 and the lowest (2.1g) in rootstock M-27. Maximum root dry weight (3.70g) in treatment in rootstock MM-106 and minimum (1.80g) in rootstock B-9. This technology will be very useful in promoting the vertical expansion of the nursery in greenhouse conditions and no. of plants per unit area can be increased 3-4 times without utilizing any extra inputs. One more additional benefit of this technology is that under greenhouse conditions a plant is attained a sufficient girth, above (5mm) and all the daughter plants are suitable for budding operation. The budding has been done to about 45% of daughter plants with an almost 95% success rate. This technology not only produced the additional 2-4 plants but also the budded plants which added the further advantage to this technology that budded plants with well-developed root system are produced in one year of the nursery cycle.

Keywords: Apple, Clonal Rootstock, Air layering, protected condition, Soilless.

◆◆◆◆◆◆

Nursery management Practice influence Quality Planting material in horticulture Uttarakhand

H.S. Baweja[1], Surbhi Pandy[2] Brijesh Gupta[3], Kavita Rana[4] Neha Verma[5] and Deepak Prakash
Deptt. of Horticulture & Food Processing
Dehradun (Uttarakhand)

Uttarakhand is enriched with remarkably heterogeneous area characterized by diverse climatic zones, allowing farmers to cultivate spread variety of horticulture crops. The leading of great nursery management is to arrange planting material for the best possible quality for new improvement field. Poor planting materials usually lead to low quality yield and dispensable thinning cost top rid off runts in planted field. Nursery management combines the principle of nursery, enhanced management counting different movement like potted the seedling, manuring, irrigation, plant protection measures, weed control, packing of nursery plants, sale management and authority of mother plants, staff practicing unusually is need of pesticides, plant protection and general safety issues regarding to nursery management, important tools for high-tech nursery management including nursery calendars, plant development registers, nursery inventories and records of nursery experiments.

Department of horticulture is leading of this division is to provide guidance to nursery men and growers to raise nursery plants by accepting modern techniques with strengthen their nurseries. Government also implement nursery act, 2020 for welfare of farmer as well as nursery workers. Department Skills and provides knowledge all aspect of nursery management. The Germplasm is old and there is lack of good planting material in the state. This is on account of lack of poor infrastructure and new technologies. Therefore more than 6 Center of Excellence of different Horticulture crops were proposed in different Central/State/NABARD Scheme in the state of Uttarakhand for which land is available in the Government Gardens, under which the mother blocks of best varieties of fruits would be established. It would be also engaged in producing the best planting material through latest scientific propagation techniques with latest hi-tech structures along with tissue culture techniques also. The trainings on the latest techniques of nursery raising, propagation, orchard management (Good Agricultural Practices) and handling of the high tech machines and on post-harvest management would be imparted to farmers/officials. So, these nurseries would prove as a milestone in not only producing the high quality planting material of fruits with in the state but would also help the farmers to understand and adopt the best practices of the orchard establishment and management thereby enhancing their economic upliftment and development. Most important the nursery enterprise contributes to national economy by providing employment opportunities for the skilled and unskilled workers. It also assists in gaining in more balanced financial development as the business flourishes both in urban and rural sector.

◆◆◆◆◆◆

POSTER

Evaluation of growth performance of ornamental trees raised in organic wastes

Hardeep Kaur, R. K. Dubey, Kamal Kishor Nagar, Ravi Deepika, Kritika Pant and Samil Kamboj
Dept. of Floriculture & Landscaping,
Punjab Agricultural University, Ludhiana.

ABSTRACT

The present investigation entitled "Evaluation of growth performance of woody perennial saplings raised in organic wastes" was carried out at Landscape nursery, Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana during year 2021-22 with an objective to evaluate the growth performance of tree saplings in different organic wastes and standardize the organic waste-based growing media for raising healthy and disease-free saplings. The experiment was conducted with six different treatments of different organic waste based media – paddy straw compost, farm yard manure, biogas slurry, sawdust, press mud along with control (soil + farm yard manure). Five different species of trees – *Cassia fistula*, *Schleichera oleosa*, *Koelreuteria paniculata*, *Bauhinia variegate* and *Putranjiva roxburghii*. The seedling and root growth parameters were found maximum in T_5 *i.e.*, press mud media. Among these trees, the highest seedlings length (31.27 cm) and root collar diameter (4.53 mm) were observed in *P. roxburghii*.The shoot dry weight was also found to be maximum in press mud media which was highest in *P. roxburghii* (4.26 g). As for root growth characteristics, the primary root length (26.62 cm) androot dry weight (4.95 g) was found to be maximum in *K. paniculata* while the primary root diameter was found to be best in *P. roxburghii* (4.42 g).The chemical and physical properties were also found to be best in press mud based treatment T_5. Based on the study, it can be concluded that the press mud based organic waste media can be used for raising the ornamental trees.

Keywords: Organic waste, woody perennials, seedling growth, root growth.

◆◆◆◆◆◆

Rooting success of hardwood cuttings of apple clonal rootstock using Indole-butyric acid and rooting media

Nowsheen Nazir, Amit Kumar, Sachin H R, Aroosa Khalil and A S Sundouri
Division of Fruit Science, Faculty of Horticulture SKUAST-Kashmir-190 025

ABSTRACT

The present investigation was carried out to obtain best combination of rooting media and IBA concentration for propagating apple clonal rootstocks in the experimental field of Division of Fruit Science, SKUAST-Kashmir, Shalimar campus, Srinagar. The experiment consists of three rootstocks S_1: M_7, S_2: M_9T_{337} and S_3: MM_{106}, three IBA concentrations G_1: 2500 ppm, G_2: 3000 ppm and G_3: 3500 ppm and four combinations of rooting media *viz.* M_1: Sand + Vermicompost (1:1), M_2: Sand + Vermicompost + Vermiculite (1:1:1), M_3: Sand + Vermicompost + Perlite (1:1:1) and M_4: Sand + Vermicompost + Cocopeat (1:1:1). The study revealed that $S_3G_2M_3$ treatment combination *i.e.* (MM_{106} + 3000 ppm + Sand + Vermicompost + Perlite (1:1:1)) recorded significantly highest root diameter (3.79 mm), maximum number of roots (13.00), maximum average root length (38.33 cm), maximum length of longest root per cutting (52.00 cm), highest fresh weight of root (7.50 g) as well as dry weight of root (3.56 g) and maximum percentage of rooted cuttings (66.66 %) The maximum root: shoot ratio (0.23) was recorded in rootstock cuttings with treatment combination $S_3G_2M_4$. The results obtained from this study can be

utilized to create a protocol for production of quality planting material of apple clonal rootstocks through cuttings.

◆◆◆◆◆◆

Reflective mulch: a cheaper and environment friendly alternative to plastic mulch for protected cultivation in hot climatic conditions

Pradeep Kumar, Nav Raten Panwar, Akath Singh, Soma Srivastava and Hari Mohan Meena
ICAR-Division of Integrated Farming System, ICAR-Central Arid Zone Research Institute, Jodhpur (Rajasthan) 342003

ABSTRACT

Mulch is an importantcomponent of precision agricultureincluding protected cultivation due to its multifaceted benefits. The most commonly used mulch material is plastic (mostly single use); hence vast uses and disposal may become anenvironmental concern. Furthermore, its application, particularly in polyhouse (plastic greenhouse) during hotter period,restricts the growth of young seedlings due to heat traps in collar region that eventually limit the production of vegetable crops (e.g., cucumber).As an alternative to plastic, we explored the potential of an abundantly and cheaply available mineral material, we named it reflective mulch (RM)— white, in powder formhaving no environmental issue rather add small quantity of mineral nutrients in the soil. In a greenhouse experiment, we tested the efficacy ofreflectivemulch (spread on surface) withplasticmulch (white on black, 25μ) and no-mulch (as control) under two levels of drip irrigation (normal, 1.0 ETc and deficit irrigation, 0.8 ETc), on growth, yield, quality and product water use intwo greenhouse cucumbers (Nagine F1and Gurka F1) during august to December growing period.Followings salient findings were obtained: i) growth andyield was higher in normal irrigation than deficit irrigation (DI);ii) fruit yield was higher in mulching (11 to 18%) than control—under normal irrigation, reflective mulch was better while under DI plastic mulch was better; iii) early growth (up to 30d) in DI was higher in reflective mulch than plastic mulch; iv)product water use (amount of water in L required to produce 1 kg produce) was reduced with the use of mulches from 44L (control) to 38L (RM) or 39L (PM); v) positive response of mulching interacting with irrigation treatments was due to better plant physiological functioning (RWC, WP, chl. index, chl. fluorescence, etc.), canopy parameters (leaf temperature), as well as better soil's enzymatic (DHA) and hydrothermal (soil temperature, moisture content) properties.

Keywords: Reflective mulch, greenhouse cultivation, arid climate, water productivity, Precision horticulture.

◆◆◆◆◆◆

Effect of rooting substrates, PGR and biofertilizers on shoot characteristic of pomegranate (*Punica granatum* L.) cuttings cv. Bhagwa

Chandra Pratap Sengar[1], P. Sonkar[1], Vijyalaxmi Balbande[2], S.K. Prajapati[3] and J. Bhandari[4]
[1]Department of Fruit Science, RVSKVV-KNK College of Horticulture, Mandsaur (M.P.)
[2]Department of Horticulture Science, RVSKVV-College of Agriculture, Indore (M.P.)
[3]Department of Horticulture Science, JNKVV-College of Agriculture, Jabalpur (M.P.)
[4]Krishi Vigyan Kendra, Ratlam (M.P.)

ABSTRACT

An experiment entitled "Effect of rooting substrates, PGR and Biofertilizers on shoot characteristic of Pomegranate (*Punica granatum* L.) cuttings cv. Bhagwa" was carried out during 2020-21 at the experimental field of Department of Fruit Science, College of Horticulture, Mandsaur (M.P.). The experiment was laid out in CRD with three replications and seventeen treatments. The results revealed that the shoot parameters *viz.* Days

taken to start the earliest sprouting of cutting (9.12 days), highest number of cutting sprouted (17.95), uppermost number of sprouts per cutting after 30 and 45 days (4.17 and 5.12), length of longest shoot (17.62 cm), maximum number of shoots per cutting (5.07), maximum number of leaves per cutting (69.26), maximum number of leaves per shoot (15.51), maximum leaf area (40.22 cm^2), highest chlorophyll content in leaves (41.76 SPAD value), fresh weight of shoots (12.55 g) and dry weight of shoots (5.81 g) were observed under treatment RS_{17} (Soil + Vermicompost + Poultry Manure + IBA @ 2500 ppm + *Trichoderma viride*@ 2.5g + PSB @ 2.5g) which was significantly higher over RS_1 (soil). It may be concluded that treatment RS_{17}can be applied for suitable hardwood cutting in pomegranate under malwa region of Madhya Predesh.

Keywords: Biofertilizers,Cutting, Pomegranate, PGR, Shoot parameters.

◆◆◆◆◆◆

Effect of Green Waste Compost on Growth and Root Morphology of Ornamental Shrubs

Samil Kamboj, R. KDubey,Simrat Singh, Ravi Deepika,Aman Sharma, Kamal Kishor Nagar and HardeepKaur

Dept. of Floriculture & Landscaping, Punjab Agricultural University Ludhiana.

ABSTRACT

The present investigations entitled "Effect of green waste compost on growth and root morphology of ornamental shrubs" were undertaken at Landscape Nursery, Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, during March 2021 – February 2022.One year old three ornamental shrubs (*Murraya paniculata, Hibiscus rosa-sinensis* and *Tabernaemontana coronaria*) were transplanted in polybags of size 9×7 inches, filled with green waste compost (GWC) and soil in different proportions *i.e.* GWC 100%, GWC 75% + Soil 25%, GWC 50% + Soil 50%, GWC 25% + Soil 75% and FYM 50% + Soil 50% (Control) during second week of March 2021. Maximum plant height (57.33 cm), root collar diameter (10.00 mm), number of primary branches per plant (3.30), Dickson qualtity index (4.99) and primary root diameter (12.55 mm) were observed in *Hibiscus rosa-sinensis* in T_3 (GWC 50% + Soil 50%) and primary root length (11.61 cm) were observed in *Murraya paniculata* in T_3 (GWC 50% + Soil 50%).Plants growing in media (GWC 100%) were somewhat stunted and chlorotic for several weeks after transplanting probably due to higher levels of EC (4.15 dS/m) and pH (7.62). On the basis of growth performance evaluated, the sequence for growth parameters is *Hibiscus rosa-sinensis>Murraya paniculata>Tabernaemontana coronaria*. GWC 50% + Soil 50% proved superior growing medium for growth of three ornamental shrubs than other media.

Keywords: Ornamental shrubs, Green waste compost, Morphology

◆◆◆◆◆◆

Macro Propagation of Banana

Shikha Jain[1], Raushan Kumar[2], Shikha Saini [3], Shubham Jagga[4] and Poonam Maurya[5]

Division of Fruits and Horticultural Technology, New Delhi, India-110012.

ABSTRACT

One of the most significant crops in many tropical and subtropical countries is banana. The difficulty in getting quality planting material limits the large-scale production of banana. This is a result of poor suckering ability that is enhanced by the main plant's strong hormone-mediated apical dominance. There are various

vegetative multiplication techniques including micro propagation, for rapid production of planting materials, but high production cost, skilled labour requirement and the necessity for specialized machinery, limit its application. Therefore, a number of macro propagation methods such as mother plant stripping, field decapitation, corm technique and excised bud technique have been developed. Macro propagation is a great way to get high quality planting material at low cost. Because of the ease of multiplication, this is a simple technique that saves cost on planting material and can produce 50-60 shoots per sucker in 4-5 months. The plantlets produced using these approaches have the same uniformity as plantlets grown in tissue culture and they are relatively simple and low-cost to set up. This method also has the potential to help farmers overcome the problems like unavailability of seedlings at farm level, by providing them with seedlings of their choice that are affordable, high-quality, less post establishment problems and true to type. It is thus an important technique that can significantly boost food security and income generation among small farmers to create a sustainable and successful banana production system.

Keywords: Banana, macro propagation, suckers, tissue culture

◆◆◆◆◆◆

Standardization of time and conditions for wedge grafting during spring season in guava (*Psidium guajava L.*) cv. Sardar

Vipin Kumar, A. K. Singh, D. C. Dimri, Pratibha and Rashmi Panwar
Department of Horticulture, College of Agriculture, G. B. Pant University of Agriculture and Technology, Pantnagar-263145 (U.S. Nagar, Uttarakhand)

ABSTRACT

The experiment entitled standardization of time and conditions for wedge grafting during spring season in guava (*Psidium guajava*L.) cv. Sardar was conducted at Horticulture Research Centre, GBPUA&T,Pantnagar (Uttarakhand) during the year 2021-2022. The experiment was laid out in two Factorial Randomized Block Design with 15 treatment combinations consisting of five dates of grafting T_1 (second fortnight of January), T_2 (first fortnight of February), T_3 (second fortnight of February), T_4 (first fortnight of March) and T_5 (second fortnight of March) and three different growing condition C_1 (polyhouse), C_2 (shade net) and C_3 (open condition). Each treatment was replicated thrice and thirty plants were taken under each replication. On basis of the interaction effect between time and condition,the minimum number of days for leaf emergence (12.08 days), maximum value of scion sprouting percentage (94.36%), survival percentage (95.05%), number of primary shoots (7.88), length of the primary shoot (14.18cm), number of leaves/per graft (25.56), leaf area (28.71cm^2), leaf area index (7.05), height of plants (56.25cm), diameter of plants (23.23mm), number of shoots on graft (4.32) and number of leaves on graft (38.61) were recorded with wedge grafting performed in the second fortnight of February under polyhouse condition (T_3C_1).However, the effect of wedge grafting performed during the second fortnight of February to the first fortnight of March under polyhouse, shade net and open condition was found to be statistically at par with respect to scion sprouting percentage, survival percentage, number of leaves per graft and leaf area index. Thus, keeping in view the almost similar effect (statistically at par values) on scion sprouting and survival percentage,the wedge grafting performed during the second fortnight of February to the first fortnight of March under polyhouse, shade net and open conditions may be recommended for raising the quality planting materials of guava.

Keywords: Guava, wedge grafting, grafting time, polyhouse, shade net, open condition, graft survival percentage.

◆◆◆◆◆◆

Low cost technology to enhance potato seed production in India

Shrilatha K. A[1], V. K. Parmar[2], Nayana K. R.[3], Nithya G. R.[4], Roja H. S.[5]and A. D. Chaudhary[6]
Department of Vegetable Science, ACHF, NAU, Navsari

ABSTRACT

Potato (*Solanum tuberosum*) is an important food crop for both consumption and industrial use and thereby contributing to income generation and livelihood improvement. Limited availability of good quality planting material at affordable prices are the major constrains in many states to take up the potato production, which accounts for 40-50 percent of the total cost of production. Hence in order to increase potato production and reduce production costs, high quality and disease free planting materials are required. The development and application of *in vitro* plant culture technology to potato propagation enabled rapid multiplication of pathogen free potato plantlets. Apical rooted cutting (ARC) is a low-cost potato seed multiplication technology and it is alternative to existing capital intensive aeroponics technology. Rooted cutting is a transplant produced in a screenhouse from tissue culture plants, which are free from diseases and that are planted in a small protected plot to produce high-quality seed. This enable potato farmers to access high-quality early generation seed or super elite planting material, which can be of better quality than purchased seed. The decentralization of potato seed production using this low-cost technology has the potential to reduce the seed costs by 25-50%. This technology will have significant positive effect on potato yield, ultimately leading to higher profits for small and marginal farmers in potato growing states.

Keywords: Potato, rooted apical cutting and planting material.

◆◆◆◆◆◆

Effect of propagating media and planting time on the propagation of Plumeria species

R K Dubey, Ravi Deepika, Kritika Pant, Simrat Singh, Kamal Kishor Nagar and Ulli Murali Krishna
Department of Floriculture & Landscaping, Punjab Agricultural University, Ludhiana.

ABSTRACT

Plumeria is highly favored tree for commercial landscape as well as for home gardens. The demand of Plumeria is increasing due to its peculiar architecture and environmental benefits. The tree is commonly propagated through hardwood cuttings. However, scanty information is available on media supportive towards propagation and time of propagation for various plumeria species. Hence, the present study was undertaken to evaluate the effect of propagating media with planting time on the propagation of *Plumeria alba, Plumeria rubra* and *Plumeria acutifolia*. The experiment was conducted in a Factorial Completely Randomized Block Design in which cuttings of *P. alba, P. rubra* and *P. acutifolia*were planted in the months of December, January, February and March in three rooting medias *viz.* Soil, Burnt Rice Husk (BRH) and sand during the period of 2019-20 and 2020-21 at Punjab Agricultural University, Ludhiana. Result revealed that BRH media with February planting showed positive impact on propagation among all Plumeria species. *P. rubra* grown under BRH in February planting produced maximum survival rate (72%) with longest root length (8.6 cm), number of roots (27.6) and plant height (28cm) followed by the *P. acutifolia*in BRH media in February planting having survival rate (70%), longest root length (7.4cm), number of roots (26.6), number of branches (2.6), stem diameter (2.6cm) and plant height (22.8cm). Highest number of branches (2.8) and stem diameter (2.7cm) were observed in *P. acutifolia*in BRH during March planting. Hence, BRH media along with February planting is beneficial for Plumeria growers especially in *P. rubra*.

◆◆◆◆◆◆

Effect of Indole-3-butyric acid on grafting success of salnut (*Juglans regia* L.)

Rakhi Gautam1 , Manju2 and K. C. Singh3
VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal, Uttarakhand, India

ABSTRACT

To study the effect of Indole-3-Butyric acid on grafting success of walnut (Juglans regia L.)" in Fruit Nursery, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Garhwal during the month of March to September 2021. The experiment was laid out on Randomized Complete Block Design with eleven treatments and three replications per treatment. Grafting in walnut is more difficult than in any other fruit trees and poor grafts take has always been considered as one of the limiting factor in mass propagation of superior walnut selections. Auxin (Indole-3-Butyric acid) increases callus proliferation and vascular differentiation in graft unions. The experiment was held with grafts of walnut where rootstock of Kaghazi and scion of Govind were used in wedge grafting method. To promote callus formation and shoot growth of grafts growth regulator IBA at five different concentrations that is 100, 200, 300, 400 and 500 ppm used separately. The scion is inserted in rootstock firmly. Among all the wedge grafted treatments best scion characters in terms of days taken to first sprout, increment in shoot length, increment in shoot diameter, number of branches per plant, number of leaves per plant and leaf area were recorded best with IBA treatment @ 500 ppm.

Keywords: Walnut, wedge grafting, indole-3-butyric acid.

◆◆◆◆◆◆

Study of protray technology in multiplication of plant material and its effect on seedling growth of turmeric (*Curcuma longa* l.) Varieties

Macherla Chandana[1], M. Padma[1], B. Neeraja Prabhakar[2], Veena Joshi[3], B. Mahender[4], P. Gouthami[5] and G. Sathish[6]

[1] Department of PSMA (Plantation, Spices, Medicinal and Aromatic crops)
College of Horticulture, Rajendranagar, Sri Konda Laxman Telangana State Horticultural University (SKLTSHU), Mulugu, Siddipet Dist.
[1]Retired Senior professor and Ex-Dean of P.G. studies, Department of PSMA (Plantation, Spices, Medicinal and Aromatic crops), SKLTSHU, Mulugu, Siddipet Dist.
[2]Hon'ble Vice-Chancellor, Department of Horticulture, SKLTSHU, Mulugu, Siddipet Dist.
[3]Associate Professor, Department of Horticulture, College of Horticulture, Mojerla, SKLTSHU, Mulugu, Siddipet Dist.
[4] Scientist and Head, Department of Plant Pathology, Turmeric Research Station, Kammarpally, Nizamabad, SKLTSHU, Mulugu, Siddipet Dist.
[5] Assistant Professor, Department of Crop Physiology, College of Horticulture, Mojerla, S KLTSHU, Mulugu, Siddipet Dist.
[6] Assistant Professor, Department of Agricultural Statistics, College of Horticulture, Mojerla, SKLTSHU, Mulugu, Siddipet Dist.

ABSTRACT

The present investigation on "Study of protray technology in multiplication of plant material and its effect on seedling growth of turmeric (*Curcuma longa* L.) varieties" was conducted at College of Horticulture, Rajendranagar, SKLTSHU, Mulugu during 2018-19. The experiment was laid out in Factorial Randomized block design (FRBD) with 3 replications and 12 treatments. The results conferred that among different sizes of planting material, S_3 -

Vertical split of mother rhizome recorded minimum number of days for initiation of sprouting (8.66), number of days for 50 % sprouting (12.55), number of days for complete sprouting (20.10), maximum seedling vigour index (2825.33) and minimum number of days taken for final transplanting (30.10). The treatment S_2 – Two node cutting of primary rhizome recorded maximum percentage of sprouting (94.03 %). The treatment S_4 (Full mother rhizome) was recorded maximum seedling height (43.54 cm), maximum number of leaves (2.16) and maximum chlorophyll content (29.31). Among varieties, variety V_1- Salem has taken less number of days for initiation of sprouting (8.16), for 50% of sprouting (11.50 days), for complete sprouting (18.58 days), for final transplanting (25.58 days). The maximum percentage of sprouting (98.12 %), seedling height (46.10 cm), number of leaves (2.86), seedling vigour index (3166.85) and chlorophyll content (31.42) were recorded in Salem variety (V_1). Interaction between size of planting material and varieties significantly influenced growth and quality parameters. S_3V_1-Vertical split of mother rhizome of Salem variety has taken minimum number of days for initiation of sprouting (5.33), for 50% sprouting (9.00 days), for complete sprouting (16.00 days), for final transplanting (24.00 days) whereas maximum seedling vigour index (3871.21) was recorded. The treatment S_2V_1- Two node cutting of primary rhizome of Salem variety was recorded maximum percentage of sprouting (99.40 %). The treatment S_4V_1-Full mother rhizome of Salem variety has recorded maximum seedling height (71.19 cm), number of leaves (3.26) and chlorophyll content (33.74).

Keywords : Protray, sprouting percentage, seedling vigour index, chlorophyll content, growth, quality, Salem

◆◆◆◆◆◆

Advance nursery management of vegetable crops

Maya Ram[1], Sutanu Maji, Razauddin, Ramesh Chand Meenaand Sudheer Kumar Yadav
[1]Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow- 226025 (U.P.)

ABSTRACT

Nursery is a place where planting material, such as seedlings, saplings, cuttings, etc., are raised, propagated and multiplied under favourable conditions for transplanting in prepared beds. The availability of quality and true-to-type planting material is the prerequisite of successful and remunerative vegetable crop production. Setting up of a nursery is a long-term venture and requires planning and expertise. In a nursery, plants are nurtured by providing them with optimum growing conditions to ensure germination. Nursery saves considerable time for the raising of the next crop. Among solanaceous, crucifer's vegetable cropsare mainly propagated by seeds and require a nursery for raising the seedlings. Herbaceousperennialsvegetablesare grown from seeds for multiplying the rootstocks from cuttings and through grafts to perpetuate the same genetic properties.

Key Wards:-Seedling, Sapling, Germination, Rootstock, Genetic properties

◆◆◆◆◆◆

Propagation studies in Dracaena reflexa lam. Under the effect of season, media and growth regulators

Navjot Bhatia[1], Parminder Singh[2],Rishu Sharma[3] and Vamsi Maddirala[4]
Department of Floriculture and Landscaping, Punjab Agricultural University,
Ludhiana, Punjab -141004, India

ABSTRACT

Song of India (*Dracaena reflexa*) is an ornamental foliage plant which is highly valued for keepingindoors. Due to increasing demand of this plant, challenge of plant multiplication is crucial to meet, therefore present study was conducted with an objective to identify suitable conditions for its propagation in 2019 at Research

Farm, Punjab Agricultural University, Ludhiana,Punjab.Terminal cuttings of *Dracaena reflexa* were treated with five concentrations each of IBA (100, 200, 300, 400 and 500 ppm) and NAA (100, 200, 300, 400 and 500 ppm) for three minutes. Treated cuttings were planted in two different rooting media; sand and water in the months of Feb-March and July-August along with untreated control. Results showed that cuttings planted in February-March sprouted early (18.77 days) with maximum shoot length (12.43 cm) while cuttings planted in July-August had maximum rooting percentage (92.3%), root length (1.68 cm) and percentage survival (92.62%). Among media, better rooting performance was observed in sand media with respect to days taken for sprouting (19.09 days), rooting percentage (87.58%), root length (2.15 cm), number of roots (4.4), percent survival (96%) and shoot length (12.69 cm). Among the growth regulators, IBA @200ppm took least number of days taken for sprouting of cuttings (18.58 days) with maximum rooting percentage (100%), root length (2.13 cm), number of roots (4.64) and shoot length (14.18 cm). Survivability of cuttings was recorded maximum (100%) with IBA 200 ppm, IBA 300 ppm, IBA 400 ppm, IBA 500 ppm, NAA 200 ppm and NAA 300 ppm.

◆◆◆◆◆◆

Influence of potting media composition on quality pot mum production

Kiran Kumari, Komal H. Motanayak and Dhawani A. Patel
College of Horticulture, S. D. Agricultural University, Jagudan, Gujarat, India, 384 460

ABSTRACT

Chrysanthemum, which occupies a prominent place in ornamental horticulture, is one among the top cut flowers and pot plants traded in the world. Getting bloom of excellent quality in chrysanthemums, especially which are grown in containers, is a challenge for nurserymen due to restricted volume of pots. Pot mums having well proportionate shape with branches producing flowers of desirable colour, shape and size are preferred by consumers. Thus, the selection of good potting media is an important factor. Keeping this in view a study was conducted at College Farm, College of Horticulture, SardarkrushinagarDantiwada Agricultural University, Jagudan, Distt. Mehsana (August, 2020 to January, 2021) to find out the effect of different potting media compositions on quality pot mum production. Pot mum variety Sadhbhavana was used for the study and fourteen growing media compositions were made by using five different potting media (soil, vermicompost, cocpeat, perlite and vermiculite) as growing substrate in different compositions on volume basis. The experiment was laid out in Completely Randomized Design (CRD) and replicated thrice with five pots per treatments. Different growth, flowering and quality characters have been significantly influenced by various media compositions. This study indicates that potting media composition cocopeat +vermicompost (2:1 v/v) was found best for flowering and overall quality of pot mums of chrysanthemum variety Sadhbhavana followed by vermiculite +vermicompost (2:1 v/v) media.

◆◆◆◆◆◆

Propagation methods as a means for combining multiple stress tolerance traits in cucurbits

HardatKaswan
Department of Vegetable Science, College of AgricultureBikaner, 334006
Swami Keshwanand Rajasthan Agriculture University Bikaner, Rajasthan

ABSRACT

Vegetable grafting is a unique horticultural technique used in the propagation of fruit vegetables due to the multitude of advantages over the conventional propagation methods. Vegetable grafting was primarily developed and practiced with an objective of avoiding the damage caused by soil borne pathogens and pests. The scope for

grafting has further widened for combating abiotic stress tolerance, with the advancement in our understanding of the rootstock mediated effect on superior performance of scion, exploiting the physiological stress tolerance reserved in the wild species. Grafting has emerged as a viable alternative to relatively slower breeding approaches for enhancing environmental stress tolerance in fruit vegetables. Grafting is a special method of adapting plants to counteract environmental stresses by grafting superior commercial cultivars onto specific vigorous rootstocks.

Cucurbits are the first group of vegetables where grafting was widely popularized to combat biotic stress particularly Fusarium wilt. Research on cucurbit grafting began in the 1920s with the use of *Cucurbita moschata* as a rootstock for watermelon in Japan. Grafting is a quick, less expensive and viable solution for combating soil borne pathogens and their novel races, in comparison to the tedious breeding approach adopted for developing resistant cultivars. Watermelon, cucumber and melons are the major cucurbits which are propagated using grafted seedlings in order to overcome biotic and abiotic stresses.

Keywords: Grafting, Multiple stress, Biotic and Abiotic Stress Tolerance, Cucurbits.

◆◆◆◆◆◆

Effect of salinity on seed germination indices and seedling parameters of Marigold (*Tagetes erecta*)

T. Thakur and Arushi Garg
Department of Floriculture and Landscaping
Punjab Agricultural University, Ludhiana, Punjab- 141004, India

ABSTRACT

The present study was conducted to determine the effect of NaCl on seed germination indices and seedling growth of marigold (*Tagetes erecta*) at Punjab Agricultural University, Ludhiana during 2020. The marigold seeds were treated with different NaCl concentrations *viz*. 0 (control, distilled water), 20, 40, 60, 80, 100 and 120 mM in petri plate kept at normal room temperature. The results indicated that the maximum germination percentage, germination rate, coefficient of velocity of germination and vigor index was reported in control (96.66%, 1.10 % per day, 27.85 % per day and 6.55, respectively), whereas maximum mean germination time was recorded in 120 mM NaCl (4.96 days). However, the crop has shown tolerance to salt stress up to 40 mM NaCl concentration by recording more than 50% germination and better seedling growth. Thus, it could be concluded that marigold seeds can mildly tolerate the salt stress and this could be further build up under the open conditions.

◆◆◆◆◆◆

Growing media and cow urine influence the seed germination and seedling growth of papaya (*Carica papaya* L.)

Pooja Sharma, R. K. Yadav, M. C. Jain and M. C. Bhateshwar
Department of Horticulture, Agriculture University, Kota Rajasthan, India

ABSTRACT

The papaya (*Carica papaya L.*) is a tropical fruit belonging to the Caricacaeae family. Papaya is grown commercially by seed that is encased in a gelatinous sarcotesta and takes 3-5 weeks to germinate. Papaya seed germination is sluggish and often partial . To enhance seed germination and minimize germination time with proper growth environment, seed treatment is necessary. The following research was carried out in the nursery

section of the Department of Horticulture, College of Agriculture, Ummedganj, in July 2019-2020. This experiment was designed in a factorial complete randomized design with 11 media combinations and 22 treatments. The minimum days required for first germination (6.17 days), for 50 per cent germination (9.00 days), minimum span of germination (19.17 days) and maximum germination percentage (90.24 %) were observed in treatment of soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) with cow urine. Shoot parameters *viz.*, height of seedling, number of leaves per seedling and stem girth of papaya were influenced significantly by different growing medias and cow urine. The maximum seedling height (15.48 cm), number of leaves (9.83) and stem girth (7.75 mm) were recorded in treatment of soil + sand + vermiculite + cocopeat + perlite (1:1:1:1:1) with cow urine at 75 days after sowing. From the context of research, it can be determined that the treatment combination soil + sand + vermiculite + cocopeat + perlite (1:1:1:1) with cow urine is preferable to the other treatment combinations for good growth of papaya seedlings.

Keywords: Cow Urine, Germination, Growing Media, Growth.

◆◆◆◆◆◆

Standardization of planting time and nutrient requirement of rat tail radish (*Raphanus sativus* var. caudatus) under Southern Rajasthan condition

SusheelSongara, R. A. Kaushik, K.D. Ameta, Rajat Singh and Akshay Raj Singh Panwar
Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur-313001 (Raj.), India

ABSTRACT

Judicious application of appropriate nutrients always promotes metabolic activities in plants, leading to convenient growth and quality. In this context, our present investigation regarding study on bio-efficacy of various doses of fertilizers on the growth and quality contributing traits of rat tail radish in different planting schedule was carried out at Hi-Tech Unit, Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur. Under the current study, we have selected twelve treatments comprising of various combinations of 4 levels of RDF, *viz.*, N0-0%, N1-75%, N2-100% and N3-125% RDF and three planting time, *viz.*, D1-15.10.2021, D2-30.10.2021 and D3-15.11.2021. All the treatments for the chosen species were evaluated with three replications under factorial randomized block design. According to the experimental results, various levels of RDF (recommended dose of fertilizer), planting times and their combinations significantly affected the growth, yield and quality of rat tail radish. Among all treatments with various fertilizer doses,125% RDF on 15.10.2021 has been found to impact most significantly on The experimental results showed that different levels of RDF, planting times and their combinations significantly affected the growth, yield and quality of rat tail radish. On applying treatments with different levels of RDF maximum number of leaves per plant at 45 and 60 days (42.89 and 54.98), number of flower clusters per plant at 45 and 60 days (10.41 and 16.97), minimum days taken for first anthesis (46.88 days), days taken to maturity (68.25 days), leaf area index (2.90), total soluble solids (6.62 oBrix) , total dry matter (9.75 %), protein content (2.74 %) and chlorophyll a, b and total content (7.53, 10.71 and 9.55 mg/g) were recorded with treatment N3 (125 % RDF). Among different planting time there was significant difference between treatments, maximum number of leaves per plant at 45 and 60 days (47.50 and 60.22), number of flower clusters per plant at 45 and 60 days (11.57 and 18.42), minimum days taken for first anthesis (47.16 days), days taken to maturity (67.57 days), leaf area index (3.52), total soluble solids (6.28 oBrix), total dry matter (9.64 %), protein content (2.80 %) and chlorophyll a, b and total content (7.13, 10.58 and 9.56 mg/g) were recorded with treatment D1 (15th Oct. sowing).

◆◆◆◆◆◆

Studies on the effect of different growing media seedling growth of rough lemon (*Citrus jambhiri* Lush.)

Shweta and R.P.S Dalal
Department of Horticulture Science, CCS Haryana Agricultural University,
Hisar-125004, Haryana, India

ABSTRACT

A field experiment comprising of ten treatment combinations with ten different growing media was conducted at Research Farm of the Department of Fruit Science, CCS Haryana Agricultural University, Hisar during the year2021-2022 in screen house.The experiment was laid out in completely randomized design with three replications.The facts and figures noted in the experiment in respect of germination and seedling growth of rootstock rough lemon were statistically analyzed. Considerable amount of variation was noticed for different characters under different growth media. There are ten different growing media: T_1:garden soil; T_2:soil:sand(1:1); T_3: soil:sand:leafmold(1:1:1); T_4: soil:cocopeat(1:1); T_5: sand:cocopeat(1:1); T_6: soil:sand:cocopeat(1:1:1); T_7: soil:FYM(1:1); T_8: sand:FYM(1:1); T_9: soil:sand:FYM(1:1:1); T_{10}: soil:sand:FYM:cocopeat (1:1:1:1). The minimum number of days (23.00) taken for first seed germination was recorded in the treatments T_5 which was statistically at par with T_4 (23.67) and T_6 (23.67). The minimum days (26.78) taken for fifty percent seed germination was recorded in the treatment T_6, which was statistically at par with T_5 (27.11) and T_4 (27.44) and significant over rest of the treatment.The highest seedling height (7.64cm), was observed in the treatment T_{10}, which was statistically at par with T_9 (7.28cm) and significant over T_5, T_8, T_4, T_7, T_1, T_6& T_3.The results of study revealed that when cocopeat is supplemented in media (T_4, T_5&T_6) there was early germination. The most of the shoot & root growth parametersimproved with the media sand:FYM, soil:FYM, sand:soil:FYM, sand:soil:FYM:cocopeat in equal proportion. Whereas, sand:soil showed very poor results in all growth aspects.

◆◆◆◆◆◆

Standardization of propagation techniques of some selected native ornamental shrubs

Yogendra Singh Adhikari[1] , Dr Priyanka Thakur[1] , Dr Sita Ram Dhiman[2] , Dr Santan Barthwal [3] , Ali Haidar Shah, Sudhanshu Verma and Manish Kumar
[1] Regional Horticultural Research and Training Station, DhaulakuanSirmour (HP)
[2]Department of Floriculture and Landscape Architecture
Dr Yaswant Singh Parmar University of Horticulture and Forestry Nauni, Solan (HP)
[3] Forest Research Institute, Dehradun UK

ABSTRACT

The present investigation was conducted at Regional Horticultural Research and Training Station, Dhaulakuan of Dr YS Parmar University of Horticulture and Forestry during 2019-2021 for “Standardization of propagation techniques of some selected native ornamental shrubs”. Propagules (hardwood, semi-hardwood, terminal softwood and leaf cuttings) of four native ornamental shrubs (Clerodendron wallichii, Gendarussa vulgaris, Phlogacanthus pubinervius and Mussaenda frondosa) were selected during the experiment. Cuttings were obtained from healthy and disease free mother plants, 10-15 cm long and having 3-4 node stage. The cuttings were treated with Bavistin @2g/L for 30 minutes and thereafter with NAA solution 500 ppm for 10 minutes before planting in sand beds. It was found that terminal soft-wood cuttings were successful in Gendarussa vulgaris and Phlogacanthus pubinervius with survival percentage of 84% & 76% respectively. Whereas,

hardwood and semi-hardwood cuttings were successful in all four selected native ornamental species (Gendarussa vulgaris, Clerodendron wallichii, Phlogacanthus pubinervius and Mussaenda frondosa), with survival percentage of 67 to 78 %. Propagation through leaf cuttings were successful in Gendarussa vulgaris i.e 62% only. Amongb the rooting parameters minimum days taken to root initiation (11.08 days) was recorded in terminal soft-wood cutting in Gendarussa vulgaris and maximum (22.02 days) in hardwood cuttings in Mussaenda frondosa. However, longest root length (8.06 cm) was recorded in Mussaenda frondosa and shortest (3.04 cm) was recorded in Phlogacanthus pubinervius. It is concluded from the experiment that semi-hardwood cuttings were found to be best for all the four selected native ornamental species.

◆◆◆◆◆◆

Effect of planting dates on growth, flowering and bulb production of *Narcissus tazetta* cv. 'paperwhite'

Ranjit Singh[1], Dixit Chaudhary[2] and Rakesh Kumar[3]
Department of Floriculture & Landscaping, Punjab Agricultural University,
Ludhiana (Punjab) 141004

ABSTRACT

A field experiment was conducted during winter season of 2020-21 at the Research Farm of Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana to investigatethe effect of different planting dates ongrowth, flowering and bulb production of *Narcissus tazett*a cv. 'Paperwhite'. The bulbs were planted at five different planting dates *viz.*, 15thSeptember (T_1), 15thOctober (T_2), 15th November (T_3), 15thDecember (T_4) and 15th January (T_5) laid out in Randomized block design with five replications. Maximum plant height (40.14 cm), highest number of sprouts per plant (33.00) and maximum width of leaves (12.19 mm) were recorded in T_1. However, maximum flower size (33.56 mm) was recorded in T_3. The maximum number of flowers (7.18) were recorded in T_1 and minimum number of flowers (4.16)were recorded in T_5. Among various bulb production parameters, maximum number of bulbs (9.30), size of bulb (43.79 mm) and weight of bulb (66.09 gm)was recorded in T_1*i.e.*, planting of bulbs on 15th September while the minimum value of the same parameters was recorded in T_5*i.e.,* 15th January planting.

The results of the study determined that the most suitable date for planting of *Narcissus tazett*a cv. 'Paperwhite' is September 15th (T_1) under sub-tropical conditions of Punjab.

Keywords: Narcissus, bulbs, planting dates, growth, flowering

◆◆◆◆◆◆

Effect of Spacing on Yield and Physio-Chemical Characteristics of Different Cultivars of Apple Under Mid Hill Conditions of Uttarakhand

Arun kishor, Raj Narayan, Sovan Debnath, Yogesh Kumar and Om Chand Sharma
ICAR-Central Institute of Temperate Horticulture Regional Station, Mukteshwar-263138, District Nainital (Uttarakhand), India
ICAR-Agricultural Technology Application Research Institute, Jodhpur
ICAR-Central Agroforestry Research Institute, Jhansi
ICAR-Central Institute of Temperate Horticulture, Srinagar

ABSTRACT

An experiment was carried out at ICAR-CITH RS, Mukteshwar to find out the effect of different

planting densities *i.e.*1.5×1.5 m, 1.5×2.5 m, 2.5×2.5 m and 6×6 m on yield and physico-chemical characteristics of three apple cultivars Starkrimson, Golden Delicious and Mollies Delicious. Observation revealed that highest mean number of fruits per tree, yield per tree, fruit weight, fruit volume, fruit length, fruit diameter maximum total sugar, reducing sugar and carotene content were recorded at 6×6 m spacing. While highest mean yield per hectare, fruit firmness and total anti-oxidant activity were recorded at 2.5×2.5 m spacing and lowest mean yield per hectare was registered at 6×6 m spacing. Cultivar Starkrimson exhibited highest fruits per tree, yield per tree, yield per hectare, fruit firmness, TSS and ascorbic acid content. While maximum fruit weight, fruit volume, fruit length and diameter and total anti-oxidant activity were registered in cv. Mollies Delicious and maximum total sugar and reducing sugar were found highest in cv. Golden Delicious. Conclusively, Starkrimson cultivar was found superior in term of yield and physiochemical characteristic as compared to other cultivar and 2.5×2.5 m spacing was found best in terms of highest yield per unit area and better quality fruits as compared to other spacing.

Keywords: Spacing, Yield, Quality, Apple Cultivars, Uttarakhand

◆◆◆◆◆◆

Nursery Management for Raising Off-Season Onion Seedling

Ramesh Chand Meena Deepa H. Dwivedi, SutanuMaji, Razauddin and Mayaram
Department of Horticulture, Babasaheb Bhimrao Ambedkar University
Lucknow 226025 (UP)

ABSTRACT

(*Allium cepa* L.) onion is one of the most important bulb vegetable crop.The area under direct seeding through sets is less (10-15%) compared to transplanting (85-90%). In onion production nursery management is the most important practice to produce healthy seedlings. Onion seedling is raised in the nursery beds of 1-1.2x3m having 10-15cm height. Number of beds will depend upon the area to be covered. In general,50-55 beds with atleast 30cm gaps individual beds are required for raising seedling for one hectare andnursery soil is mixed with well rotten FYM and phorate granules to kill any soil born insects. Thiram or captan or carbendazin @ 4-5g/ m^2 is also applied for eliminating soil borne diseases.Formalin solution is used to sterilise the soil,It is prepared by adding 2.5 ml commercial grade formaldehyde per litre of water and the soil is drenched @ 45 litre of solution per m^2 to saturate the top soil surface up to a depth of 15–20 cm. The drenched area is covered with a polythene sheet of 200 gauge so that the fumes of formalin penetrate into the soil to kill the pathogens. The polythene cover is removed after 48 hours and soil is raked so that the fumes of formaldehyde gas escape from it. The bed is kept open for 7–10 days prior to seed sowing. It must be ensured that there are no fumes of formaldehyde gas prior to seed sowing.Such treated soil is free from all types of soil born insects-diseases. 10-20g SSP is also mixed with the soil. Seed rate is 10-12 kg/ha. onion seeds can be treated by captan/ thiram/ carbendizam @ 3gm/Kg seeds before sowing. Line sowing of seeds with spacing of 3-5cm is done. Seed sowing time Usually in kharif season nursery is sown during May-June when temperature is high and humidity is low. It is very difficult to raise the seedlings due to scorching sunlight since the mortality of seedlings will be high. The seeds are covered with any organic mulches, *i.e.* paddy straw, sugarcane trash powdered farmyard manure or compost after sowing to helps in maintaining soil moisture until seed germination during hot weather. After seed germination mulch material should be removed carefully to avoid any damage to emerging plumules. It should be removed during evening hours. Watering is done at alternate day.Seedlings are ready for transplanting in 35-40 days after sowing (DAS) for Kharif and 45-50 DAS for late Kharif. Seedlings may also raise in portrays for long distance transpiration.

◆◆◆◆◆◆

Session-3

Innovative Production Technology

INVITED LECTURE

I-1 Cashew Research in India

J. DinakaraAdiga and G.L. Veena
ICAR-Directorate of Cashew Research,
Puttur-574202, Karnataka

The cashew is an important horticultural crop introduced to India from Brazil by Portuguese travellers during 16th century. Cashew was utilised to mitigate soil erosion along the coastal areas in west coast. In India, cashew is cultivated on a wide range of soil types such as sandy to sandy loam, laterite soil, loam and red latosols. Due its drought hardiness, cashew is widely cultivated in degraded hillocks and slopy lands, where profitable production of other crops is not possible. The potential of cashew was first realized by India during early 1900s through export of kernels. Since beginning India dominated the cashew production and trade. In the current scenario there is a huge demand for cashew kernels both from domestic and international markets. India imports raw cashew nuts from other countries to meet the demand of processing industries. Of late, the import possibility from many of the other countries is dwindling. The research in cashew has made it possible to address the problem of low productivity. Many improved varieties *viz.,* Vengurla-4, Vengurla-7, Bhaskara, Nethra Ganga, Nethra, Jumbo-1, BPP10, BPP11, Balabhadra etc with bunch bearing habit, high kernel recovery, medium to big size nuts with export quality, precocity in bearing, high percentage of fruit set and / or better nut retentionwere released. High density planting with a spacing of 4m x 4m instead of 7.5m x 7.5m made it possible to accommodate morenumber of plants per hectare and increase in yield by 2.5 folds in the initial decade of plantation. The ultra-high-density planting technique with 1111 or 1600 plants per hectare with a spacing of 2.5 m x 2.5m with an ability to realize a potential yieldof 1.5 kg/plant from the second year of planting itself, by following the relevant agro -techniques was also standardised.Nutrient management, drip irrigation, intercropping, soil and water conservation practices and canopy management through top working or rejuvenation of old senile orchardsto increase the productivity are some of other technologies developed. The phenological studies were carried out in cashew for the first time at global level by using BBCH scale and seven important principal growth stages and 37 secondary stages were identified in cashew according to BBCH scale.Thebiotechnological interventions like draft genome sequence assembly, *de novo* assembly of shoot transcriptome, novel genic SSRs microsatellite markers paved a way for advanced research in cashew with the potential for reducing period of breeding cycle. The biological control of cashew stem and root borers using EPN has been standardized at ICAR-DCR, Puttur. The stem nesting bees were successfully conserved using simple cost-effective artificial nesting sites or trap nests designed at ICAR-DCR, Puttur for enhancing pollination in cashew. Protocols have been standardised for preparation of diversified value-added products from cashew apple and kernels and sprouted kernels,which are helpful to enhance the income of growers. Mechanization related to processing of cashew nut as well as cashew apple are standardized and commercialized at ICAR-DCR, Puttur. Mechanizationof harvesting, applications of drone and proper phytosanitary measurements to control major pests and diseases will contribute to realizing higher cashew productivity in India. Various mobile apps and software have been developed to facilitate the transfer of technology in cashew.

◆◆◆◆◆◆

I-2 Container gardening of fruits for meeting the nutritional needs of city dwellers

K.K. Srivastava and P.L. Saroj
ICAR- Central Institute for Subtropical Horticulture, Rehmankhera,
P.O. - Kakori, Lucknow 227 101

Problem of malnutrition among the urban and semi-urban areas pose the serious health issues. Growing fruits (perennial plants) in the container always been a challenging task, accordingly ICAR-CISH, Lucknow, initiated research with the financial support of UPCST, Govt of UP, Lucknow, on standardization of container size, growing media type and type of fruit plant and their varieties for successful containerized fruit culture. It can be helpful for fruits growing on the roof top. The results obtained from the experiment conducted revealed that canopy spread (60-75 cm) recorded in different containerized fruit plants with canopy height (70-125 cm).The fruit plants propagated through air layering always been ideal for container gardening purpose in view of branching pattern and bearing potential. In guava 0.14-0.52 m^3, pomegranate 0.15-0.51 m^3 and in citrus 0.21-0.42m^3 canopy volumes recorded after 3 years. Higher canopy growth recorded in larger containers; however, yield and quality attributes did not vary in different container sizes. In Citrus, 'Kagazilime' variety 'Sriganganagar Lime-1', Jaffa (Sweet orange) and Navel Orange (Sweet orange) and 'Kinnow' performed best in container. Maximum canopy spread (79.30 cm) was noted in Sriganganagar Lime-1 grown in 30x45 cm container which was on par to 45x60 cm, 45x45 cm container size. Pomegranate variety Mridula was found most suitable for growing in the container. In case of guava 'Shweta', 'Lalit' cultivars were found most suitable for container farming. Maximum canopy volume recorded in 'Lalit' variety grown in 45x60 cm container size with average canopy spread 64.48 cm. Growing substrate or media (M1) which comprise garden soil, sand, FYM and vermicompost, neem cake, cocopeat, bone meal mixed in definite proportion has been found light in weight and are suitable for most of the fruited plants. Phenological parameters showed that different fruits grown in container have 4-7 days' advance in flowering and fruit maturity than field condition. In guava, 4-5 kg fruits, pomegranate 2-3 kg and in citrus group fruit 3-4 kg fruits per containerized plants were harvested in 3rd years. Water requirements vary according to season, containers size and type of fruit plants. Maximum ET and water requirement was recorded in guava, followed by pomegranate and citrus. During summer approximately 1.80-3.50liter water/ container/day needed in guava while during winter 0.30-0.60 Liter /container/day water required in guava, citrus and pomegranate. The B: C ratio for production of fruited containerized plants is 4:1. The containerized fruited plants along with media are in great demand and are being sold costly(600-800/potted plants)

◆◆◆◆◆◆

I-3 Wetlands: A new dimension in Horticulture Production

Deepa H. Dwivedi
Department of Horticulture, School for Agriculture Science and Technology, Babasaheb Bhimrao Ambedkar University, Lucknow-226 025

A large number of edible plant species are found growing naturally in wetland sites since ancient times and many of these form a part of the traditional diet of societies inhabiting adjoining areas. Transitional lands between terrestrial and aquatic ecosystems with a water table usually at or near the surface, or the lands covered by shallow water are termed as wetlands. These are one of the most productive ecosystems since sunlight can penetrate the surface of the typically shallow waterbodies to facilitate subterranean photosynthesis. Thus, they have the capacity to support large populations in terms of food, fiber and raw materials besides nourishing a large biodiversity. Marginal wastelandsalong irrigation canals, floodplains of rivers, submerged areas, marshes, tidal plains, natural lakes, barrages, etc which are not being utilised for agrarian activities since the substrate is predominantly undrained hydric soil are termed as wetlands. About 4.7% of the total geographical area in India accounts for wetlands and covers about 15.3 million Ha area. Horticultural crops form an important component of the wetland flora which can be consumed by humans and thus, need to be explored.

With the increasing pressure of urbanisation encroaching upon arable lands, wetland sites offer a potential for cultivation of alternative plant species of commercial importance for food, nutrition, medicine as well as ornamentals. Commonly Wild Rice*(Zizania sp. aquatica),* Rice *(Oryza glaberrima; Oryza sativa),* Watercress *(Nasturtium microphyllum)* , Water Pepper (*Persicaria hydropiper),* Water Spinach (*Ipomoea aquatica),* Wasabi (*Wasabia japonica),* Water Chestnut (*Trapanatan*var *bispinosa)*, Chinese waterchestnut (*Eleocharis dulcis,),* Makhana (*Euryale ferox*)*,* Lotus (*Nelumbo nucifera* Gaertn), Cocklebur (*Xanthium strumarium* L), Wild capegooseberry (*Physalis minima*), Water Lily (*Nymphaea alba* L) etc are among the many acquatic species which are consumed as part of the diet in certain societies. Since these cerops are growing in their wild forms they are rich in minerals and other bioactive molecules and possess high antioxidant activities imparting immune-protective properties. Despite this acquatic plants are still ignored and their potential is underexploited. It is only in the last decade that water chestnut and fox nut/makhana have gained some prominence but even these are in their infancy. A large germplasm of water-chestnut (*Trapanatans*var*bispinosa)* has been documented in the northern plains of Uttar Pradesh. Over a period of time, with increasing market farmers have limited cultivation to just few of the superior varieties which have larger sized fruits and better kernel quality. Application of chemical fertilizers as well as other agri-chemicals has also increased with the growing awareness about the potential of this crop. The fruit of water chestnut is sold in the local market as fresh or boiled fruit and is available from December/ January. It is processed into flour after drying the fruit. It has immense potential for phytoremediation and contributes in improving soil and water health.

Thus, wetlands and wetland flora contributes in the sustainance of livelihood of humans and numerous services from wetlands and can play a significant role in overcoming the problem of food security. In the present scenario marginalized water bodies lying unutilized could provide a source of alternate horticulture production systems which could add to socio-economic development of the society. This would be milestone for sustainable horticulture production systems.

◆◆◆◆◆◆

I-4 Impact of Customized Balance Nutrition on Productivity, Quality, Soil Health & Climatic Resilience in Horticultural Crops

Murlee Yadav, Vineet Singh, Naresh Deshmukh and Mahesh Girdhar
Smartchem Technologies Limited, Sai Hira Building, Mundhwa Road, Pune - 411 036

Balanced crop nutrition ensures application of fertilizerson 4R principles *i.e.,***right ratio, right dose,rightmethod**,**right time,** which in turn results in sustenance of soil fertility (physical, chemical and biological) and increase in crop productivity. It also enhances tolerance of crops againstabioticandbioticstresses (Kumari *et al*,2022).

However, as percurrent scenario, farmers are using nutrient ratios with huge variability across country viz.3.5:1.8:1in Maharashtra to61.7:19.2: 1in Punjab against 4:2:1 as Ideal. The nutrient response ratio is going down *i.e.* from 13.4 to 3.7kg grain/kg ofNPK due to imbalanced&indiscriminate use of fertilizers, lesser use of organics and use of low efficiency fertilizers resulting inlow nutrient use efficiency and therebylower productivity &poor quality of produce.

Horticultural crops vary a great deal in their nutrient removal patterns depending upon respective targeted yields. Quantum of K removal was observed to be 3-4 times higher in fruit crops than N and P compared to annual vegetable crops. Considering the nutrient removal rate projections in the year of 2016-17, the fertilizer requirement for fruits and vegetable was estimated to be 7.56 million tonnes (Malhotra and Srivastava 2015). For most horticultural crops, due to increased fertilizer prices, growers are concerned about how to improve fertilizer use efficiency ensuring maximum yield and quality improvements. Adoption of improved technologies at faster pace is one of the solutionseg. use of fertigation in fruit crops is reported to save 30-50% of fertilizer doses as well as irrigation (Shirgure and Srivastava 2014, Shirgure*et al*. 2003a).

Balanced nutrient management as per the crops and their stages plays an important role in improving the productivity, quality,and significant saving in nutrient losses. Horticultural crops like Grapes, Tomato, Banana, Pomegranate, Melons, Citrus and other horticultural crops are highly nutrient responsiveparticularly through fertigation. However, except in few states and in few crops, nutrients are applied through bulk fertilizers via soil applications. This is a big bottle neck for productivity and quality enhancement of our horticultural crops as these crops do not get nutrients as per their stage specific requirement on real time basis.

SMARTCHEM TECHNOLOGIES LTD (STL), a 100% subsidiary of Deepak Fertilizers & Petrochemicals Corporation Ltd., Pune has been working on the above mentionedproblem for the last 4 years. As per STL's experience, Nutrient Use Efficiency (NUE) in horticultural crops can be further improved through right customization of nutrients as per respective crop and their stages in comparison to nutrients applied on individual basis through fertigation. This also brings ease of application and better decision making for the growers.

STL conducted multilocation trials (Maharashtra, Karnataka, Gujarat etc) between 2018-2022for the development of Crop &Stage Specific Customized Water Soluble Fertigation Grades(Solutek) along with complete package using 20 : 80 principle of nutrient ratio (soil vs. fertigation) for Grapes, Tomato Pomegranate, Banana, Melons, Citrus, Potato, Sugarcane, Chilli and other fertigated crops.

These grades / complete package solution were launched under the brand name "SOLUTEK" in 2020-21 for Grapes, Tomato, Pomegranate. Under these Solutek fertigation solutions, 80% nutrients go through SolutekGradesand 20 % nutrients go through soil applied Enhanced Efficiency Fertilizers (EEF)powered by Nutrient Unlock Technology which are mentioned as below:

Customized Water Soluble Grades for Fertigation:

1. **SolutekGrapes** : (**Grade-1**: 15:28:06+TE, **Grade-2**: 6:34:17+TE &**Grade-3 :**6:00:37:16+TE),

2. **SolutekTomato** : (**Grade-1**:17:14:09+TE, **Grade-2**:13:12:19+TE &**Grade-3**: 09:08:28+TE)
3. **Solutek Pomegranate**: (**Grade-1**:08:44:07+TE,**Grade-2**:10:22:20+TE &**Grade-3**: 5:10:35+TE)

Common basal application : Croptek 9:24:24and Bensulf SUPERFAST (90% Sulphur)

These Solutek grades & solutions are thoroughly tested, validated and evaluated against **RDF** through straight fertilizers for 2-3 years at ICAR Institute for Grapes (NRCG, Pune), tomato (IIHR, Bangalore) and Pomegranate (NRC, Pomegranate, Solapur), respectively.

Solutek solutions not only increased the productivity & quality of fruits in different crops, but also improved the nutrient use efficiency significantly by saving significant quantities of nitrogen, phosphorus and potash versus existing RDF and common farmer practices. In addition to this, Solutek grades also helped in sustainingbetter post-harvest soil & petiole nutrient status in comparison to RDF.

- In Grapes,as per two year's study (2020-21 & 2021-22) at NRC Grapes; there is average 17 % increase in yield , two days increase in shelf-life as well as 62% saving in nitrogen dose (99kg/Ha against the RDF-240 kg/Ha in April+ October pruning). These benefits translated into additional income of Rs. 1.56 Lac/Ha over RDF through straight water soluble fertilizers. In STL's inhouse trials, the average increase in yield was recorded to be 27% over farmer practice.
- Solutek Studies of Tomato conducted at IIHR, Bangalore recorded 23% improvement in yield with 11% increase in 'Lycopene' content alongwith saving of 62 % nitrogen versus IIHR RDF. STL's inhouse trials conducted between 2019 to 2022 recorded average yield increase of 40 % over farmer practice.
- The STL's inhouse Solutek Pomegranate multilocation trials recorded 39% improvement in yield, 26% in fruitweight, 26% in aril weight and 4 % in TSS along with color improvement over Farmer practices.

Overall, 'Solutek Solutions' in horticultural crops are not only increasing farmer's income by enhancing their crop productivity, quality and saving in input cost, but they are also making their farm operation very easy and convenient because farmers are not required to make difficult decisions every now and then, they don't have to put many fertilizers from many different sources. Over and above these 'Solutek Solution' are improving the NUE significantly hence, saving significant quantity of nitrogen *i.e.* 62-67% along with minimum percentage of AmideNitrogen. India is committed to reduce its GHG emissionsby 30% under the nationally commitment by the year 2030 (MoEFCC,2019). Seventy seven percent (77%) of the total N_2Oemissionisdueto theapplicationofnitrogenousfertilizers(MoEFCC,2019). Type of Nitrogenous fertilizers and water management impact on climate change because of emission of GHG.Therefore, development of climate smart technologies for mitigation of GHG emissions, is the need of the hour.

◆◆◆◆◆◆

I-5 Using Hi-Tech Horticulture As Modern Intervention for Mitigating Impact of Changing Climate on Productivity of Temperate Fruits– A Case Study of Apple in Indian Himalayas

K K Jindal

UGC Emeritus Scientist & Former Director Research Dr YS Parmar Univ of Horticulture & Technology, Solan Himachal Pradesh

The phenomenon of global warming has now become fairly well entrenched. The hither to set climatic pattern has become erratic affecting productivity of agricultural crops. Temperate fruits trees have been most affected group. In their annual growth cycle these crops have a specific requirement of chilling during the winter months. This requirement of late not being fully satisfied in most of the areas that were only marginally suitable for the temperate fruit cultivation.

The productivity of temperate fruits especially apple in Himalayas is declining at a faster rate. Average yield of apple in India has been estimated at about 6 tonnes per hectare which is far below the level of 30 tonnes per hectare in most of advanced countries. The productivity has also not kept pace with the expansion in area under temperate fruits due to various biotic and abiotic problems faced by the farmers in the Himalayas have been discussed in details.

The low productivity of apple has become a serious concern for the farmers, research workers and development agencies at national and state level for the last two decades. Several factors have been visualized which attributed to the declining trend in productivity like expansion of apple cultivation to marginal areas, monoculture of Delicious varieties, declining standards of orchard management and the fluctuating abnormal climatic conditions.

The shift in climate pattern has made it clearly imperative to constantly monitor winter chilling being received in the various agro-climatic regions. Fruit growers can thus be attracted timely about the need to spray dormancy breaking chemicals. If the quantum of chilling is far less year after year, there may be need to consider a diversification towards low chill fruit crop or cultivar that can be grown in the region. The chill unit estimation models are available, but they are not applicable universally. Studies indicate need for location specific chill unit models.

The measures to adapt to climate changes is critical for sustainable production. Increased temperature and weather vagaries will have more effect on reproductive biology. In the present studies, strategies have been identified and addressed to mitigate the adverse efforts of weather and development of climate resilient plant species, like low chill crops, improved cultural practices and efficient use of water resources. Concerted and integrated technological approach can convert challenges into opportunity.

◆◆◆◆◆◆

I-6 Single Hedge Row Planting System: CongregatingLitchi Plant Growth Nature and Potential for Increased Yield and Income

Vishal Nath, Krishna Prakash and Swapnil Pandey
ICAR-Indian Agricultural Research Institute Jharkhand, Gauria Karma, Hazaribagh
[2]Fruit Research Station, BallowalSaukhri, Punjab

Doubling farmer's income has a matter of concern for technologists and agriculturists. Over the past 50 years, planting densities infruit crops have been increased due to development of improved crop management techniques and need for higher productivity per unit input used.The use of dwarfing rootstockshave been the key to the dramatic changes in tree size, spacing, early crop and better yields in a number of fruit crops.Improvements towards development of architecturally designed trees, improved training-pruning strategies and physiological studies of flowering-fruiting, light interception and distribution studies have significantly contributed to the change in tree density. In many fruit crops including litchi, due to non-availability of dwarfing rootstocks, their planting densities have not increased much resulting in low yields per unit area. Economic considerations have also halted the march toward higher and higher tree densities in some of the fruit crops.To break the stagnant productivity level of litchi in the era of limiting natural resources, adoption of high-density planting, canopy management and precision production tools are imperative.

◆◆◆◆◆◆

I-7 Recent Innovation in Mechanization for the Field of Horticulture

R.N. Pateriya
Dept. of Farm Machinery and Power Engineering
Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

Rotary tillage implements are now being projected as important rotary tools that result in production of fine tilth soil however the rotavator being in line with the tractor at the back cannot be used in orchards due to the hindrance posed by narrow space between the trees. Hence there is need of some tillage tool in offset to the central line of tractor so that it can reach to the area under the tree with the tractor placed in between the rows therefore, an offset rotavator was mostly imported to our country and evaluated to find their suitability under Indian conditions. The study was undertaken to evaluate the performance evaluation of the modified offset rotavator in orchard fields of Horticulture Research Center (HRC), Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, District U.S. Nagar (Uttarakhand), India and influence of λ – ratio, depth of cut at different fields of mango with different parameters such as field performance index, residue incorporation, area uncovered near the girth by a modified Offset Rotavator were studied. The rotavator (derived from rotary cultivator) is a tractor mounted active tillage implement comprising of blades mounted on flanges with affixed to a shaft that is driven by the tractor (PTO). Rotavator performs (one plowing and two harrowing) operation in single pass therefore, rotavator is accepted by the majority of farmers of our country, as a time-saving equipment under low land and up land conditions. It saved 30–35% of time and 20–25% in the cost of operation as compared by cultivator. It gave higher quality of work (25–30%) than the cultivator. Soil pulverization with rotavator was found to be better than traditional implements. It could be used effectively for intercultural operation in horticultural crops and for puddling in paddy cultivation.

◆◆◆◆◆◆

I-8 Development of microbes assisted fruit production system

A.K. Srivastava
ICAR-Indian Agricultural Research Institute, Gogamukh 787034, Assam

Soil is an environmental medium, playing crucial role in global C cycle (soil C pool as the second biggest carbon pool), mainly through changes in soil fertility. Soil is, therefore, viewed as a part of climate change problem, but it can be a better part of the solution. Besides elevated CO_2, changes in rainfall pattern and increase in average temperatures brought about by climate change with inflict over-riding effects on soil fertility changes vis-à-vis crop performance. Synergism between the effect of CO_2 and nutrients is stronger under no water limiting conditions. However, such short term changes in fertility dynamics do not portray the long term effect either on soil fertility or on production responses, unless supported by defined analogues of soil and climate. Different fruit crops sequestering 24 – 109 tons CO_2/ ha display their ability to moderate climate change-related issues on one hand and elevate the crop fertilising ability for improved plant nutrition, besides water-use-efficiency, on the other hand. Therefore, response of different fruit crops under elevated CO_2 condition is a function of nutrition status of the crop. Our studies demonstrated the maximum nutrient demand at fruit set stage (March-April for winter crop and August-September for summer crop under sub-humid tropical climate of central India). As per crop ontogeny, unless there is some mitigation strategy available. Of late, certain citrus growing pockets of central India irrespective of orchard nutrient status (possibility of disturbed K metabolism), exhibited abnormal fruit growth (greater growth along equatorial than radial axis), the exact cause and effect relation still remains to be established. A large difference in fertility of two sites (Ustorthent versus Haplustert) indicated by a much greater increase in yield response at the low fertility soil site (Ustorthent) than the high fertility soil site (Haplustert), when added nutrient augmented to the same optimal fertility. Bu,t with climate change, such responses will be caused by nutrient limitation that can develop in poor fertility sites having shallow rooting depth. The recommended dose of fertilizers (RDF) worked out in 1990 – 91 is no longer effective now (2010 - 2015), due to rise in average temperature by 1.5 – 2.0 ^{0} c during fruit set stage, necessitated addition of 25% more K to moderate such temperature stress in citrus. How does RDF behave in the long run in different crops?.

Better responsiveness of soil microbial biomass over chemically available nutrient pool to nutrient input, has led to renewed interest in measuring the quantum of nutrients held microbially. Long term data accrued on response of organic manuring versus inorganic fertilizers demonstrated that important soil quality indices like soil microbial diversity, soil microbial biomass nutrient (C_{mic}, P_{mic} and N_{mic}) and organic carbon partitioning displayed significant changes, but without much difference in quantum of fruit yield.The efficacy of microbial consortium (*Paneibacillus alvei (MF113275), Bacillus pseudomycoides (MF113272), Micrococcus yunnanesis (MF113274), Acinetobacter radioresistens (MF113273) and Aspergillus flavus (MF113270)*) was tested successfully in both nurseries as well as well grown-up orchards as best management practice to cut down the rate of CO_2 release compared to inorganic fertilizers for storing larger proportion of plant-derived C in long term pools in the soil and reducing the exposure of such stored C to lesser decomposition, in addition to better post-harvest shelf life of citrus and other fruits. The other approaches involving multiple microbial inoculation alongwith enrichment of organic manures through inorganic fertilizers known as substrate have further been highlighted to provide an understanding of mechanism involved in C stabilization in soils for regulating soil C sequestration and associated nutrient dynamics under INM-based production system in perennial fruit crops. Crop-based adaptation strategies are needed keeping in view the nature of crop, its sensitivity level and the agro-pedological setup. Simultaneously, keeping an eye on carbon sink potential of different fruit crops vis-à-vis annual field crops will further aid in developing a blue print for redressal of climate change related issues for microbes assisted fruit crop production.

◆◆◆◆◆◆

I-9 Transforming India Through Horticultural Technologies of IARI

S. S. Sindhu
Division of Floriculture & Landscaping, ICAR-IARI, New Delhi

Horticulture is the second most after the cereal crops important sector for livelihood and nutrition security. IARI have made significant achievements by developing a large number of varieties of fruits, vegetable & flowers along with several technologies. The horticulture is considered the most lucrative business & surpasses the production of cereal crops and it is easiest way for doubling. The farmer income can be doubled in a shorter period

Over a period of several decades, the IARI is working in the field of research and developed several horticultural technologies which could easily be adopted by end users. These sector has also export the production like fruits especially mango Alphanso, dried grape and nuts among fruits. Govt. of India has launched centre sector scheme NHM (now known as MIDH) to promote and develop the horticulture in the country to promote domestic and export markets. The farmers are being given financial support in cash and kinds to promote protected cultivation, seed material, fresh producer of vegetables, fruits, flowers, nuts, honey bee and allied activities through centre sector scheme under the umbrella of Ministry of Agriculture and farmer Welfare, Govt. of India.

In 2022, India emerged as a major **producer of horticultural crops (342.33 million tonnes surpassing food grain production of 316.06 million tonnes)** third year a row and is placed second after China in both fruit and vegetable production. Also horticulture in India with its higher annual growth rate has become a major contributor to growth of Indian agriculture. It is, therefore, important that horticultural crop production is given more emphasis so that it could sustain the desired growth rate in agriculture sector and provide job opportunities to the emerging youth force. Presently, the horticulture sector contributes around **34% of the GDP** and 38% of the total exports of agricultural commodities from about 13.08% of area, During the last three Five Year Plan periods, focused attention was given to horticultural research and development, which placed India as the second largest producer of fruits and vegetables; largest producer and consumer of cashew nut, tea, spices; third largest producer of coconut; fourth largest producer and consumer of rubber and sixth largest producer of coffee in the world. About 10 % of the total budget of Indian Council of Agricultural Research (ICAR) and 30% of the total budget of the Department of Agriculture & Cooperation (DAC) is now being earmarked for the Horticulture Sector. Several new programmes are in operation and significant developments in production, value-addition and exports have taken place. Budgetary and institutional allocations have also increased considerably.

- The Government has flagged several initiatives with the objective of ***doubling the income of Farmers by 2022***in a Mission Mode. The different developmental facets to achieve this goal ranges from different programmes, namely, 'more crop per drop' and 'soil health card' for better water and nutrient management, 'Crop insurance', 'e-Nam' and e-mandi, 'custom hiring of farm equipment' to promote mechanization; Organic farming, massive 'skill development programme for entrepreneurship development, Promoting FDI in 'post-harvest sector and value chain development' etc. In National agriculture scenario, Horticulture sector has the silver lining it has ample scope to meet nutritional security even in adverse agro-climatic conditions. Horticulture production surpassed food grain production in India for first time during 2013-14. This trend continued during 2015-16 (283.36 MT) too. The share of horticulture output in agriculture increased to more than 33% with highest annual growth of 9.5% in fruit production (2013-14) and now horticultural production is 341 million tons (2021-22) and significant increase in vegetable production and floriculture crops.
- India is second largest producer of fruits & vegetables; largest producer of banana & mango and second largest producer of potato, tomato *etc*.Indian Horticulture has been gradually penetrating in the International

market with significant increase in exports of fresh fruits, vegetables, flowers, spices, cashew etc. There has been significant increase in export of various horticulture commodities, *i.e.* 536.42 times in quantity and 2007.80 times in value (1991-92 to 2012-13).

- A lot of achievements has been made by ICAR is research and development towards popularization of superior clones, varieties and hybrids in various horticultural crops. A total of 1,596 improved varieties have been developed with characteristics like higher productivity, good quality, pest and disease resistance and tolerance to abiotic & biotic stresses. In mango, hybrids like 'Mallika' are doing well in southern states (Karnataka, Andhra Pradesh, West Bengal, *etc*. while 'Amrapali' has extended from Tripura to Gujarat. Pesticide-free fresh grapes are now entering EU and Middle East and South East Asian markets. Best quality walnuts, cashew, organic spices, saffron and herbs; fresh pomegranate, banana are the reality. Owing to the efforts of the farmers to diversify, banana, guava, papaya, pineapple sapota, apple *etc*. are now even available in the rural markets and small towns.

The IARI, a premier Institute in the country have developed several varieties and technologies in the field of horticulture and transformed the Indian economy through export and enhancement of domestic market providing not only the nutritional security even open the doors for several employment opportunities.

The school of Horticulture at IARI have evolved more than 100 varieties and developed several technologies for production of quality produce of fruits, vegetables and flowers during the last decade as described hereunder.

1. **Vegetables:**Eight varieties of vegetable crops, two hybrids have been released by CVRC,some of the outstanding varieties and hybrids are Brinjal cv. Pusa Vaibhav and cucumber Pusa Gyonecious Hybrid-18. Around 65 varieties have been released by Delhi State Varieties Release Committee. Okra (A-4, A-5 and Pusa bhindi-5), Gynoecious parthenocarpic Cucumber for greenhouse cultivation, Tomato (Pusa Rakshit, Pusa Cherry and Pusa Parashanskrit for processing type), Melon (Pusa Sunheri), Onion (Pusa Sona) and several hybrids in cole group even beta rich carotene cauliflower.
2. **Fruits:**Eight varieties in fruit crops (04 Mango), (02 Grapes), (01 Sweet orange) and01 Acid Lime released by CVRC and 15 varietieshave been released by State Varieties Release Committee. Some of the outstanding varieties are Mango (02): (Pusa Deepshikha & Pusa Manohari), Grape (02) (Pusa Purple Seedless & Pusa Swarnika), Citrus (04): Pummelo (Pusa Arun), Sweet orange (Pusa Sharad), Acid lime (Pusa Udit) and Lemon (Pusa Sel. 1), Guava (Pusa Aarushi and Pusa Pratiksha) and Papaya (Pusa Preet).
3. **Flowers:**22flower varieties have been released by State Varieties Release Committee of different flower crops. Some of the promising varieties are: Pusa Shwet, Pusa Guldasta, Pusa Sundri, Pusa Lohit in chrysanthemum; Pusa Valentine, Pusa Shanti and pusa Rajat in Gladiolus, Pusa Mahak, Pusa Alpana, Pusa Barghava, Pusa Laxami in Roses and Pusa Bahar, Pusa Deep, Pusa Prav and Pusa Utsav in Marigold.

The varieties and technologies developed in horticultural crops at IARI have been scaledup in several states in the country and transformed India to the greater extent.

- Mango varieties developed by IARI particularly Amarpali covering large area in UP, Orissa and Jharkhand and in addition to that it has become very popular in NCR under kitchen garden cultivation. The other recent varieties rich in anthocynin with moderate sweetness (Pusa Pratibha, Pusa Arunima, Pusa Surya and Pusa Pitamber) are making dent in the export in Gulf countries, Japan and US market.
- Coloured juicy varieties like Pusa Navrag can be used for wine making apart from the others (Pusa Urvashi and Psa Aditi) used for table purpose. In case of Papya, Pusa Nanha and Pusa Delicious, gynocious type still ruling varieties in term of fruit quality. In citrus: Lemon (Pusa Kagzi Klan), Pusa Sel-1; Acid Lime (Pusa

Abhinav), Sweet Orange (Pusa Round). In case of Guava Pusa Arushi (Pink tppe) and Pusa Pratiksha (white type) and most ideal for high density orchard with high fruit quality for table purpose.

- A number of Hi-tech interventions including adoption of Tissue culture raised plants, high density planting, rejuvenation and replanting, canopy architecture, water and nutrient use efficiency including micro-irrigation & fertigation, protected cultivation, use of growth regulators, tissue and nutrient guide based applications, crop-specific micro-nutrient mixture, round the year vegetable production, hi-value floriculture production, organic production, primary and secondary processing, innovative marketing and export promotion have opened up new vistas in Modern Horticulture, which give several benefit to the farmers.
- Apart from the academic contribution of IARI to produce the best HRD, there is great opportunity to skill the youths for employment in high demand jobs & self employment. IARI Horticultural technologies can play important role in generating employments for rural youth in warehousing, cold chain, logistics & supply chain, commodity & financial markets, digital & agriculture technology, weather forecasting, farm mechanization, micro-irrigation, protected cultivation, medicinal & herbal, organic farming etc.
- The R&D efforts made in the last few decades have impacted horticulture in the country in many ways. There is now a large R & D network in the country with several institutions and with number of programmes. Now the time has come when we have to take Horticulture as an enterprise right from production site to consumer's table. The present day commercial Horticulture has to be competitive in almost every aspect of commodity chain and then only it could be remunerative to the growers, retailers, processors and exporters.
- During the last five years, Division of Vegetable science has developed 25 improved varieties and five F_1 hybrids of vegetables crops having higher and early yield, resistance to biotic and abiotic stresses, desirable quality and nutritional traits were developed and subsequently notified by Central Variety Release Committee for commercial cultivation. All this has made it possible to produce vegetables in wider areas of various agro-climatic conditions and there is a quantum jump in the productivity, production and quality of vegetables in the country.
- In cauliflower, Pusa Meghna and Pusa Kartik Sankar varieties made a dent in increasing yield and quality in warmer climates. It has now become possible to grow tomato for most part of the year with the development of variety like Pusa Sadabahar. Pusa Rohini and Pusa Hybrid-8 (F_1) of tomato have thick skinned fruits and longer shelf life which have helped in long distance transport.
- In brinjal, production has gone up due to adoption of our varieties, namely, Pusa Uttam, Pusa Shyamla and Pusa Kaushal. In bitter gourd, Pusa Aushadhi a predominantly gynoecious variety became very popular in Rajasthan, Gujarat, Haryana & Delhi states. In garden pea, Pusa Shree with *Fusarium* wilt tolerance and superiority over popular variety Arkel for earliness and yield was developed. In cucumber, Pusa Uday a indigenous type variety with light green in colour with whitish green stripes and soft skinned was developed which has became very popular to the farmers of Northern plains. In carrot, a very popular high yielding self core red coloured variety Pusa Rudhira with high consumer preference and delayed bolting and another variety having heat tolerant capacity Pusa Vrishti suitable for off-season was released for commercial cultivation. There has been an all round increase in demand of seeds of these vegetable varieties and F_1 hybrids in production areas.
- Breeder Seed of high yielding varieties and parents of hybrids are taken up on large scale and are being sold to NSC and other public/private institutions for further multiplication and distribution. Due to taking up of seed production and sale, based on popularity of hybrids in tomato, brinjal, cauliflower, bottle gourd, bitter gourd and pumpkin by NSC the sale price of hybrid seed dropped in the market considerably. Two gynoecious line of bitter gourd, namely, PVGy-201 and PDMGy-201 were licensed to private seed company. Breeder

seed of vegetable varieties and seed of parental line of hybrids was sold to 6 public sector Institutions including NSC and 40 private seed companies for further multiplication and supply to farmers.Two genetic stocks of Sponge gourd namely DSG-6 (IC-0588956, INGR 12013) resistant to *Tomato Leaf curl New Delhi Virus* and predominantly gynoecious bitter gourd PreGy-1(IC-059254,INGR 12014) were registered at NBPGR and are being utilized by state agricultural universities and ICAR institute for transferring these desirable traits for development of varieties.

- The Institute is offering several kinds of services to the farmers and in private sector by licensing the technologies for production of quality seed and planting material to upscale for the end users. IARI marigold and roses are known every nook and corner of the country. In-addition providing leadership role to ICAR Institutes, SAU's, KUKs and State Govt for capacity building and technology enhancement.

Despite of having all such outstanding varieties and technologies available, challenges are many *viz.* nutritional security, threat of climate change, need for new plant genotypes, production deficit and gluts, lack of infrastructure in commodity value-chain, retail chains and organized market systems, farmer producer companies and export promotion of produce.

◆◆◆◆◆◆

ORAL PRESENTATION

Novel research approaches in Adenium pot plant

Alka Singh, G D Patel, H P Shah and Vipul Parekh
ASPEE College of Horticulture
Navsari Agricultural University, Navsari-396450, Gujarat

ABSTRACT

Pot plant industry is gaining popularity with the recently increasing domestic as well as international trade of ornamental plants. *Adenium obesum*(Forssk.) Roem. &Schult, belonging, to the family Apocynaceaeis recently gaining high popularity as pot plant, although until recently it was being considered a relatively new flowering plant in the ornamental plant industry. It is a native from Africa and is now in cultivation in many tropical countries including India. Owing to its compact growth habit,beautiful flowering behaviour and sculptural caudex, good branching habit and tolerance to drought stress with newly developing varieties, its market demand is increasing.Adenium is not only an excellent pot plant but also a wonderful plant for rock gardens and roof top gardens. Though being a desert plant, adenium is well adapted to warm and humid conditions and survives in varied climate and thus seen as a potential nursery plant for export. Specific breeding approaches clubbed with special cultural practices and quality planting material can result into maintained compact profuse flowering pot plant that can fetch good income.

Research on different aspects like breeding, varietal evaluation, propagation techniques, soilless growing system in adenium as pot plant is being conducted at advance technology centre of soilless growing system for various crops, at Aspee College of Horticulture, Navsari Agricultural University, Navsari. As a result of breeding work through hybridization, two varieties *viz.*, Gujarat Adenium 1 bearing dark red coloured flowers having triple whorl of petals and Gujarat Adenium 2 bearing purplish red double whorl of petals have been developed and released at CVRC and further new varietal development work is in progress. Besides, graft technique for propagation of adenium has been standardized. Pinching and pruning technique for developing good plant canopy has also been standardized. Further, innovative approach of multi graft technique on a single plant to develop novelty has also been worked out. Adenium in pot plant industry has potential to exhibit high income generating horticulture business.

◆◆◆◆◆◆

Vegetable Grafting: Eco-friendly surgical approach towards fusarium wilt in cucurbits

Indu Arora, Kuldeep Kumar, Vikash Kumar, Vikram, Kalpana Yadav and Amit Kumar
[1]Deptt. of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004

ABSTRACT

Among the vegetables, Cucurbits are one of the important group of vegetable crops belonging to family Cucurbitaceae, which primarily consists of about 118 genera and 825 species. In India, number of major and minor cucurbits are cultivated, which share about 5.6% of the total vegetable production.One of the major problems in cultivation of most of the cucurbits like watermelon, muskmelon, bottlegourd etc is the decrease in fruit yield and quality due soil borne diseases, mainly *Fusarium oxysporum f. sp. Niveum*.In cucurbits, there are different ways to prevent the attack of soil pathogens to the plants *i.e.* crop rotation, genetic improvement and soil fumigation (Alan *et al*., 2007) but each of these practices has some inconveniences. The possibility of

breeding new cultivars with resistance to different diseases take long time and is a very expensive method. Soil fumigant, methyl bromide (MB) is now banned internationally or is used in limited amount as a result of environmental contamination and high toxicity to humans.Vegetable Grafting in cucurbits with resistant rootstocks *i.e.* Tarkakdi used as rootstock in Watermelon, offers one of the best ways to avoid soil borne diseases through surgical approach.Though it is labour intensive method but is now spreading and expanding rapidly over the world due to safe adaptation of it in production of organic as well as environmental friendly production, as it minimizes uptake of undesira

◆◆◆◆◆◆

Effect of growth hormones on callusing and morphogenesis in G. jamesonii

Bhawna Anand
University Department of Botany, L.N. Mithila University, Darbhanga.

ABSTRACT

Influence of nutrient medium hormonal composition on the induction of callusing was studied during standardization of an improved micropropagationprotocol in *Gerbera jamesonii*. Gerbera explants used for in vitro studies were shoot apices, leaf discs, floral buds, floral stalk, capitulum and seeds.Different hormones like IBA, 2, 4-D, NAA, BAP and Kn were used separately in different concentrations like 1.0, 1.5, 2.0, 2.5 and 3 mg/ L. It was found that 2.0mg/L - 2.5mg/L concentrations of auxins like IBA, NAA and 2,4D on Murashige and Skoog(MS) basal medium are most effective in inducing maximum percentage of callus. Kinetin showed little or no effect on callus induction. Friable type of callus was produced by IBA, friable and nodular type of callus by 2,4D and NAA while compact and nodular callus was produced by BAP. Different combination of hormones on the callus induction and growth was studied for leaf and bud explants. It was found that 3mg/L 2, 4-D and 1.0 mg/L BAP showed maximum percentage of callusing in both explants. Leaf explants showed best callus growth with 3.0mg/L 2,4D and 1.0 mg/L BAP while bud explants exhibited best callus growth in 2.5mg/L 2,4D and 1.0 mg/L BAP. 3.0 mg/L 2,4D and 1.0 mg/L BAP took minimum time for inducing callus which was found 12-14 days in case of leaf explant and 10-12 days in bud explant. As regards NAA, 2.5 mg/L and 3.0 mg/L of NAA with 1.0 mg/L BAP also exhibited best callus growth in minimum time for both explants. This protocol opens up prospects for using biotechnological approaches for gerbera improvement.

◆◆◆◆◆◆

Mepiquat Chloride to improve the yield and quality of mango

A.K. Singh, Sunita Kumari and J.S. Shivran
Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand

ABSTRACT

An experiment was conducted during the year 2019 and 2020 at Horticulture Research Centre, GBPUA&T, Pantnagarwith a view to study the efficacy of different concentrations of mepiquat chloride (5% AS)on yield and quality of mango cv. Langra.The experiment was laid out in a randomized block design with eight treatments and three replications. The different concentration of mepiquat chloridewas sprayed,1 month before the initiation and at the initiation of inflorescences. The results obtained from pooled data of two years indicated that themepiquatchloride 5% AS@ 62.50 g *a.i.* ha^{-1}or 12.50 ml $tree^{-1}$sprayed at 1 month before initiation of flowering (T_2) results in a higher number of inflorescences (20.97per m^2) and fruit set (14.28 per m^2). This treatment (T_2) has significantly improved the yield parameters *i.e.*number of fruits (460.17/tree), fruit weight

(282.46g) and fruit yield (12.87 t ha^{-1}). The total soluble solids (18.54°B), total sugar (14.53%), total carotenoids (1.81mg/100g fruit) and shelf-life (7.67 days) were also found higher with T_2 treatment. It was also observed that there was no phytotoxicity of mepiquatchloride on mango trees. Thus, the spray of mepiquat chloride (5% AS)is recommended @ 62.50 g a.i. ha^{-1} or 12.50 ml $tree^{-1}$ at 1 month before initiation of the inflorescence to increase the yield and quality of mango.

Keywords: Mango, Mepiquat Chloride, Quality, Yield, Shelf-life.

◆◆◆◆◆◆

Hort Technologies for Tripura

Biswajit Das, H. Lembisana Devi, Bapi Das, Pradip Sarkar, Vinay Singh, AsitChakraborti, Lopamudra Sahoo, Ashima S. Baidya, Rajib Deb, Mujammil Abedin and Prithvijit Das

ABSTRACT

ICAR Research Complex for NEH Region, Tripura Centre, Lembucherra- 799210, Tripura The north eastern state Tripura has diverged range of topography, communities, endemic flora and fauna. Topography comprises plain low land and hilly terrains with altitudinal range of 15-940 m amsl.The climate of Tripura is Tropical to sub-tropical in nature. Summer is hot (17.0-39.0^{0}C) and very much humid (75-80% RH), rainy season (June-September) experience maximum precipitation as monsoon rainfall, pre and post monsoon rain \ fall occurs during April-May and September-October with average annual rainfall around 2500 mm, respectively, autumn season is also hot as well as humid (October-November) and winter is mild (5.0-26.0 ^{0}C) with scattered rainfall (December- February). Tripura falls in agro-climatic zone1 Eastern Himalayan region. The soil types of Tripura can be classified under five major groups, red loam and sandy loam soil occupies43.07% the total area, reddish yellow brown sandy soils 33.06%, other three types are older alluvial soil (9.7%), younger alluvial soil 99.3%) & lateritic soil (5%). Distribution of 5 types of soil orders are inceptisols (80.6%), entisols (8.1%), ultisols (6.6%), alfisols (4.5%) and histosols (0.25). Soil is acidic (4.0-5.5 pH). Cropping Intensity is 191 % (All India – 142%), average size of holding is0.49 ha (All India – 1.15 ha) and small & marginal farmers are 96% (All India – 85%). Net sown area is about 2.56 lakh ha (24% of the total area) out of which 66.6 thousand ha is under fruit and 39.1 thousand ha is under vegetable farming. The agro-climatic condition of the state is very much suitable for cultivation of majority of the tropical and sub-tropical fruit crops, winter and summer vegetables as well as some specialized cut flowers.

◆◆◆◆◆◆

Spacing, training and pruning levels influence growth and yield of vertically trained watermelon [*Citrullus lanatus* (Thunb.) Matsum. & Nakai] under rain shelter

Naveda Murthy, S.K. Nisha, S. Sarada and Sheeja K. Raj
College of Agriculture, Vellayani, Kerala Agricultural University 695 522

ABSTRACT

Watermelon is an important cucurbitaceous crop grown in tropical and subtropical areas and has greater global consumption. Compared to traditional method of growing watermelon horizontally, more number of plants can be accommodated in rain shelter by training vertically. Plant density management is essential to obtain greater number of fruits of commercial standard.

An experiment was conducted at Department of Vegetable Science, College of Agriculture, Vellayani,

Kerala, to study the effects of spacing, training levels and pruning heights on yield and quality of watermelon hybrid 'Saraswati' under rain shelter. The treatments were factorial combinations of three planting densities (1.5 m × 0.6 m, 1.5 m × 0.45 m and 1.5 m × 0.3 m), two training levels (single vine, double vines) and two pruning heights (pruned at 2m and unpruned) arranged in randomized block design with two replications and control with horizontal training of vines in open condition.

The wider plant spacing (1.5 m x 0.6 m) recorded the highest value in all the growth parameters except leaf area per plant and leaf area index. Among yield parameters, fruit polar diameter, fruit weight, yield per plant and yield per plot were significantly affected by spacing, pruning and training levels under rain shelter, whereas number of fruits per plant was affected by training and pruning levels. Treatments under rain shelter registered longer crop duration (119.6 days) compared to the control (79 days).

The results revealed that highest yield per plot (99.89 tonnes ha^{-1}) was recorded in narrow spaced unpruned plants with double vines. Training to two vines showed better performance for number of fruits per plant and yield of mini watermelon.

◆◆◆◆◆◆

Effect of Different Water Retention Techniques with Foliar Application of NAA on Yield and Quality of Cashew (*Anarcadium occidentale* L) CV. BPP-8

P.K.Panda, Sonali Gouda[1], K.Sethi, R.K.Panda[2] and Chinmaya Jena[1]
All India Coordinated Research Project on Cashew
Odisha University of Agriculture and Technology, Bhubaneswar-751003,Odisha,India
[1]-Department of Fruit Science and Horticulture Technology,OUAT, Bhubaneswar
[2]-Department of Plant Physiology,OUAT,Bhubaneswar

ABSTRACT

Cashewnut(*Anarcadium occidentale*L), the 'Wondernut'of the world is an important export valued crop cultivated in nearly 34 countries of tropical region lying between latitudes 27^0N and 28^0S.In India,cashew are widely grown in coastal and hinterlands areas,where soils are predominantly characterized by poor organic matter.Cashew farming provided cash and subsistenceto small-holders and creates employment opportunities to more than 3.0 lakh people in the farms and processing factories.The rawnuts and processed cashews fetches sizeable foreign exchange through export earnings.The main cause of low productivity in cashew growing areas is water stress throughout the crucial periods of fruit growth and development,which is brought on by sloppy land topography and inadequate water holding capacity of the soil.A few other significant issues affecting cashew farming nationwide include prolonged flowering,inadequate development of flawless blooms,a narrow sex ratio and low fruit set.The majority of cashew plants in the nation rely on rain water,have low yields and produce low quality kernels.Water management,in particular during the time from fruit set to fruit maturity is crucial under such circumstances for increasing the yield.Plant stress during important growth stages can be caused by uneven rainfall from an unpredictable monsoon,which can have an impact on crop productivity and quality of the produce as well.Therefore, the present investigation entitled "Effect of different water retention techniques with foliar application of NAA on yield and quality of Cashew (*Anacardiumoccidentale*L.) cv. BPP-8" was carried out at All India Coordinated Research Project on Cashew, (OUAT), Bhubaneswar, Odisha during the year 2021-22. The objective of the investigation was to study the effect of water retention techniques and foliar application of NAA on flowering behaviour, nut yield and quality of cashew. The experiment consisted of nine treatments along with control. The treatments are T_1- Only irrigation, T_2- Irrigation + Polythene mulch, T_3,- Irrigation + NAA @ 100 ppm, T_4- Irrigation + Stone mulch, T_5-Irrigation + Residue mulch, T_6- Irrigation + Polythene mulch + NAA @ 100 ppm, T_7- Irrigation + Stone mulch + NAA @ 100 ppm, T_8- Irrigation + Residue mulch + NAA @ 100 ppm and T_9- No irrigation (control). Irrigation was applied at the rate of 200 litres per plant after that, the

root zone of the plants were covered with different types of mulching materials.NAA @ 100 pm was sprayed at three stages *viz.* pre-blooming stage, flowering stage and after fruit set. The experiment was laid out in Randomized Block Design (RBD) with three replications. Biometrical observations on vegetative characters, flowering characters,yield attributes and quality parameters were recorded.

◆◆◆◆◆◆

Strategies to improve water use efficiency in vineyards under semi-arid tropics

A. K. Upadhyay[1], Anuradha Upadhyay, R.G. Somkuwar and A. K. Sharma
ICAR-National Research Centre for Grapes, Pune

ABSTRACT

Majority of the grape cultivation in India is concentrated in the semi-arid tropics. The availability of ground water is declining and coupled with erratic rainfall, water becomes a major constraint. The competition from industry water will further reduce its availability and grape is no exception. Though it's a drip irrigated crop, nevertheless, apprehension about the produce quality leads the farmer to apply excessive irrigation.

ICAR-National Research Centre for Grapes has standardised irrigation schedule based upon pan evaporation and crop growth stage through surface drip for Thompson Seedless vines. This led to 52% savings in irrigation water over farmer's practice. Irrigation schedules have also been developed for commercial table and wine grapes. Subsequent studies have quantified the impact of moisture stress during crop growth stages on grapevine productivity. In Fantasy Seedless, analysis at transcript level revealed that deficit irrigation did not elicit significant molecular response, indicating that vines do not experience the stress. However, at 50% irrigation level, genes belonging to response to stress, organic substance metabolic process and primary metabolic process were affected. A considerable number of heat shock proteins (HSPs) were also affected. An upregulation of these proteins indicated that Fantasy Seedless grapevine exhibited activation of pathways required for adaptation to moisture stress. As breeding of varieties/ rootstocks for drought tolerance is a time taking process, institute has utilized water saving technologies *viz.* subsurface irrigation, combination of mulch with antitranspirant and partial rootzone drying technique developed approaches to enhance productivity. The same has been demonstrated in the farmer's field. In Jath (Sangli Dist.), Manjari (Dist. Pune) and Sawargaon (Dist. Nasik), a saving of 46.8, 25and 20.3% irrigation water was recorded respectively under subsurface irrigation technique over farmer's practice. Use of recommended irrigation schedule through surface drip led to 25.8% and 31.6% irrigation water saving at Jath and Palsi (Sangli Dist.) respectively. Similarly, in Fantasy Seedless vines, subsurface irrigation and Partial root zone drying techniques respectively used 121mm and 65 mm less irrigation water, however produced only 2t less berry yield than recommended irrigation schedule.Utilisation of Decision support system that handles queries on irrigation, nutrition and problems caused due to moisture and temperature stress reduced input usage by 14-17%.

◆◆◆◆◆◆

Effect of Season on The Performance of Turmeric (*Curcuma longa* L.) Cultivars

J. P. Singh, Dhirendra Singh and Priyanka Khairiya
G .B .Pant University Of Agriculture And Technology, Pantnagar, Uttarakhand, India-263145

ABSTRACT

An experiment was conducted during 2011-12 to 2020-22 to study the yield and quality characters of fifty genotypes of turmeric (*Curcuma longa* L.) under irrigated conditions. There were significant variation for genotypes and genotype x environment interaction for plant height, rhizome length, weight of primary rhizome

per plant, days to maturity, rhizome yield and curcumin content. Pant Haldi-17 gave the highest rhizome yield (377 q/ha) followed by Pant Haldi-15 (314 q/ha) and Pant Peetabh (300 q/ha). Pant Haldi-9 and Pant Peetabh showed stability for rhizome yield, curcumin content and other important characters.

◆◆◆◆◆◆

Evaluation of bio-stimulants for growth, yield and quality of Thompson Seedless grapevines

Ajay Kumar Sharma[1], R G Somkuwar[1], A K Upadhyay[1], Archana P Kale[2], Rohit M Palghadmal[1] and Javed Shaikh[2]

[1] ICAR-National Research Centre for Grapes, Pune-412307

[2]Research and Development Dept., Rashtriya Chemicals and Fertilizers Ltd., Mumbai

ABSTRACT

Environment friendly grape growing is aprimary practice towards supporting GreenViticulture under tropical conditions of India where grapevines face various type abiotic and biotic stresses.Bio-stimulants are a broad category of biological products used in crop production to improve conventional nutrition management system. This study was conducted to evaluate potential of two different type bio-stimulants on growth, yield and quality of Thompson Seedless.Presentresearch work was carried out at vineyard of ICAR-National Research Centre for Grapes, Puneduring the fruiting season of 2020-21, where double pruning and single fruiting practice is adopted. There were seven treatments (four vines/treatment) and replicated four times for two grades of RCF bio-stimulants (sprays and bunch dipping). Applications of bio-stimulants were resulted in improved grape yield, bunch and berry quality as compared to control. Among the treatments,T7 [RDF + 1.5 % (Spray: 3rd) + 0.2 % as bunch dipping (Stage 1) + 0.5 % as bunch dipping (stage 2)]of Grade- I showed better performance in improvement ofgrowth, bunch and berry quality parameters as well as yield.Similar trend was observed in T7 of Grade-II also. On the basis of data generated under this study it is concluded that the application of RCF bio-stimulants (both grades) is effective in improving bunch and berry quality as well as yield of Thompson Seedless grapes under tropical conditions.

◆◆◆◆◆◆

Exploring Diversified Livelihood Option for Farmers: A Case Study of Sun Melon Cultivation in Cold Arid High Altitude Trans-Himalayan Ladakh

Arpit Huria, Tsewang Tamchos, Tsewang Norbu, Dorjey Angchok and Tsering Stobdan

Defence Institute of High Altitude Research, DRDO, Leh, Ladakh

ABSTRACT

Sun melon (Cucumis melo var. indorous) is a warm season crop and is not traditionally grown in trans-Himalayan region. Its feasibility of growing was studied under a low-input cultivation system in open field condition in the high-altitude (3344 amsl) Ladakh region by Defence Institute of High Altitude Research (DIHAR)-DRDO, Leh in collaboration with Indian Agricultural Research Institute (IARI), New Delhi. The study was conducted on various varieties, their yield potential and other quality parameters in Ladakh region. The findings revealed that the best-performing variety (Pusa Sunehri) on Black Polythene Mulch (BPM) yielded an average of 2000 kg/kanal (500 m 2) marketable fruit, which suggested that sun melon can successfully be grown in open field conditions in the trans-Himalaya. The technology was successfully demonstrated at farmers' fields in different regions of Ladakh. The know how were then transferred to the UT administration and agriculture

department during Ladakhi Kisan Jawan Vigyan Mela- 2022 held at DIHAR, Leh for its further dissemination in various villages of Ladakh. Sun melon in Ladakh can now be successfully grown by the local farmers on commercial basis and their produce apart from the local market could also be supplied to the Defence Forces deployed in Ladakh sector. Therefore, it could be concluded that sun melon has a high potential to be a diversified livelihood option for increasing the income of the farmers in trans-Himalayan Ladakh region.

◆◆◆◆◆◆

Tissue culture technology: a miracle in commercial multiplication of horticultural crops

Sashikala Beura
Prof. & Head, Department of Floriculture and Landscaping;
Department of Fruit Science and Hort. Technology &
Director, Biotechnology-cum-Tissue Culture Centre

ABSTRACT

Biotechnology plays a significant role in horticulture industry. It has an immense impact on horticultural crops such as fruits, vegetables, ornamentals, spices, medicinal, aromatic and plantation crops as a minute change in structure, texture, form, size, architecture, colour, flavor, fragrance, quality, postharvest life, tolerance to biotic and abiotic stresses brings tremendous miracle commercially. Tissue Culture Technology is the real truth of Biotechnology and a vital backbone of the horticulture industry in perpetuation of horticultural crops. Right now there are 200 commercial tissue culture companies prevail in India with production capacity of around 500 million plantlets per annum. Plant Tissue Culture Technology is happened to be a common traffic for micropropagation, embryo culture, somaclonal variation, haploid and diploid production, secondary metabolite production, plant genetic engineering and cryopreservation. A potential technology “micropropagation” is used for production of pathogen free true-to-type healthy plantlets in horticultural crops. It becomes the commercial method for propagation of many horticultural crops like banana, strawberry, grapes, cauliflower, potato, cassava, yam, ginger, turmeric, cardamom, high value cut flower crops such as gerbera, anthurium, carnation,orchid, heliconia & bird of paradise. Besides, house plants such as aglaonema, dracaena,calathea, cordyline, philodendron and peace lily etc are also perpetuated by micropropagation. Seed culture, embryo culture and embryo rescue on artificial medium in vitro are very effective for combating the problems of post-zygotic failure of embryos and success has been achieved in banana, papaya, grapes, citrus, tomato, potato, orchids, rose, ilex & iris etc. In vitro production of haploids and further diplodisation have been achieved in dutura, nicotiana and super male production in asparagus. Somatic embryogenesis is practised for obtaining somaclonal variation in many horticultural crops. Different propagation materials such as somatic embryos, shoot tips and embryogenic calli formed in vitro are taken for syn seed production in mulberry, banana, potato, carrot, brinjal, dioscorea & orchids and these can be cryopreserved. Cell surpension culture is an important technology for secondary metabolite production. Transgenic cultivars of petunia Surfiana, Moon series of carnation, blue rose Applause, blue chrysanthemum produced are propaga ted by vegetative means. Hence, micropropagation is a miracle in commercial multiplication of horticultural crops.

◆◆◆◆◆◆

POSTER PRESENTATION

Influence of variable nitrogen levels and cutting frequencies on growth and yield of vegetable Amaranth (*Amaranthus spp.*)

Mukesh Kumar and Manoj Raghav
Department of Vegetable Science,
G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand-263145

ABSTRACT

The present investigation was carried out at Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, U. S. Nagar Uttarakhand,during summer season of year 2022-23in Randomized Block Design with three replications to assess the influence of variable nitrogen levelsand cutting frequencies on growth andyield of vegetable amaranth(*Amaranthus spp.*). The experiment comprised oftwelvetreatments in which nitrogen was applied@ 0, 30, 60 and 90 kg/ha^{-1}along with three plant spacing 45×15cm, 45×30cm and 45×45cm. 1/3rd of nitrogen was applied as basal dose and remaining dose of nitrogen was topdressed equally in two split doses. The results revealed that treatment T_4(N@90 kg/ha^{-1})was found superior for edible leaf yield. On the other hand, the cuttings taken at shorter intervals increased the regrowth, but very frequent cuttings reduced the total dry matter of the leaves. It was observed that cuttings taken at biweekly intervals increased the number of leaves, number of branches, fresh weight of the leaves and dry matter per plant. On the basis of field study, it can be concluded that treatment T_4 (N @90 kg/ha^{-1}) and cutting intervals of two week was found to be most effective in improving the growth and yield attributes ofvegetable amaranth in *Tarai*conditions.

◆◆◆◆◆◆

Effect of iron and zinc oxide nanoparticles synthesized via green route on Grapes: An eco-friendly approach

Yukti Verma[1] and Ajay Kumar Upadhyay[1]
[1]ICAR-National Research Centre for Grapes, Pune, Maharashtra 412307, India

ABSTRACT

For the past few decades, extensive research efforts have been made towards the preparation of cost-effective and eco-friendly nanostructured materials in the research fields of nanotechnology, a propitious branch of science that has received major success in the era of modern technology. Considering this, nanoparticles of iron and zinc were fabricated through novel green route. The obtained products (assumed as Fe-NPs and Zn-NPs) were subsequently characterized by Fourier Transform Infrared Spectroscopy, UV-vis spectra, Scanning Electron Microscopy and Particle Size Analysis techniques. The LCMS/MS was per-formed for the identification of biomolecules present in the grape pomace extract for formulating Fe-NPs and Zn-NPs. The morphology of Fe-NPs was monitored by SEM analysis and the particles were found in agglomerated form whereas the morphology of Zn-NPs was mostly spherical/agglomerated in shape.

To assess the impact of nanoparticles on grapes, field experiments were conducted. A significant increase in leaf Fe (+36.59%) and Zn content (+28.39%) as well asberry Fe (+34.78%) and Zn content (+30.07%) wasrecorded on application of Fe-NPs and Zn-NPs over conventional fertilizers inThompson Seedless.These findings suggested that Fe and Zn NPs have potential applications and could be used as a promising candidate for enhancing micronutrient content.

Keywords: Nanoparticles, iron, zinc, FTIR, SEM

◆◆◆◆◆◆

Influence of different growing media combinations on growth and yield of parthenocarpic cucumber incontainer cultivation

Ravindra Babu. M, Thomson. T and Ashok. P
Horticultural Research Station, Dr Y.S.R.Horticultural University,
Venkataramannagudem-534101, Andhra Pradesh

ABSTRACT

An experiment was conducted in polythene grow bags under naturally ventilated polyhouse conditions during 2020-21 and 2021-22 at Centre of Excellence for Research and Training in Protected Cultivation, Horticultural Research Station, Dr.Y.S.R.Horticultural University, Venkataramannagudem, West Godavari District, Andhra Pradesh to standardize growing media combination for soilless cultivation in parthenocarpic cucumber. The experiment was laid out in Randomized Block Design with fourteen treatments and three replications. The growing media includes coco peat with two different levels of electrical conductivity, farm yard manure, vermicompost and neem cake in various proportions. The variety used for the study is Pusa Parthenocarpic Cucumber-6. The pooled data for two years revealed that maximum vine length (240.53 cm), number of leaves per plant (28.77), total leaf area (610.24 cm^2), minimum days to first female flower (19.60) were recorded in treatment T_{13} (Cocopeat with EC 0.50 $\pm$ 0.10 dSm^{-1} @ 75 % + Vermicompost @ 10 % + FYM @ 10 % + Neem Cake @ 5 % (v/v)), whereas maximum number of fruits (29.33) was recorded in T_{13} (Cocopeat with EC 0.50 $\pm$ 0.10 dSm^{-1} @ 75 % + Vermicompost @ 10 % + FYM @ 10 % + Neem Cake @ 5 % (v/v)). The yield per plant (3.49 kg) and estimated yield per hectare (65.34 t/ha) were recorded highest with the treatment T_{13} (Cocopeat with EC 0.50 $\pm$ 0.10 dSm^{-1} @ 75 % + Vermicompost @ 10 % + FYM @ 10 % + Neem Cake @ 5 % (v/v)) which were on par with T_9 (Cocopeat with EC 0.50$\pm$ 0.10 dSm^{-1} @ 75 % + Vermicompost @ 15 % + Neem Cake @ 10 % (v/v)) (3.19 kg and 59.52 t/ha respectively). Highest B:C ratio (1.13) was recorded with the treatment T_{13} (Cocopeat with EC 0.50 $\pm$ 0.10 dSm^{-1} @ 75 % + Vermicompost @ 10 % + FYM @ 10 % + Neem Cake @ 5 % (v/v)) (1:1.10). Among all the growing media combinations Cocopeat with EC 0.50 $\pm$ 0.10 dSm^{-1} @ 75 % + Vermicompost @ 10 % + FYM @ 10 % + Neem Cake @ 5 % (v/v) was found best for container cultivation of parthenocarpic cucumber under naturally ventilated polyhouse.

Key words : Parthenocarpic cucumber, container cultivation, soilless culture, naturally ventilated polyhouse

◆◆◆◆◆◆

Influence of drip irrigation, mulching and micronutrient (Boron & Copper) on Yield and Water management of Litchi cv. Rose Scented

Rajat Sharma, Satish Chand, Ranjan Srivastava, V.P. Singh and RatnaRai
Department of Horticulture, College of Agriculture, GBPUA&T, Pantnagar Uttarakhand

ABSTRACT

The study entitled “Influence of drip irrigation, mulching and micronutrient (B & Cu) on Yield and water management of Litchi cv. Rose Scented” was conducted at Horticulture Research Centre, Patharchatta, GBPUA&T, Pantnagar during 2018-19 and 2019-20 on 17 year age treeplanted at a spacing of 5m x 5m. The experiment comprised of application of water through drip irrigation at 25%, 50%, 75%, 100% and 125% of estimated water requirement (ER), mulch along with foliar spray of borax or copper sulphate. However, the control was given surface irrigation. The experiment was laid out on randomized block design comprising of three replication. The number of fruits/tree and yield (kg/tree) were found to be significantly influenced by drip irrigation, mulching and micronutrient and their interactionfor both the years and pooled data. Maximum number of fruits and fruit and yield

were found with 75% ER irrigation coupled with Mulch and Borax application. While least were obtained with control and 25% ER irrigation coupled with Mulch and Borax application. Water Use Effeciency (kg/m^3) was found best (20.87) with 25% ER with Plastic Mulching and copper sulphate spray. However, minimum (4.29) was noted with 125% ER with Plastic Mulching and Borax spray. Water Productivity was noted maximum (233.35) under 125% ER irrigation coupled with Borax application but without Mulch and minimum (48.57) was recorded under 25% ER with Plastic Mulching and copper sulphate. From present study, it may be concluded that 75% ER with Plastic Mulching and foliar application of Borax has proven to be best for yield attriutesand both25% ER with Plastic Mulching and foliar application of CuSo4 as well as 125% ER with Plastic Mulching and foliar application of Borax has shown promise for WUE & Water Productivity respectively from water management.

◆◆◆◆◆◆

Effect of IBA and biofertilizers on shoot and root parameters of Pant Lemon-1

Rashmi Panwar, Pratibha Bhatt and Vineeta Rathore
College of Agriculture, G.B.P.U.A. &T., Pantnagar-263145, U.S.Nagar (Uttarakhand)

ABSTRACT

The present investigation was carried out at Horticulture Research Centre, Patharchatta, G. B. Pant University of Agriculture and Technology, Pantnagar during 2019. The experiment was laid out in Randomized Block Design consisting twenty one treatments.Treatments comprised of different concentrations of indole-3-butyric acid (500ppm, 1000ppm, 1500ppm and 2000ppm) and biofertilizers (5ml Azotobacter + 5ml PSB, 10ml Azotobacter + 10ml PSB, 15ml Azotobacter + 15ml PSB and 20ml Azotobacter + 20ml PSB) and control. The investigation was replicated thrice with 20 cuttings in each treatment and treated cuttings were planted in 1 kg capacity polybags which were placed under shade net. The findings of the experiment showed a significant effect of IBA and biofertilizers on vegetative traits and rooting of lemon cuttings. The results indicated that among the various treatments, the treatment combination of 2000ppm IBA + 20ml Azotobacter + 20ml PSB reported better results for most of the root and shoot growth parameters which include % sprouted cuttings, number of shoots & leaves per cutting, length & diameter of shoot / cutting, fresh & dry weight of cuttings and root parameters like number of primary & secondary roots per cutting, length & diameter per cutting, length & diameter of longest root per cutting, fresh & dry weight of roots and % cutting rooted.

◆◆◆◆◆◆

Role of Nano Fertilizers in Horticultural Crops

Satyendra Verma, Subhash Chandra Singh
Department of Fruit Science, College of Horticulture, Banda University of Agriculture and Technology, Banda, U.P. -210001

ABSTRACT

Fertilizers are being used for the last many years in horticulture for the benefit of the farmers. Conventional fertilizers are costly as well as harmful to humans and the environment. Hence, there is a need to develop eco-friendly fertilizers with high nutrients as well as compatibility with soil and environment. Nano-technology in the form of nano-fertilizers is emerging as a promising alternative to enhance their qualitative characteristics. A nano fertilizer includes nano formulations of nutrients for plants, enabling continuous and homogeneous absorption. The present horticulture practices are being upgraded and updated with the use of various technologies including nanotechnology. The regular release of nutrients by nano fertilizers helps to increase nutrient utilization efficiency beyond the many associated adverse consequences. Nano fertilizers in horticultural

crops such as fruits, vegetables, flowers, spices, medicinal and aromatic plants have successfully increased yield, nutrient uptake, physical and biochemical characteristics as well as improved global food security. Through various research work on this aspect, it has been observed that nano fertilizers are beneficial for enhancing the productivity, quality and shelf life through their positive effects on physical, morphological, physicochemical and molecular characteristics. Eco-friendly products are expected to reduce the use of conventional fertilizers by 50 percent. Although nano fertilizers have a lot of advantages, their results should always be carefully examined and taken into account to make them more beneficial during and after application. **Keywords:** Nanotechnology, Nano fertilizers, Chlorophyll, Food Security.

◆◆◆◆◆◆

Performance of China aster [*Callistephus chinensis* (L.) Nees] cultivarsunder semi-arid condition of Bundelkhandregion of Uttar Pradesh

Rajat Patel, Krishna S.Tomar, Ajay Kumar Singh and Rakesh Kumar
Banda University of Agriculture and Technology, Banda, Uttar Pradesh

ABSTRACT

China aster [*Callistephuschinensis* (L.) Nees] belongs to one of the largest families of flowering plants, 'Asteraceae'. China aster is a free blooming half hardy, easy growing winter annual grown for cut as well as for loose flowers. The cut flowers have good vase life and are used in flower arrangements, vases, bouquets, for interior decorations etc. The loose flowers are widely used for making garlands, for decorations, for worship and are also used in social functions. A field experiment was conducted during 2021-22 to evaluate theperformance of China aster cultivars at the Instructional Farm of the Department of Floriculture and Landscaping, College of Horticulture, Banda University of Agriculture and Technology, Banda, Uttar Pradesh. The experiment was laid out in randomized block design (RBD) with fourteen treatments replicated thrice. All the cultivars performed with wide and significant differences for all the parameters studied *i.e.* their growth, quality and yield. Fourteen cultivars were evaluated for vegetative growth, flowering, yield and postharvest life, revealed that the cultivars, Phule Ganesh Purple, Phule Ganesh Violet, Namdhari White and ArkaShashank were found promising for longer flower stalk (44.48 cm, 43.93 cm, 39.29 cm and 38.43 cm, respectively) and vase life. These cultivars Phule Ganesh Violet, Phule Ganesh Purple, Namdhari White and ArkaShashank also having promising flower yield per ha which can be usePresenting d for cut flower production. ArkaAadya, ArkaArchana and ArkaPoornima recorded highest yield per ha as well as showed minimum flower stalk length. Hence, these cultivars were found promising for loose flower production and garland making. Cv.Matsumoto Scarlet initiated flower very early and less spreading, may be used for garden display and bedding purpose in landscaping. Cv. AAC-1 exhibited to produce flower initiation toolate; hence it may be considered for transplanting in early season.

◆◆◆◆◆◆

Effect of boron, zinc and humic acid on growth and yield of okra (*Abelmoschus esculentus* L. Monech)

Palanisamy Karthigaand Snehasish Chakraborty
Department of Horticulture, Central University of Tamil Nadu, Thiruvarur-610005

ABSTRACT

In India, okra is a prominent warm-season vegetable crop and is grown extensively across almost all the states. Boron and zinc play an important role directly and indirectly in improving the growth and yield of

okra. Humic acid can directly influence the crop as a growth regulator or indirectly as a chelating agent increasing the growth of shoots and roots, absorption of nitrogen, phosphorous, potassium, calcium, magnesium by plants.Therefore, the present research was conducted in Salem, Tamil Nadu, to determine the effect of boron, zinc and humic acid on the growth and yield of okra. Among the 8 treatments tested, the results indicated that foliar treatment of boron, zinc and humic acid at concentrations of 0.1 percent, 0.1 percent and 2%, respectively, had a significant influence on the growth, flowering and yield characteristics of okra, either alone or in combination. Among the various treatments, the combination of Boron @ 0.1 percent and Zinc @ 0.1 percent resulted in the following: maximum plant height (136.17 cm), maximum leaf number (29.61), maximum plant girth (3.74 cm), earliest days to first flowering (36.55), 50% flowering (39.94), earliest days to first picking (42.60), maximum days to last picking (100.77), maximum fruit length (17.41 cm), fruit weight (19.00 g), no. of fruits per plant (33.11), yield/plant (617.92 g).

◆◆◆◆◆◆

Effect of different mulch material with potassium fertilization for quality improvement in Jackfruit

Gunjan Joshi and Pratibha
G. B. Pant University of Agriculture and Technology, Pantnagar, U. S. Nagar, Uttarakhand
Gunjanj861@gmail.com

ABSTRACT

Fruits are a vital part of our diet since they are packed with nutrients which are good for us, including vitamins, fibre, carbs, antioxidants and other substances. Despite this, consumption rate is relatively low as per capita.With increasing demand of fruits it is necessary to increase its production with quality enhancement. Keeping this in consideration present experiment was carried out at Horticulture Research Centre, Pattharchatta, G. B. Pant University of Agriculture and Technology, Pantnagar, during 2019-2020. The study was conducted to test the effect of different mulching material with variable doses of potassium fertilizer on growth and quality of Jackfruit (*Artocarpus heterophyllus* L.) with thirteen treatments and three replications. The experimental results revealed that among all treatment silver black plastic mulch with 750g of potassium soil application was found to be superior concerning to tree growth parameter, fruit physical parameters *viz.*, fruit length, width, weight and pulp weight, chemical parameters *viz.*, total soluble solids, titratable acidity, ascorbic acid, total sugar, reducing and non-reducing sugars. The least values for all the above parameters were recorded in control treatment. Thus we can conclude that the application of mulching with potassium fertilization significantly influences the growth and quality of jackfruit.

◆◆◆◆◆◆

Effect of foliar application of different levels of Gibberellic acid, 1-Naphthalene acetic acid and their combinations on Yield and Quality of Papaya (*Carica papaya* L.)

Okram Bijaya Devi, Yumnam Somi Singh
North- Eastern Hill University, Chasingre, Tura, Maghalaya, India- 794002

ABSTRACT

An experiment was carried out at Horticulture Farm, Department of Horticulture, NEHU Tura campus, Chasingre, Meghalaya in the years 2020 and 2021 to evaluate the effect of foliar application of differentlevelsof

Gibberellic acid, 1-Naphthalene acetic acid and their combinations on Yield and Quality of Papaya (*Carica papaya* L.). The results revealed that yield and quality parameters of papaya fruits were significantly influenced by plant growth regulators studied. Among the treatments, treatment T_7(RDF- Recommended Dose of Fertilizer + NAA 50 ppm + GA_3 50 ppm)showed superiority in different yield-attributing characteristics, such as number of flowers per node, fruit set percentage, number of fruits/plant, fruit length, fruit diameter, fruit volume and fruit weight. T_7 took minimum days to first flowering, days to first fruiting and days from first flowering to fruit maturity compared to other treatments. Quality parameters such as TSS, ascorbic acid, total reducing sugar, reducing sugar and non-reducing sugar of fruits, treatment T_7exhibited significantly maximum value. Meanwhile, the minimum value for yield attributing characteristics and quality parameters were recorded with the treatmentT_0 (RDF + Control -water spray).

◆◆◆◆◆◆

Fruit bagging: A Novel Technique for Improving Fruit Quality in Horticultural Crops

Sanjay Kumar, Jeet Ram Sharma, R.A. Kaushik and Ankit Gavri
Department of Horticulture, CCSHAU, Hisar

ABSTRACT

Among Several good agricultural practices, pre-harvest fruit bagging emerged as novel practice for production of high quality fruit with less dependence on man-made chemicals throughout the World. During their growth and development, fruit undergo several physical and chemical changes and are susceptible to insect pest infestations, bird attack, various pathogens and mechanical damage, all of which can reduce their commercial value and thereby cause significant yield and economic losses. Bagging is a physical protection method which not only improves the visual qualityof fruit by promoting skin colouration and reducing blemishes, but can also change the micro-environment for fruitdevelopment, which can have several beneficial effects on internal fruit quality. Pre-harvest bagging of fruit can alsoreduce the incidence of disease, insect pest and/or mechanical damage, sunburn of the skin, fruit cracking,agrochemical residues on the fruit and bird damage. Due to its many beneficial effects, fruit bagging has become anintegral part of peach, apple, pear, grape and loquat. Now a days, various types of bagging materials (Such as, paper bag with different colours, cellophane or fabric bags, newspaper bag, Nylon bags *etc*.) are used for covering the fruit. These may be depend on the stage of fruitdevelopment when bagged, the duration of fruit exposure to natural light following bagremoval, and/or fruit- andcultivar-specific responses. Pre-harvest fruit bagging is a simple, grower-friendly technology which is safe to use and has several beneficial effects on the physical appearance and quality of fruit. Furthermore, it is the safest approach to protect fruit from insect pests, diseases and other disorders. This approach is an integral part of fruit production in some parts of the World.

◆◆◆◆◆◆

Effect of Pre-harvest Treatments and Bagging in Improvement of Bio-chemical and Organoleptic Characteristics of Guava (*Psidium guajava L.*) cv. L-49 Fruits

Saransh Saxena[1], Priyamvada Sonkar[1], RN Kanpure[1], SB Singh[2], GPS Rathore[3]
College of Horticulture, Mandsaur, MP

ABSTRACT

The experiment was undertaken in the Department of Fruit Science, KNK College of Horticulture, Mandsaur, RVSKVV Gwalior (M.P.) during the year of 2019-20. The experiment

was laid out in Randomized Block Design (RBD) with three replications. There were three different concentrations of Calcium Chloride (1%, 1.5% and 2%) and Ascorbic acid (200 ppm, 300 ppm and 400 ppm) with two bagging materials (Brown paper and Yellow polyethylene bag) used as pre-harvest treatments in guava. The effects of different treatments on different bio-chemical parameters (TSS, acidity, ascorbic acid content, pectin content, pH and chlorophyll content in leaves) along with organoleptic test (fruit taste, fruit colour, fruit texture and fruit aroma) were studied.The bio-chemical parameters were significantly influenced by the application of pre-harvest treatments and bagging. The maximum TSS (11.50-^{0}B), maximum ascorbic acid content (192.39 mg), highest TSS: acidity ratio (26.63), greatest pectin content (1.05 %), higher pH (4.73) and maximum chlorophyll content in leaves (46.10 SPAD) were recorded in T_{11} ($CaCl_2$ @ 2% wih Brown paper).The organoleptic test was also significantly influenced by spraying and bagging. The maximum scores for fruit taste (7.33), fruit colour (8.00), fruit texture (7.67) and fruit aroma (7.33) were observed and recorded under the application of treatment T_{11} ($CaCl_2$ @ 2% wih Brown paper).

◆◆◆◆◆◆

Influence of mulch types and drip irrigation levels on growth and yield parameters in litchi cv. Rose Scanted

Prerna Nautiyal, Satish Chand, A. K. Singh and Ranjan Srivastava
G.B.PantUniversityofAgricultureandTechnology,Pantnagar,Uttarakhand263145)

ABSTRACT

The present investigation was carried out at Horticulture Research Centre, Patharchatta, of the University during 2022. The litchi trees planted at a spacing of 5m × 5m and were subjected to drip irrigation with or without mulch along with one control. There were twelve treatment combinations including drip irrigation at 50 per cent, 75 per cent and 100 per cent of estimated water requirement along with black polyethylene (100 micron UV stabilized) and litchi leaf mulch (10 cm thickness) whereas, the control involved flood irrigation along with unmulched condition. The experiment was laid out in randomized block design comprising of three replications. The objective of investigation were to study the effect of above treatments on vegetative growth, flowering, yield, fruit quality attributes and water use efficiency on 22 year old litchi tree cv. Rose Scented. Non- significant effect of above treatments on vegetative growth and floral characters were recorded. But, significant effect on fruiting, yield and other quality attributes was found. The fruit set and fruit drop percentage also varied significantly due to the effect of mulch and drip irrigation. Further, minimum fruit cracking (8.50%), maximum fruit number (1375.28/tree) and yield (32.28 kg/tree) were recorded under black polyethylene mulch with drip irrigation at 100% level. In terms of fruit quality, the treatment black polyethylene mulch with drip irrigation at 100% levelwas found superior with maximum fruit weight (23.79 g/ fruit), length (34.07 mm/fruit), width (29.25 mm/fruit), volume (22.08 ml/fruit), pulp weight (15.48 g/fruit), T.S.S (18.77°B), ascorbic acid (29.04 mg/100g) and total sugars (16.33%). The maximum (15.81 kg/m^3) water use efficiency was registered under the treatment black polyethylene mulch with drip irrigation at 50% level.Overall, the study revealed that application of black polyethylene mulch with drip irrigation at 100 per cent level black polyethylene mulch with drip irrigation at 100% level was better over other treatments but in terms of water use efficiency, the treatment combination black polyethylene mulch with drip irrigation at 50% level.was found most beneficial.

◆◆◆◆◆◆

Row cover-based vegetable cultivation for doubling farmer income in problematic areas

Ranjit Chatterjee, Arindam Das and Dibya Jyoti Mukhia
Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, INDIA

ABSTRACT

Changes in climatic parameters have a significant impact on the performance of various vegetable crops and fluctuations in temperature, light, humidity, or wind velocity have an adverse impact on the crop growth, physiological processes, flowering, fruit setting, yield and economic return. To increase the availability of fresh vegetables in problematic areas, proper protection technologies should be adopted to provide a favourable growing environment for the crop. Row cover or low tunnel are low-cost, transparent polythene sheet cover structures used to mitigate the negative effects of cold winter, strong winds and heavy rain. Such structures can be used to modify the microclimate in order to extend the growing season and expand production areas for profitable vegetable cultivation in problematic areas. Raising vegetable seedlings during the winter months in north India or during the rainy season in north-eastern India, as well as cultivation of high-value vegetables in hilly areas during the cold winter, are all possible with large-scale use of row cover or low-cost poly tunnel. Under cold winter conditions, row covers conserve the warmth, stimulate the seed germination and early growth, protect the crops from frost injury, advance the maturity and finally increase the yield and improve the quality of the harvest. The full paper discussed the diverse utilization of row cover for seedling production or vegetable cultivation in problematic areas to make the production system economically viable and remunerative.

◆◆◆◆◆◆

Implications of Graft Hybridization in Vegetable Crops

Sulochana K H[1], Kowsalya K B[1]
[1]Division of Vegetable Crops, ICAR- Indian Institute of Horticulture Research, Bengaluru, Karnataka

ABSTRACT

Climate change is impacting the agricultural production considerably.There is need to breed varieties resilient for climate change, most significant and the oldest methodwith its full potential is Grafting technique. When grafting is done between two genetically dissimilar plant parts, a hybrid plant is produced exhibiting characters of both the stock and the scion and these new characters are heritable in nature when the grafted scion is selfed and advanced to next generation (Liu *et al*., 2006) called as "Graft hybridization". The concept was first proposed by Darwin in 1868. mRNA molecules derived from the stock cells could possibly be reverse transcribed into cDNA capable of being integrated into genome of the scion cells, resulting in heritable changes in the scion. mRNA andsRNAare transported and they travel between plant cells as long-distance information macromolecules (Li *et al*., 2013).Mobility of sRNA via Phloem and plasmodesmata from rootstock or scion occurs (Melnyk*et al.,* 2011).Graft hybridization is now explained by horizontal gene transfer and DNA transformation. Graft induced changes created phenotypic variation in pepper fruits (Tsaballa*et al*.,2013). Investigation of the graft transmission of high-temperature tolerance into tomato scions (non-transgenic) from transgenic rootstocks, where the fatty acid desaturase gene (LeFAD7) was RNA-silenced (Nakamura *et al.,*2016). Transgenic rootstocks have been used to understand the signaling mechanisms and helps in understanding the process if graft hybridization in the plant system. Graft hybridization is considered to be a simple and efficient means of plant breeding for the crop improvement.

◆◆◆◆◆◆

Effect of Ferti-Fortification of Iron and Zinc Fertilization on Quality Parameters of Mango Cv. Kesar

Archana Mahida
Department of Horticulture, Central University of Tamil Nadu,Thiruvarur-6100005

ABSTRACT

The mango is delicious fruit of tropical countries and holds a premier position amongst the commercial fruit grown in India. It is national fruit of India belong to family annacardiacae. In Western India, several mango varieties *viz.,* Alphonso, Kesar, Rajapuri, Pairi, Mankurad, Fernandin, Jamadar, Dadmiyo, *etc.* are commercially grown and accepted by the consumers. Out of which Kesar has been found with good yield potential, almost regular bearer, mid-season variety, having good consumers' acceptance, attractive shape, size with saffron coloured pulp and very good keeping quality. Mango play important role in balancing diet of human being by providing about 64-66 calories per 100 grams of ripe fruits. The king of fruit is nutritionally very rich, unique in flavour. From last few years, some physiological stresses and quality related issues has been raised in mango orchard. It was observed that unbalanced fertilization, micronutrient deficiencies, poor tree management and inadequate cultural practices are mainly responsible for orchard related quality issue Therefore, food supplements and mineral supplements are necessary for healthy crops. The present research was accomplished on mango cv. Kesar to investigate the effect of foliar spray of iron and zinc fertilization on quality parameter of mango. The experiment was conducted in completely randomized design and replicated 3 times with 9 treatments. The significant increase in TSS and ascorbic acid content were recorded with the foliar application of 0.5 % $FeSO_4$ and 0.5 % $ZnSO_4$which was at par with treatment T_7 (0.25 % $FeSO_4$ + 0.50 % $ZnSO_4$).

◆◆◆◆◆◆

Estimation of generation mean analysis and scaling test for fruit yield and its attributing traits in okra (*Abelmoschus esculentus* L. Moench)

Kalyani D Deshmukh, VS Khandare and BM Kharat

ABSTRACT

The experimental material comprised of six generations (P1, P2, F1, F2, BC1 and BC2) through generation mean analysis of six crosses with different parents. The generations were analysed during *kharif* 2019 in Randomized Block Design with randomization of generations within each cross in two replications. The traits were studied plant height (cm), number of branches per plant, internodal length, days to 50% flowering, first flowering node, first fruiting node. The scaling test indicated the presence of non-allelic interaction in all the crosses. The PBNOK-6 x Pusa Makhmali and VRO-103 x Hissar Naveen showed superior mean performance in all the traits. In days to 50% flowering all crosses showed superior mean performance. In most of the crosses additive type (d) component showed superior performance in the characters first flowering node, number of branches per plant, internodal length. In all the six crosses days to 50% flowering was observed superior in all type of gene action. Additive x additive type (j) of gene action was observed to be important in the characters like number of branches per pant and internodal length. Most of the characters showed complementary type of gene action. Complementary type of gene action play role in transfer inheritance characters. Some characters showed duplicate type of epistasis.

◆◆◆◆◆◆

Increasing quality, productivity and stress management of fruit crops by using nanoparticles

Sampurna Nand Singh[1] and Navin Singh[1],
G.B. Pant University of Agriculture and Technology, Pantnagar Uttrakhand[1]
Email id- sampurnanandsingh2014ss@gmail.com

ABSTRACT

Fruit production plays a significant role in the Indian economy and nutritional security of the population of country and also in national economy. Although fruit crop production in India has been steadily increasing, it is also important to focus on the quality of the produce.From the addition of organic matter to farms to the use of synthetic fertilizers, crop nutrition has advanced significantly. However, using chemical fertilizers has its drawbacks, particularly a lower nutrient use efficiency due to losses in the form of volatilization, denitrification, fixation and immobilization.Nanotechnological intervention has been demonstrated to be successful in overcoming these losses as well as in increasing the production and quality of the fruit crops. A nanoparticle or ultrafine particle is usually defined as a particle of matter that is between 1 and 100 nano meter (nm) in diameter. Nanoparticles possess a great potential in targeted delivery of nutrients to living systems. Nanoparticle owing to their smaller size, higher surface area to volume ratio, higher entropy due to colloidal state and quantum effect have their more efficient uptake and translocation within the plant cell through plasmodesmata. Nanofertilizers are target specific, slow releasing and highly efficient in increasing vegetative growth, pollination and fertility in flowers, resulting in increased yield and improved product quality for fruit trees. Substantial use of nanotechnology would significantly promote growth, increase yield, reduce post-harvest losses and reduce some biotic and abiotic stresses through maintaining the quality on field as well as during storage duration of fresh and processed fruits. The availability of useful nanoparticles and safety assessments of their field application are needed for ensuring food and nutritional security of the ever-increasing world population in a changing climate scenario.

◆◆◆◆◆◆

Impact of integrated nutrient modules on growth, yield and economics of Potato (*Solanum tuberosum* L.)

Ankush Chaudhary[1] and Monisha Rawat[2]
Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh (173230)
Lovely Professional University, Phagwara, Punjab (144410)

ABSTRACT

Potato (*Solanum tuberosum* L.) belongs to the family Solanaceae with chromosome number 2n = 48 and is the fourth important staple food crop. A field experiment was carried out in the year 2019 at Vegetable Research Farm, Department of Horticulture, Lovely Professional University, Phagwara, Punjab to study the effect of integrated nutrient management for horticultural and biochemical characteristics, yield of potato cultivar Kufri Chipsona-3 in sandy loam soils of Punjab.The experiment involved the integrated use of different chemical fertilizers,organic manures and biofertilizersi.e., NPK, FYM (Farm Yard Manure), vermicompost, bio-fertilizers (phosphorus solubilizing bacteria and Vesicular Arbuscular Mycorrhizae) and absolute control.The experiment comprised of 7 treatments with one control replicated thrice in a RandomisedBlock Design in 1.8 x 1.6 m^2plot size. The study revealed that maximum yield (27.9 t/ha) was obtained in the treatment T_4 which comprised integrated use of 75% recommended dose of NPK + FYM (Farm Yard Manure) @ 50 t/ha + PSB @ 10 kg/ha as compared to other treatments. The treatment also had positive effect on growth and quality attributes *viz.*

plant height (39.85 cm, 48.73 cm and 51.62 cm at 30, 60 and 90 days after sowing respectively), number of compound leaves (41.84, 46.46 and 49.49 at 30, 60 and 90 days after sowing respectively), dry matter content (20.66%) and specific gravity (1.12 g/cm^3) but the treatment had no significant effect on chlorophyll content. Thebenefit: cost ratiowas also maximum (1:2.21) in the same treatment.

Keywords: Biofertilizers; Vermicompost; VAM.

◆◆◆◆◆◆

Effect of Scion Dip treatment and Growing Condition on Growth, vigour and survival of Mango Graft (*Mangifera indica* L.) cv. Dashehari

Lokesh Nagar and C.S. Pandey[2]
College of Agriculture, JNKVV, Jabalpur,482004 (Madhya Pradesh)

ABSTRACT

A trial was conduct at Fruit Research Station, Imaliya College of Agriculture Jabalpur,Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur Madhya Pradesh during 2021-22. The experiment is consisted of two factor under shade net condition and open condition. The results of experiment revealed that minimum days taken to first sprout of mango grafts was recorded with BAP and $ZnSO_4$ 40ppm & 500ppm respectively as Scion dip treatment 10.33 days under the shade net condition and 12.28 days in the open condition and Dashehari as the variety of Scion also the Maximum no.of the Successful Grafts at 1,2 and 3 months after grafting(MAG) was observed in soaking treatment no. 9 (BAP 40 ppm & $ZnSO_4$ 500 ppm). Maximum number of leaves of graft 2 & 3 was noted in T_9 (13.57 and 15.60) under Shade net and (10.21 &12.45) in open condition. Therefore scion dip treatment in shade net condition can be utilized for best success, enhancing earliness and production of vigorous grafts.

◆◆◆◆◆◆

Foliar Application of Micronutrients on Sweet Orange (*Citrus Sinensis* (L.) Osbeck) Cv. Mosambi for Sustainable Production in a Non-Traditional Area

Kumari Nandita, Manoj Kundu, Feza Ahemad and Priyanka Kumari
Department of Horticulture, Bihar Agricultural University, Sabour, Bhagalpur

ABSTRACT

The present study was conducted to analyse the effect of foliar application of micronutrients on sweet orange (Citrus sinensis (L.) Osbeck) cv. Mosambi in calcareous and alkaline soil where yield, poor fruit quality and increased incidence of granulation is prominent due to hindrance in smooth micronutrient uptake by the plants. Zn@0.5% +Fe@0.2% +B@0.3% +Cu@0.1% was found to help improve physiological growth, followed by B@0.3% +Fe@0.2% and Zn@0.5% +B@0.3%. The Zn@0.5% + Fe@0.2% + B@0.3% + Cu@0.1% treatment gave the maximum fruit yield (19.92 t ha-1), however the B @0.3% + Fe @0.2% treatment retained the maximum fruit's weight and volume (173.80 g and 190.53 cc, respectively). Also, the Zn@0.5% +Fe@0.2% +B@0.3% +Cu@0.1% spray had the highest TSS:acid ratio, sugar and phenol content of the fruit. Also, there was the least amount of granulation with the Cu@0.1% spray (1.96%) and at par with the Zn@0.5%+Fe@0.2%+B@0.3%+Cu@0.1% (2.33%). Therefore, three foliar sprays of Zn@0.5% +Fe@0.2% +B@0.3% +Cu@0.1% can be used between May and July to obtain a maximum yield of better-quality, granulation-free fruit from mosambi orchards in non-traditional citrus growing tracks with calcareous and alkaline soil.

◆◆◆◆◆◆

Effect of different levels of N, P and K fertigation on the vegetative and flowering attributes of gladiolus cv. White Prosperity

Yograj Kushwaha, B. D. Bhuj, Ranjan K. Srivastava, V.P. Singh, Satish Chand
Department of Horticulture, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

ABSTRACT

The experimentwas laid out in randomized block design (RBD) with five treatments and four replications from November 2019 to May 2020 to study the effect of different levels of N, P and K fertigation on the vegetative and flowering attributes of gladiolus cv. White Prosperity. The corms of uniform size were taken. The treatment combinations were T_1&T_2 at same RDFi.e. 300:200:200 kg NPK/ha in different combination 33.3:33.3:33.3% and 40:20:20% respectively at vegetative, heading and flowering stage and T_3&T_4 at same RDFi.e. 225:150:150 kg NPK/ha in different combination 33.3:33.3:33.3% and 40:20:20% respectively at vegetative, heading and flowering stage. In T_5 (control) RDF were applied @300:200:200 kg NPK/ha in which full dose of P&K and two split dose of nitrogen were applied. The crop was raised under uniform cultural conditions. The results revealed significant differences among the treatments. At 60 days, the maximum plant height (70.04 cm) was obtained in T_1 while the maximum number of leaves/plant (8.54) was exhibited by T_3.The treatment T_3showedthe best results especially for commercial traits like spike length (121.63 cm), number of florets/spike (13.67), rachis length (56.53 cm), diameter of second floret (11.97 cm) and number of florets open at a time (5.96). On the basis of the present findings, it may be concluded thatfertigation is a promising way of fertilizer application for enhanced quality at low input.

Keywords: RBD, NPK, RDF, Fertigation, Spike, Rachis, Floret.

◆◆◆◆◆◆

Effect of bio-agents on the Vegetative and Flowering attributes of gladiolus cultivars under tarai region of Uttarakhand

Aakash Deep Kamboj, B.D. Bhuj, Navneet Pareek, Ranjan K. Srivastava, Satish Chand
Department of Horticulture, College of Agriculture, GBPUA&T, Pantnagar – 263145, U.S.

ABSTRACT

Experiment was laid out in factorial concept of randomized block design (RBD) in open field condition during 2020-21. The objective of investigation was to study the Effect of bio-agents on different cultivar and their interaction effect on plants for quality and agronomic parameters. The medium sized (8-10 cm)of corms were used as experimental material from the four gladiolus cultivars *viz.* “Fortuna”, “Prince of Orange”, “Rose Supreme” and “White Prosperity”, which were treated with different treatments of bio-agent and fungicide *viz.* T_1 (Bavistine @ 0.2%), T_2 (Nativo @ 0.2%), T_3 (*Pseudomonas syringae* @ 3%), T_4 *(Trichoderma harzianum* @ 3%), T_5 in conjoint application of both the organisms(*Pseudomonas syringae* + *Trichoderma harzianum* @ 3%) along with one untreated *i.e.* T_6 (Control). According to findings of present experiment emphasized that most of the vegetative and floralparameters were highly affected by bio-agents.The vegetative parameters like plant height, stem girth, numbers of leaves, numbers of tillers and flowering parameters *viz.,* days to spike initiation and days to flowering, floret size, spike and rachis length, numbers of florets per spike and blooming duration were found to be best with application of bio-agents especially when corms were treated with T_5 (*Pseudomonas syringae* + *Trichoderma harzianum*). On the basis of current findings it can be concluded that the combined use of both bio-agents *Pseudomonas syringae* + *Trichoderma harzianum*to corms would be beneficial for the enhancement of floral characters.

◆◆◆◆◆◆

Effect of different levels of N, P and K fertigation on corm and cormel attributes of gladiolus cv. White Prosperity.

Yograj Kushwaha, B. D. Bhuj, Ranjan K. Srivastava, V.P. Singh, Satish Chand
Department of Horticulture, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

ABSTRACT

The experiment was carried out in randomized block design (RBD) with five treatments and four replications from November 2019 to May 2020 to study the effect of different levels of N, P and K fertigation on corm and cormel attributes of gladiolus cv. White Prosperity. The corms of uniform size were taken. The treatments combinations were T_1&T_2 at same RDFi.e. 300:200:200 kg NPK/ha in different combinations 33.3:33.3:33.3% and 40:20:20% respectively at vegetative, heading and flowering stage and T_3 &T_4 at same RDFi.e. 225:150:150 kg NPK/ha in different combinations 33.3:33.3:33.3% and 40:20:20% respectively at vegetative, heading and flowering stage. In T_5 (control) RDF were applied @300:200:200 kg NPK/ha in which full dose of P&K and two split dose of nitrogen were applied. The crop was raised under uniform cultural condition. The results showed significant differences among the treatments. The maximum number of corms (1.25) was found in T_2. Maximum diameter and weight was found (60.01 mm & 43.30 g) in T_1, while the minimum diameter weight (50.99 mm & 37.75 g) was recorded in T_5 (Control). The maximum number and weight of cormels (49.67 & 28.95 g) were found in T-$_1$, whereas the minimum (13.79) in T_2 and (23.41 g) was in T_5 (control) respectively. On the basis of the present findings, it may be concluded that fertigation is a potential method of applying fertilizer for improved quality at minimal input.

Keywords: Fertigation, Corms, Cormels, Diameter, Weight.

◆◆◆◆◆◆

Influence of severity and time of pruning on fruit yield and quality ofhasta bahar in acid lime

S. R. Patil, A. M. Sonkamble, R. D. Walke, S. M. Bichkule, N. H. Ramteke and R. N. Deshmukh
Post Graduate Institute, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola (M.S.), India

ABSTRACT

An experiment was carried out to evaluate effect of severity and time of pruning on yield and quality of hasta bahar in acid lime in Factorial Randomized Block Design with two factors, time with three levels *viz.*, 1st September, 15th September and 1st October and severity with three levels *viz.*, 5 cm, 10 cm and 15 cm with overall 9 treatment combinations and replicated three times. In time of pruning, pruning at 1st September found significantly superior in regards to average weight of fruit, volume of fruit and length / breadth ratio (Fruit index).While, pruning at 15th September found significantly superior in regards to fruits per tree, yield per tree, fruit juice per cent and TSS. In severity pruning, pruning with 15 cm found significantly superior in regards to average weight of fruit, volume of fruit and length / breadth ratio (Fruit index).While pruning with 10 cm found significantly superior in regards to fruits per tree, yield per tree, fruit juice per cent, TSS and ascorbic acid. Pruning with 10 cm severity at 15th September time was found significantly superior in regards to fruits per tree and yield per tree.

◆◆◆◆◆◆

Vibration to Ensure Better Pollination in Greenhouse Tomato Crop

Pooshpendra Singh Dixit and Dr. C. M. Tripathi
DRI, Krishi Vigyan Kendra, Chitrakoot (U.P.)

ABSTRACT

Pollination is the act of transferring pollen grains from the anther to the stigma of a flower. Tomato is self-pollinating crop, as flower are equipped with both male and female parts. Tomato plant is capable of producing fruits on its own, without the need of planting another one. Tomato (*Solanum lycopersicum* L.) is highly self-pollinated crop but aided pollination of flowers is generally needed in the green house grown tomatoes due to limited air movement and high humidity. In several countries bumble bees are being used as a pollinator for the green house tomato crop. Bumble bees are the perfect pollinators under environmental stress condition (under low and high temperature humidity conditions). But in several countries an electric or battery powered vibrators are being used to vibrate flowers clusters. The vibration will release sufficient pollens which are necessary for pollination. The practice is done twice a day 10.00 to 11.00 AM and 2.0 to 3.0 PM. Flowers are vibrated or shaken every day. Electric vegetable pollination tool/tomato pollinator is a very useful tool to increase the percentage of inseminated flowers, fruits set and improve the tomato yield with good quality fruits.

◆◆◆◆◆◆

Performance of Zucchini (*Cucurbita pepo* L.) in terms of growth and yield as affected by planting dates and spacing levels in Prayagraj (Allahabad) Agro-climatic conditions

Utkarsh Singh[1] and Samir E. Topno[2]
[1]Department of Vegetable Science, College of Horticulture, Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh–173230.
[2]Department of Horticulture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj (Allahabad) – 211 007 (Uttar Pradesh)

ABSTRACT

Summer squash (*Cucurbita pepo* L., 2n=2x= 40), an economically important member of the gourd family, Cucurbitaceae. Trial was conducted in factorial randomized block design with three planting dates and four different spacing during the kharif season of 2018-19, at Horticulture Research Field, SHUATS, Prayagraj, UP. While observing the effect of planting dates, highest vegetative growth & highest number of female flowers was recorded in D_3 21th September whereas, lowest sex ratio in D_2 06th September. Among highest number of fruits per plant, fruit yield per plant, yield per plot and yield per hectare was recorded in D_1 21th August. Among various spacing S_4 (90 x 150cm) noticed significantly highest vegetative growth and highest number of fruits per plant. Whereas, highest number of female flowers, lowest sex ratio, fruit yield per plant, yield per plot and yield per hectare was recorded in S_2 (70 x 90cm). From the present investigation, it is concluded that early planting (D_1 22nd August) combined with plant spacing S_2 (70 x 90 cm) performed better in terms of growth, yield and physical quality. Therefore, based on the result of this findings, it is hereby concluded that combination of treatment S_2 D_2 (70 x 90 cm, 6th September) had the best B:C ratio of 3.79 for the production of zucchini.

Keyword: flowering,planting dates, sex ratio,spacing, yield, zucchini.

◆◆◆◆◆◆

Influence of split application of different levels of NPK through dripfertigationongrowthandfloweringofchrysanthemum

Ashok Choudhary[1 2], Ajit Kumar[1], B.D.Bhuj[1], Ranjan K. Srivastav[1] and Rajesh Choudhary[3]
[1]Department of Horticulture, GovindBallabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand
[2]ICAR-Central Arid Zone Research Institute, *Jodhpur*
[3]Department of Horticulture, SKN Agriculture University, Jobner-Jaipur

ABSTRACT

The experiment was conducted during 2019-20 and 2020-21 at ModelFloriculture Centre, Department of Horticulture, G.B. Pant University of Agriculture andTechnology, Pantnagar. The experiment was laid out in randomized block design with fivetreatments and four replications. The water soluble fertilizer and straight fertilizers wereused which were applied through drip system and soil application. The treatments usedwere NPK @ 100:150:100 kg/ha/year (T_1 i.e. control), NPK @ 100:150:100 kg/ha/year(T_2), NPK @100:150:100 kg/ ha/year (T_3), NPK @ 75:112.5:75 kg/ha/year (T_4) and NPK @75:112.5:75 kg/ha/year (**T_5**). Observationswererecordedonvegetativegrowth andflowering attributes. Results revealed that treatment T_3 was found most superior than other treatmentsand resulted in higher plant height, number of primary branches,number of leaves (181.34) and length of branch. This treatment also showed improvedflowering traits like earliest flower bud appearance (48.24 days), flower bud diameter,numberofflowersperbranch,duration of flowering(47.46days),numberofcutflowersperplant(11.03),numberofcutflowersperhectare(5,26,990.00) andtreatmentT_1recorded minimum valuesof alloftheaboveparameters.

◆◆◆◆◆◆

Precise Technologies can lead to innovative crop management for horticultural crops

M.L. Jat[1], G.S. Rana[2], R.K. Jat[3], Jitendra Singh Shivran[4] and Rajesh Mor[5]
[1&2], College of Agriculture, CCS HAU, Hisar, Haryana 125004
[3] Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Mehsana, Gujarat 384460
[4] College of Agriculture, GBPUA&T, Pantnagar, Uttarakhand 263145
[5] College of Horticulture. MHU, Karnal, Haryana 132001

ABSTRACT

The present techniques provide a perspective on the historical and advanced strategies of information technology and their application in the field of horticulture for improvement. Precision horticulture is a field of study in which growers utilize technology to fine-tune crop production techniques. It assists farmers in determining precisely when and what to plant, as well as what inputs to use, how to control the environment, lighting, irrigation and nutrition for maximum yield and how to monitor the growth of crops by greenhouse bay, zone and bench. It aids in the collection of the site- and plant-specific crop data. Precision horticulture provides farmers with a high return on their crops while minimizing crop inputs. Precision horticulture is also help in reducing environmental impact on horticultural crops and reduces risk of any hazard which causes economic losses of farmers.Accurate data or precise information is essential at all stages of production, from pre-planting to post-harvest. Field production requires location- and time-specific data on the crops, soil, pests, topography and climate. Temperature, humidity, moisture and many other factors all matter during the postharvest period. Previous crop records may provide some insight into this. For the system to function properly, it needs access to additional data in near-real time. The terms “Remote Sensing System,” “Geographic Information System,” “Small Unmanned

Aerial System," "Light Emitting Diode," "Internet of Things," "Automation techniques" Global Positioning Systemall refer to examples of this type of technology. Aspects of precision horticulture help boost productivity and quality, which in turn effectively meet the growing food needs of the world's population.

Key word: Precision horticulture, site and specific data, remote sensing, GPS, GIS, horticultural crops.

◆◆◆◆◆◆

Effect of farmyard manure and nitrogen application on growth of *Ruscus hypophyllum* L. under subtropical conditions of Punjab

Dr. Ranjit Singh, Dhawan Shweta Macchindra and Priyanka Kamboj
Department of Floriculture & Landscaping, Ludhiana, Punjab – 141004, India
College of Horticulture & Forestry, Punjab Agricultural University, Ludhiana, Punjab

ABSTRACT

Ruscus hypophyllum L. is an emerging cut foliage crop which is having high demand in international market, due to its high vase life period. It can be cultivated under various agroclimatic conditions throughout India under 75% shade conditions *i.e.,* under tree canopies (as intercrop with fruits/plantation crops) or shade nets. A study was conducted to investigate the effect of nitrogen application along with farmyard manure. Three combinations of nitrogen *i.e.*, 125kg/ha, 250kg/ha, 375kg/ha was applied along with 25, 50, 75 tonnes of farmyard manure per hectare respectively. The application of 50 kg FYM + 100 g N was found most economical for enhanced yield of cut foliage stem with good and more exhibitable qualities.

◆◆◆◆◆◆

Assessment of Amaranth genotypes for Microgreens production

Basabadatta Sahu and Joydip Mandal
Department of Horticulture and Post-Harvest Technology,
Institute of Agriculture, Visva-Bharati, Sriniketan (West Bengal) – 731236, India

ABSTRACT

Microgreens are an emerging food acclaimed for their freshness and health promoting properties. Different genotypes of amaranth at microgreen stage represents a good potential source of food and nutritional security. An experiment was conducted to study the performance of ten amaranth genotypes (Arka Anamika, Arka Suguna, Rajendra Pusa, White Khada, Chaulai-SBS,Ganga, Jaba Kusum, Lal Kanka, Kosala Red, Danta Ekdala White and White Kosala) for microgreens production at field laboratory in Horticulture farm, Sriniketan. The amaranth microgreens were grown under artificial light condition with an average light intensity of 1900 lux. The amaranth seeds were sown in a 1.5 ft x 2 ft HDPE tray filled with a combination of soilless substrate *i.e.* cocopeat: perlite: vermiculite in 3:1:1 ratio. These genotypes were accessed for plant height, hypocotyl length, leaf area, root length, total yield, fresh weight, dry weight, total chlorophyll and carotenoid content. The study results revealed the presence of significant variation in plant height, hypocotyl length, leaf area, total chlorophyll and carotenoid content. However, no statistically significant variation was observed for total yield, fresh weight and dry matter content. Mean microgreens yield of amaranth was recorded 39.47 g/tray at 11 th day after sowing of seeds. Kosala Red amaranth recorded the maximum plant height (5.92 cm), hypocotyl length (5.81cm) and leaf area (16.33 mm 2). Arka Suguna recorded the highest chlorophyll content (0.307 mg/g fresh leaf) whereas White Kosala recorded the highest carotenoid content (0.49 mg/g fresh leaf). Therefore, studies showed that selection among the amaranth genotypes can be done based on their nutritional superiority.

Keywords: Amaranthus, microgreen, yield, nutrition, carotenoid

◆◆◆◆◆◆

Role of bio-stimulant and auxins (PGR) on growth and yield attributing characters of Strawberry cv.Winter Dawn

C. Bishnoi, Aparjot Kaurand B K Yadav
PAU, Regional Research Station, Bathinda, 151001, Punjab

ABSTRACT

In sustainable agriculture, plant bio-stimulants and plant growth regulator (PGR) are the most effective methods to promote growth and improve crop productivity. The present investigation was to find out the integration effect of auxins and humic acid given separately or in combination on growth, yield and quality of strawberry cv. "Winter Dawn". Different concentration of IBA and NAA (0 ppm, 100 ppm, 200 ppm given foliar) and humic acid (basal + foliar) applied after 30 and 45 days of crop transplanting. Among the different treatments, T_6 (basal dose of HA @ 0.5 % + foliar application of HA @ 0.2 % in combination with IBA @ 200 ppm) recorded the significantly the highest average values with respect to different morphological and yield parameters *viz.*, Plant height (24.6cm), plant spread (21.2 cm), fresh plant weight (50.5 g), number of plant leaves (21.5), crown diameter (13.3 mm), dry weight (14.1 g), fresh fruit weight (11 g), fruit length (40.23 mm) and yield/plant (248 g) when compared with control, whereas, different physiological contributing characters i.e relative leaf water content (90.3%), Chlorophyll a (3.64 mg/ g), Total chlorophyll (5.52 mg/g) recorded highest in treatment T_8 (basal dose of HA @ 0.5 % + foliar application of HA @ 0.2 % in combination with NAA @100ppm). The result showed that cv. Winter Dawn performed well in plant growth and yield attributing characters when humic acid was applied in combination with foliar application of NAA @ 200 ppm.

◆◆◆◆◆◆

Study of zinc oxide nanoparticles fabricated by different extracts

Vishnu Kumar Dwivedi, Navina Wadhwani, R K Shukla and Anchal Srivastava
Department of Physics, University of Lucknow, Lucknow 226007, India

ABSTRACT

Green nanotechnology is an interesting research area as it is an step towards the development of clean technologies aimed at minimizing environmental and human health hazards. Nano- products prepared using such technology are comparatively environment friendly during their entire life besides an increased possibility of exhibiting desired properties. Especially, biologically produced nanomaterials have become an important branch of Nanomaterials with optimum performance in the field of agriculture. In this study, peel extracts of grapefruit (citrus limetta), Lemon (Citrus limon) and orange (citrus reticulate) were used to synthesize the zinc oxide nanoparticles (ZnO NPs) using simple green synthesis process. Zinc acetate dihydrate is used as a precursor with peel extracts. The structural and optical properties of NPs are investigated by X-ray diffraction (XRD), scanning electron microscope (SEM), ultraviolet-visible spectrophotometer (UV-Vis) and Fourier transform infrared (FTIR)spectroscopy. The size range of ZnO NPs prepared from Lemon (Citrus limon) is 6-46 nm,from grapefruit (citrus limetta) is 12-66nm and from orange (citrus reticulate) is 12-42nm. A comparative study is presented in this paper for the ZnO NPs prepared by using three different peel extracts.

Keywords: Green synthesis, peel extract, XRD, nanoparticles

◆◆◆◆◆◆

To Study The Effect of Different Concentration of Indole-3- Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) on Rooting of Firethorn Cutting (Pyracanth crenulata M. Roem.)

Gopal Mani[1] and Rajani Pant[2]
[1]Ph.D Scholar, Department of Horticulture, G.B. Pant University of Agriculture and Technology Pantnagar (U.S. Nagar) Uttarakhand-263145.
[2]SMS Horticulture, KVK Lohaghat, Champavat – 262524, India
gaurgm97@gmail.com

ABSTRACT

Firethorn is a very important species in the forest ecosystem of Uttarakhand Himalaya, locally known as Ghingharu which attains height up to 5 m and found in Kumaun Himalayas between 2000 ft to 7000 ft in chir and banj forest. It is major food source for wild animals. Recently it has been seen that modernization and climate change drawing adverse effect on its habitat. In Uttarakhand it is widely spread in the Nainital, Chamoli, Uttarkashi, Tehri, Almora, Bageshwar, Champawat and Pithoragarh districts. The other common name are Himalayan firethorn, Nepal Firethorn, Nepalese Firethorn, Nepalese White Thorn, Indian Hawthorn, chota seb etc. The present investigation was to propagation technique of Ghingharu (Pyracantha crenulata) through semi hardwood cuttings in mist propagation chamber during 2019-2020. The experiment was allocated within three replications and each replication contained 15 cuttings under a completely randomized design with nine different treatments of IBA and NAA 2000 ppm, 4000 ppm, 6000 ppm, 8000 ppm and control. In this investigation, most of the root and shoot characters of cuttings were significantly influenced by the different treatments of IBA and NAA as compared to control. IBA application of 6000 ppm was found to be the best all the days taken to sprouting, number of leaves per cutting, average leaf area (cm 2), shoot and root length (cm), shoot diameter (mm), fresh and dry weight of shoots (g), number of primary and secondary roots, fresh and dry weight of roots (g), total fresh weight (g), percent rooted cuttings and survival percent of semi hardwood cutting of firethorn.

Keywords: Firethorn, cuttings, IBA & NAA.

◆◆◆◆◆◆

Precise technologies can lead to innovative crop management for horticultural crops

M.L. Jat[1] , G.S. Rana[2] , R.K. Jat [3] , Jitendra Singh Shivran[4] and Rajesh Mor[5]
[1&2] Department of Horticulture, College of Agriculture, CCS HAU, Hisar, Haryana 125004
[3] Department of Fruit Science, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Mehsana, Gujarat 384460
[4]Department of Horticulture, College of Agriculture, GBPUA&T, Pantnagar, Uttarakhand 263145
[5]Department of Fruit Science, College of Horticulture. MHU, Karnal, Haryana 132001

ABSTRACT

The present techniques provide a perspective on the historical and advanced strategies of information technology and their application in the field of horticulture for improvement. Precision horticulture is a field of study in which growers utilize technology to fine-tune crop production techniques. It assists farmers in determining precisely when and what to plant, as well as what inputs to use, how to control the environment,lighting, irrigation and nutrition for maximum yield and how to monitor the growth of crops by greenhouse bay, zone and bench. It aids in the collection of the site- and plant-specific crop data. Precision horticulture provides farmers with a high

return on their crops while minimizing crop inputs. Precision horticulture is also help in reducing environmental impact on horticultural crops and reduces risk of any hazard which causes economic losses of farmers. Accurate data or precise information is essential at all stages of production, from pre-planting to post-harvest. Field production requires location- and time-specific data on the crops, soil, pests, topography and climate. Temperature, humidity, moisture and many other factors all matter during the postharvest period. Previous crop records may provide some insight into this. For the system to function properly, it needs access to additional data in near-real time. The terms “;Remote Sensing System” “Geographic Information System”; “;Small Unmanned Aerial System”; “;Light Emitting Diode,”; “;Internet of Things”; “;Automation techniques”; Global Positioning System all refer to examples of this type of technology. Aspects of precision horticulture help boost productivity and quality, which in turn effectively meet the growing food needs of the worlds population.

Key word: Precision horticulture, site and specific data, remote sensing, GPS, GIS, horticultural crops.

◆◆◆◆◆◆

Transforming Horticulture through Hydroponics: An innovative technology with Precision Agriculture systems

Ankur Agarwal, Om Prakash, Basant Ballabh and Devkanta P. Singh
Defence Institute of Bio-Energy Research (DIBER), DRDO, Haldwani,
Distt Nainital, P.O. Arjunpur, Uttarakhand- 263139, India

ABSTRACT

The challenge to agriculture in coming decades is to provide safe food to ever growing population without destroying natural resources. Himalayan states of India have key role in biodiversity conservation, but these states are also going through important problem of decreasing share of agricultural livelihood and rapidly increasing problem of migration from border villages. Among the various factors reported for migration, few important are depleting productivity from agriculture due to changing climatic conditions, problem of wild animals and search for better livelihood opportunities. Hence, measures are required to increase the livelihood opportunities in these border areas to curb the problem of migration through intervention of modern technologies. Among these technologies, soil-less cultivation (hydroponics) have shown potential for sustainable agriculture in varying environments. Most of the time due to topographical challenges it is not possible to codon the farm area with fencing and thus make it vulnerable to attack by stray and grazing animals vis-à-vis wild animals. Secondly, possibility of vertical farming allows farming in a compact area with substantial water saving due to reuse and recycling and hence dependency on rain can be minimized for farming. Another important feature this technology has offered is production of safe fresh food without residual toxicity. Defence Institute of Bio-Energy Research (DIBER), DRDO has successfully standardized and customized technology of cultivation of multiple vegetable crops *viz.*, leafy vegetables (lettuce, spinach, coriander, parsley, pakchoy, oregano, lahi); fruit vegetables (tomato, cucumber, brinjal, capsicum, broccoli, strawberry, bitter gourd, sponge gourd, etc) and root vegetables (beet root, turnip and radish) under single nutrient solution. This customized hydroponics technology allows cultivation of mora than 10 vegetables simultaneously under single nutrient system thereby ensuring year round vegetable cultivation with higher yield. In comparison to conventionalagriculture, hydroponics technology allows vertical utilization of space, water saving to the tune of 80% and near to zero use of pesticide and weedicides, thus ensuring no residual toxicity. This technology also makes it possible to use collected rain water as the requirement for water is low. The entire system is low cost, low maintenance and environment friendly. The institute has also developed a suitable nutrient composition suitable for wide range of vegetables. The article deals with the hydroponics technology in detail vis-à-vis efforts made at DIBER for standardization of hydroponics technology.

◆◆◆◆◆◆

Studies on planting space of tomato crop (*Solanum lycopersicum*) in Chhattisgarh

[1] Puneshwer Singh Paikra and [2]Vikas Ramteke
[1] Late Dr. RCSD CARS, Korea, IGKV, Raipur (C.G.) – 497335, India
2 SG CARS, Jagadalpur, IGKV, Raipur (C.G.) India
Email: puneshwersinghpaikra@gmail.com

ABSTRACT

Tomato is one of the vegetables with its highest production in C.G. and growers used as a source of income due to its cash value nature. In tomato cultivation inappropriate spacing is one of the major problems at the study area. A ûeld experiment was conducted to determine inter and intrarow plant spacing for yield and yield components of tomato at Farsakani Farm, College of Agriculture & Research Station, Kunkuri, Jashpur under irrigation condition. The treatment comprises of three intrarow spacing (10, 20 and 30 cm) and three interrow spacing (40, 60 and 80 cm) replicated three times and arranged in randomized block design using tomato variety Kanshi Adarsh. Data collected on fruit yield and yield components were analysed. The main eûect of interrow spacing signiûcantly aûected marketable fruit, unmarketable fruit, marketable fruit number, unmarketable fruit number and fruit diameter. Planting tomato in interrow spacing (60 cm) and 20 cm intrarow spacing resulted in 50% yield increment than the widest (80 cm) space between rows 40 cm intrarow spacing and very closer spacing 40cm interrow spacing and 10 cm intrarow spacing. The present result indicates that determinate tomato type can produce higher total and marketable fruit yield under narrowly spaced plants 60x20 cm. Tomato (Kanshi Adarsh) growers around the study area can be benefited if they use narrow spacing (30 cm intra and with 60 cm inter-row spacing).

Keywords: Tomato, intra-row spacing, inter-row spacing, yield

◆◆◆◆◆◆

Effect of Foliar Application of Humic Acid and Seaweed Extract in Strawberry (*Fragaria* × *ananassa* Duch.)

Binayak Chakraborty and Satyananda Basak
Regional Research Station (Terai Zone), Directorate of Research, Uttar Banga Krishi Viswavidyalaya, P.O. Pundibari- 736 165, Cooch Behar, West Bengal

ABSTRACT

An investigation was carried out to evaluate the effect of foliar application of humic acid (HA) and seaweed extract (SE) on growth, yield and quality in strawberry. The HA and SE were applied as foliar sprays individually (1.0 ml l -1 and 2.0 ml l -1) as well as in combination to the strawberry plants (cv. Camarosa and Nabila) starting from one month after planting of uniform runners to 120 days after planting at 15 days interval. The plants which received foliar spraying of water were treated as control. The experiment consisted of nine treatments and three replications. The experiment was laid out in Factorial Randomized Block Design. The results indicated that foliar spraying of 2.0 ml l -1 HA + 1.0 ml l -1 SE significantly increased the plant spread, number of leaves, number of crowns, leaf area, length of petiole, number of runners, number of flowers, number of fruits, fruit weight and fruit yield over control plants, irrespective of strawberry cultivars. However, fruits with significantly the highest total soluble solid, ascorbic acid and total sugar and lowest titratable acidity content were recorded with the foliar application of 2.0 ml l -1 HA + 2.0 ml l -1 SE. The strawberry cultvar Camarosa exhibited the highest number of leaves, flowers and fruits per plant. This cultivar also registered better fruit yield

and quality than the strawberry cultivar Nabila.

Keywords: Humic Acid, Sea Weed Extract, Foliar Application, Strawberry

◆◆◆◆◆◆

Effect of pinching and growth regulators on yield, quality and marketability of kiwifruit (*Actinidia deliciosa*) cv. Allison

Kamal K. Pande[1] , H.C. Joshi1, N. K. Singh1 and D. C. Dimri[2]
[1]Krishi Vigyan Kendra (ICAR-VPKAS), Kafligair- 263628,Bageshwar, Uttarakhand
[2]Department of Horticulture, GBPUAT, Pantnagar, Udham Singh Nagar, Uttarakhand

ABSTRACT

An investigation was conducted by KVK, Bageshwar during 2019 at Sama village of Kapkot block of district Bageshwar to find out the suitability and efficacy of different crop regulating options of kiwifruit in farmer's perspective. The prime purpose of the study was to increase the yield of A grade fruits to maximize the returns. Four treatments (T1- No pinching and no use of PGRs, T2- Pinching 20 percent growth at petal fall that continued till harvest at one month interval, T3- T2 + Fruit dipping at 20 DAFB in 50 ppm GA3 solution for 5 second, T4- T2 + Fruit dipping at 20 DAFB in 50 ppm 2,4 D solution for 5 second) were applied for the assessment of various technologies. Pinching of 20 percent shoot growth at petal fall stage that continued till harvest at one month interval was found most appropriate. This practice gave 24 kg A grade fruits (>70 gm) per vine, 17 kg B grade fruits (50-70 gm) per vine and 7 kg C grade fruits (<50 gm) per vine, while the farmer's practice (no pinching) resulted in 6 kg A grade fruits (>70 gm) per vine, 13 kg B grade fruits (50-70 gm) per vine and 21 kg C grade fruits (<50 gm) per vine. The total soluble solid content (TSS0B) of fruits from pinching treatment was also higher (16.10 0B) than the fruits from no pinching vines (14.95 0B). Use of GA 3 (50 ppm) and 2,4 D (20 ppm) as fruit dip method at 20 days after full bloom (20 DAFB) could not further increase the grade A and B fruit yield significantly over pinching alone. Thus, Pinching of 20 percent shoot growth at petal fall stage that continued till harvest at one month interval is recommended for obtaining maximum quantity of "A"grade fruits that will successfully compete in market for better price.

◆◆◆◆◆◆

Effect of Gibberellic Acid And Boron on Development and Quality of Aonla Fruits Banarasi

Bhawna Singh[1], Bhanu Pratap Singh[2] , Prachi Madhur [3] and Akhil Kumar Chaudhary[4]
[1,3]PG Student, [2]Professor, [4]Ph.d Student
[1,2,3] Department of Fruit Science, [4]Department of Vegetable Science
Acharya Narendra Deva University of Agriculture & Technology Kumarganj, 224229, Ayodhya(UP)

ABSTRACT

Aonla or Indian gooseberry (Emblica officinalis Gaertn.), a member of family the Euphorbiaceae, is one of the indigenous minor fruits of India. It thrives well throughout tropical as well as sub-tropical regions of India. The fruit is highly nutritive and the richest source of ascorbic acid after Barbados cherry. Fruits are made into preserves, jam, pickles, candy, sauce, dried chips, powder, etc. In order to investigate the effect of gibberellic acid and boron on aonla fruits 'Banarasi'. There were in all 15 treatment combinations comprising borax at three levels (0, 0.2 and 0.4%) and GA 3 at five levels (0, 50, 100, 150 and 200 ppm), applied as foliar spray on 1

August, replicated thrice in randomized block design taking a single plant as a unit treatment. From this experiment, it was concluded that among borax concentrations 0.4% proved most effective in increasing the length (4.64 cm), diameter (4.96 cm), weight (47.46 g), volume (43.62 cc), TSS (10.75°Brix), total sugar (8.75%), ascorbic acid (582.8 mg per 100 g of pulp) and reduced titratable acidity (2.14%); whereas among GA3 concentrations, application at 150 ppm increased the length (4.74 cm), diameter (5.11 cm), weight (48.26 g), volume (44.24 cc), TSS (11.21ºBrix), total sugar (9.07 %), ascorbic acid (596.66 mg per 100 g of pulp) and reduced titratable acidity (2.04%). The combined application of B at 0.4% and GA 3 at 150 ppm recorded maximum length (4.86 cm), diameter (5.14 cm), weight (48.60 g), volume (44.45 cc), TSS (11.50ºBrix), total sugar (9.32%), ascorbic acid (605 mg per 100 g of pulp) and minimum titratable acidity (2.01%).

◆◆◆◆◆◆

Approaches to Mitigate Abiotic Stresses using Grape Rootstocks

R.G. Somkuwar , Kiran P. Bhagat, Prashant Nikumbhe and Nishant A. Deshmukh
ICAR- National Research Centre for Grapes, Pune- 412307

ABSTRACT

Climate Change is a complex phenomenon with a wide range of unpredictable impacts on the environment. Abiotic stresses imposed through changing climate cause modifications in soil-plant-atmosphere continuum and are responsible for reduced yield in several major crops. Grape (Vitis vinifera L.) is one of the major fruit crops in India which is majorly hampered by various abiotic stresses. However, stresses are not necessarily a problem for plants because they have evolved effective mechanisms to avoid or reduce the possible damages. Therefore, selection of an ideal grape rootstock is an essential criterion to fetch an attractive yield in grapes. To establish the vineyard, different rootstocks are being used extensively as it provides a platform for manipulation of a broad range of vine characteristics which can consequently improve vineyard efficiency. The use of suitable grape rootstocks for raising vineyard became an imperative selection due occurrence of soil salinity, drought and declining productivity. The uses of rootstocks have recently gained importance as the only effective and successful strategy to combatabiotic and biotic stresses in major grapegrowing countries worldwide. However, the choice of specific rootstock is becoming increasingly difficult as a result of the availability of numerous new rootstocks. A rootstock found to be beneficial for one cultivar may not be universally advantageous for others, as the interaction of stock and scion influence the vine performance more than the stock scion alone. Rootstocks perform differently with different soils and climates and thus, regional rootstock evaluations are essential indetermining which rootstock is best suited to a particular environment. Rootstocks have been selected to confer a wide range of other traits for grapevine improvements. In the tropical and subtropical climate of India, Dogridge induced more vegetative vigour in the scions, which reduced the bud fruitfulness of Thompson Seedless in the long run. In this context, there was an increased demand for an alternative rootstock that would be suitable for Thompson Seedless in the tropical and subtropical climate of the Indian subcontinent. Another grape rootstock *i.e.*, 110-R which is alternative rootstock to the present Dogridge was introduced to overcome these problems. Though, a rootstock found to be beneficial for one cultivar may not be universally advantageous for others, as the interaction of stock and scion influences the vine performance more than the stock or scion alone. In addition, rootstocks are known to influence the growth pattern of scions after grafting and some may even induce resistance to diseases by variousphysiological and biochemical changes in grafted vine.

Keywords: Abiotic stresses, Canopy management, Grapes, Scion and rootstocks, Vineyard

◆◆◆◆◆◆

Botanical descriptors of Water Chestnut (*Trapa natans* var bispinosa L.): A potentialcrop for Sustainable Horticulture

Munni Gond[1], Tinku Nagar[1] and Deepa H. Dwivedi[1]
[1]Department of Horticulture, Babasaheb Bhimrao Ambedkar University,
Lucknow, Uttar Pradesh- 226025, India

ABSTRACT

Trapa natans var bispinosa L. (water chestnut) is known as singhara or paniphal in India, belonging to family Trapaceae. It is an annual, aquatic, herbaceous, angiosperm nut crop, a free-floating plant which grows in shallow water fields, ponds, wetlands or swampy land. The crop has potential as an alternative source of nutrition which can be grown in waterlogged soils. It originated in Europe, Asia and Africa and is a rich source of phytometabolites. Different genotypes from different locations in Uttar Pradesh were collected and their vegetative characterization was done at the Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, to develop the botanical descriptors through herbarium. Anatomical study of the various parts of the plant were also undertaken. The main root system adheres in muddy soil providing anchorage to the plant. The green, aerial, adventitious roots are of assimilatory nature and contain chlorophyll. The stem of Trapa is 1 to 5 m long, flexous and ascending in nature which produces ten to fifteen terminating rosettes. The plant produces floating, hydrophytic and spongy leaves, arranged in a rosette. Leaf shape was found rhombic to rhombic ovate, rhombic deltoid and even fan shaped in some morphotypes. Inflorescence is inconspicuous, solitary, axillary and pedicillate bisexual flowers, white in colour, were found in axil of surface leaves. The flowers are cross pollinated in nature. The fruit of water chestnut are red and green in colour and bear large fruits having spines. The variety T. natans var. natans is four spined while T. natans var. bispinosa has a two spined fruit . The delicious fruit is a one seeded, top shaped drupe, with fleshy pericarp and covers a large two or four horned stony endocarp. The kernels of fruit are delicious to eat and are rich in phytonutrients. Transverse sections of the various parts of the water chestnut plant show the presence of large air chambers in the spongy tissue, vacoules or air spaces in the cortex which are helpful in helping the plant to float on water. Water chestnut is a potential crop for the waterlogged soils and thus, important for sustainable horticulture under the changing climatic patterns

Keywords: Trapa, aquatic, root, rosettes, leaves, flower, fruits.

◆◆◆◆◆◆

Effects of nitrogen sources on soil characteristics and fruit production in apricot orchards

Mohammad Ashaq Kuchay, D P Sharma, Bhawna Kaushal
Department of Fruit Science, Dr. YSP University of Horticulture & Forestry, Nauni,
Solan, H.P, India

ABSTRACT

Nitrogen is the primary nutrient, which is often deficient for crop production in sandy loam soils. For this region, maintaining nitrogen levels is crucial to substantial economic returns for apricot growers. In the experiment, four forms of nitrogen sources like calcium ammonium nitrate, calcium nitrate, urea and vermicompost were included to optimise the yield without deteriorating the soil quality. The 20% reduction in chemical fertilizers managed with vermicompost improved the productivity of apricots (1.15, 2.13 kg per unit area) in the 2017 and 2018 years of study, respectively. However, yield efficiency improved from 0.13 kg cm -2 in 2017 to 0.25 kgcm -2 in both years of the study. Furthermore, the application of high rates of vermicompost in conjunction with low

rates of N-chemical fertilisers resulted in an increase in soil pH (7.29 and 7.33), organic carbon (1.51 and 1.52%), available N (321.00 and 319.67 kg ha-1), available P (25.23 and 25.94 kg ha -1), available K (203.37 and 207.67 kg ha -1), urease (222.05 g NH4 + g -1 soil h -1), dehydrogenase (2.78 µg TPF g -1 soil h -1), acid phosphatase (8.50 µg P-nitrophenol g -1 soil h -1) and alkaline phosphatase activity (11.17 µg P-nitrophenol g -1 soil h -1). It was concluded that the treatments that provided 80% N in the form of urea and calcium nitrate along with 20% N in the form of vermicompost improved soil quality and apricot production.

Keywords: nitrogen, soil characteristics, vermicompost, production

◆◆◆◆◆◆

Role of Zn and Ti Nano- fertilizers on sustainable agriculture

Razauddin, Sutanu Maji, Maya Ram and Ramesh Chand Meena
Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India-226025

ABSTRACT

Nano-fertilizers have nano scale size with large surface area, capacity to encapsulate nutrients and have higher mobility, which may increase plant nutrient access and crop yield and thus, are regarded as deliverable 'smart system of nutrients'. It is required in very small amount, for example 500 ml nano-urea would able to replace 45 kg of urea and only 10 g of nano-zinc would be sufficient for a hectare of land and thus, help in reduction in the requirement of chemical fertilizers by 50% - 70% as stated by the Indian Farmers Fertilizer Co-operative Limited (IFFCO). Among the various plant nutrients, Ti and Zn are the most important and widely used for plant growth and development. Ti is the second most abundant transition metal, after iron (Fe), about 5 times less than Fe and 100 times greater than Cu, however, plays an important role in plant metabolism and promotes absorption and activity of some other nutrient elements and thereby improve biomass of plant, increase chlorophyll content in tomato, ascorbic acid and capsanthin in pepper, N concentration, photosynthesis rate. However, lower concentration of TiO 2 can increase the seed germination and growth of seedling in comparison to high concentration. It also provides various biotic and abiotic stress= tolerance to plants. Similarly, Zinc oxide nano particles (ZnO-NPs) stimulates seed germination and plant growth as well as disease suppression and plant protection by virtue of their antimicrobial activity. It also reduces Cd toxicity by studying the growth, photosynthesis reactions, antioxidant system, oxidative stress and protein content. ZnO-NPs helps to induce an upregulation of antioxidative enzymes which protect the photosynthetic apparatus in plants and thereby, improves general performance of plants. Nanotechnology has the potential to revolutionize agricultural systems, biomedical, environmental engineering, safety and security, water resources, energy conversion and many other fields.

◆◆◆◆◆◆

Diversification Strategies for Hill Agriculture: Role of Off- season Vegetable Cultivation

Ankush chaudhary[1] , Anuj Sohi[2] and Parul Pathania[3]
Department of Vegetable Science, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, H.P. (173230)

ABSTRACT

Agriculture plays an important role in the economy of Himachal Pradesh, 67 per cent of the total population dependent on it for its livelihood. Only 11 per cent of the total geographical area is available for agriculture, out of

which 80 per cent is rain-fed and the holdings are small and scattered. Despite these barring factors, the climate of the state is congenial for the cultivation of many off-season vegetables, horticultural and floricultural crops, especially in the hilly regions of Kullu, Solan and Shimla. In Kullu district, the acreage of cereal crops has declined from 59 per cent to 5 per cent but has been recompensed by vegetable crops over a period from 1990-91 to 2002-03. In Himachal Pradesh, several vegetables grown in the summer season and kharif season are harvested at a time when they can not be produced in the plains. There is a large scope for crop diversification through vegetables and other farm enterprises in the region due to wide variety of agro-climatic conditions and soil types that enable the cultivation of various vegetables crops. It is recommended as an effective strategy in raising incomes, generating employment opportunities and alleviating poverty among small and marginal households. Another potential approach is perfection and promotion of protected cultivation of vegetables. Off-season vegetable production and marketing is the most profitable farm business giving very high production and income to farmers per unit area of land. The cultivation of crops outside the regular cropping calendar when supply is low and prices are high can give farmers better profits and consumers more choice. However, off-season production may increase pesticide risk if crops are more affected by pests and diseases and farmers do not handle pesticides correctly. In the absence of storage infrastructure and vegetable processing industry in the country, off-season vegetables farming is the only viable option that can add value to the farmer produce.

◆◆◆◆◆◆

Assessment of Economic Importance and Adequacy of Agromet advisory services for capsicum crop of Tarikhet Block in Almora district

Mukta Nainwal[1] and Renu[2]

[1]Subject Matter Specialist Agrometeorology, Krishi Vigyan Kendra, Almora

[2]Subject Matter Specialist Horticulture, Krishi Vigyan Kendra, Almora

ABSTRACT

The study was conducted by Krishi Vigyan Kendra, Almora during 2022 in the adopted village Billekh and nearby villages to assess the importance and usefulness of Agromet Advisory Services in village level under DAMU Pantnagar. The selected crop was capsicum which is very beneficial crop for this study area. The aim of the study was to check the importance of advisory services and economic impact on the crop using Agromet Advisory Services. District Agromet Units (DAMU) established in Krishi Vigyan Kendra by joint program of IMD (India Meteorological Department) and ICAR (Indian Council of Agricultural and Research). The services provide in twice a week on Tuesday and Friday. The warning and crop related advisory,included cultural practices also include in the advisory. The main mode of dissemination of advisory through whatsapp group which is created at block level and cover more villages of related block. There are eleven blocks in the Almora district. The study area comes under Tarikhet Block with latitude 29.622 æ% N and longitude 79.394 æ% E of Almora. The assessment was based on the dynamic feedback to come at using of Agromet Advisory Service by farmers. The farmers those with Agromet advisory (AAS farmers) benefited by timely and appropriate application of fertilizers, accurate weather forecasting with warnings and timely agricultural operations for better yield in capsicum crop as compared to those who get not received Agromet advisories (Non AAS farmers). Agromet Advisory Services will be very beneficial to the farmers in adopting the crop cultural practices with changing weather. Farmers will get benefit with locally available data of their block with accurate management practices. The farmers will reduce the input cost in agriculture and get more profit in terms of yield and production by adopting weather based agroadvisories.

Keywords: AAS (Agromet advisory services), IMD (India Meteorological Department), DAMU (District Agromet Units), Capsicum

◆◆◆◆◆◆

Hydroponics vegetable production: Present Status, Techniques and Future Prospects

Anuj Sohi[1] , Ankush Chaudhary[2] and Parul Pathania[3]
Department of Vegetable Science, Dr. Y.S. Parmar University of
Horticulture and Forestry, Nauni, Solan, H.P. (173230)

ABSTRACT

With the advent of civilization, open field/soil-based agriculture is facing some major challenges; most importantly decrease in per capita land availability. In 1960 with 3 billionm population over the World, per capita land was 0.5 ha but presently, with 6.8 billion people it is only 0.25 ha and by 2050, it will reach at 0.16 ha. Due to rapid urbanization and industrialization as well as melting of icebergs (as an obvious impact of global warming), arable land under cultivation is further going to decrease. Again, soil fertility status has attained a saturation level and productivity is not increasing further with increased level of fertilizer application. Besides, poor soil fertility in some of the cultivable areas, less chance of natural soil fertility build-up by microbes due to continuous cultivation, frequent drought conditions and unpredictability of climate and weather patterns, rise in temperature, river pollution, poor water management and wastage of huge amount of water, decline in ground water level, etc. are threatening food production under conventional soil-based agriculture. Under such circumstances, in near future it will become impossible to feed the entire population using open field system of agricultural production only. Naturally, soil-less culture is becoming more relevant in the present scenario, to cope-up with these challenges. In soil-less culture, plants are raised without soil. Improved space and water conserving methods of food production under soil-less culture have shown some promising results all over the World.

◆◆◆◆◆◆

Vegetable Microgreens : A Novel Approach for Nutritional Diversification

Parul Pathania[1] , Anuj Sohi[2] and Ankush Chaudhary[3]
Department of Vegetable Science, Dr. Y.S. Parmar University of
Horticulture and Forestry, Nauni, Solan, H.P. (173230)

ABSTRACT

As the world's population increasing at a rapid speed, food system must be revised to supply adequate nutrition while minimizing environmental impact. Thus, microgreens are a new specialty crop which are gaining popularity these days. They are tenuous cotyledonary leafy greens of many vegetables, spices and herbs that are found in variety of colours, textures and flavours, which are harvested at infancy stage. Microgreens are edible seedlings, consumed when they have two fully developed cotyledon leaves. They are baby plants, 2.5 to 7.5 cm in height, usually harvested within 7-14 days after germination.They belong to class of functional foods. They are dense source of many nutrients such as minerals, vitamins and antioxidants which are potential to prevent many diseases and deficiencies when consumed in small quantity. Microgreens may contain 4-40 times the amount of nutritional compounds as the mature vegetable plant. They can be the best alternative to cater malnutrition Microgreens can be easily cultivated and it takes minimum resource demands *i.e.* water, soil and pot or tray. Commonly grown microgreens are mustard, spinach, beetroot, lettuce, cilantro, cabbage, radish and broccoli. However, microgreens perish fast, therefore need to be produced in sufficient quantity in a sustained manner to ensure availability. Microgreens are an emerging aspect of agribusiness sector and there is a good scope for future research in this area due to increase in its demand and consumption among health conscious people.

◆◆◆◆◆◆

Economic assessment of High-Density Apple cultivation and selection of suitablevarieties under agroclimatic conditions of Almora district in Uttarakhand

Renu[1] and Mukta Nainwal[2]
[1]Subject Matter Specialist, Horticulture, KVK, Almora
[2]Subject Matter Specialist, Agrometeorology, KVK, Almora

ABSTRACT

Apple (Malus x domestica Borkh.) holds an important position in the fruit industry of Indian Himalayas as it accounts for about 2.05 % in total world apple production and 2.36 %of the total fruit production of the country. India is the fifth largest producer of Apple in the world with area of 0.308 million hectares and production quantity of about 2.316 million tons of which about maximum 70.54 % comes from Jammu and Kashmir and only 2.66 % comes from Uttarakhand that varies from year to year as the crop is highly sensitive to weather conditions. So, there is a need to practicing farmers for innovative production technology. Climate also plays a crucial role as apple experience 1,000-1,500 hours of chilling (the no. of hours during which temperature remains at or below 7 0 C during the winter season). The present investigation of apple cultivation under High Density Plantation of commercially important varieties having demand in domestic and international market was recorded at Billekh village of Almora district of Uttarakhand in seven year old orchard. High density plantation is a very remunerative enterprises that increases the plant population per unit area of land to increase the number of fruits and helps the farmers to overcome the problems like lowproduction, productivity and the long gestation period for the early returns. The Plantation was done at 3x1m spacing, thus total no of plants in a hectare were 3333 including 30 per cent pollinating varieties such as Golden Delicious, Red Gold , Granny Smith, Red Lumgala etc. The produce was sold in the Delhi markets and received premium price ranging from Rs. 7000 to 8250 per quintal. The gross cost varied from Rs. 14.00 to 20.56 lacs per hectare. According to an assessment maximum Net Income received from Granny Smith variety and minimum was in Super Chief. Accordingly, B: C ratio ranges from 2.86 to 3.33.

Keywords: Apple, Economics, Variety, Granny Smith, Net return, Gross income

◆◆◆◆◆◆

Effects of deficit irrigation and mulching on soil properties and soil microbial population in VNR Bihi guava

Rajkumar Jat, Vijay Pratap Singh, Ratna Rai, Maneesh Kumar and Jitendra Singh Shivran
Department of Horticulture, G.B. Pant University of Agricultural and Technology, Pantnagar (Uttarakhand)- 263145, India

ABSTRACT

Deficit irrigation in many horticultural crops has frequently proved to be an efficient tool for improving water-use efficiency. A field experiment was conducted during two consecutive years (2019-2020) in a commercial 5-year-old guava orchard at Horticulture Research centre, G.B.P.U.A.T Pantnagar (U.K.) to examine effects a deficit irrigation and mulching on soil properties and soil microbial population which included three irrigation strategies: severe deficit irrigation (DI50), moderate deficit irrigation (DI75) and full irrigation (FI100), as well as four mulching methods: silver-black mulch (MSB), black mulch (MB), organic mulch (MOM) and a control without mulch (MWM). The results showed that maximum availability of soil NPK, soil fungal and bacterial population of the rhizosphere of guava trees increased with an increase in the irrigation regime. Average soil

temperature was raised by 2.26 °C in 2019-20 and 2.24 °C in 2020-21 in black plastic mulch as compared to without mulch treatment. Moreover, the maximum soil available N, P and K, total bacterial and fungal count was found to be greater in the organic mulched soil followed by silver-black mulched soil and minimum was recorded in unmulched soil during both the years of experimentation.

Keywords: Deficit irrigation, mulching, soil temperature and soil microbial population

◆◆◆◆◆◆

Bioreactors: A Rapid Approach for Mass Propagation of Ornamental Plants

Shantesh Ramesh Kamath 1 and Namita 2 and M. K. Singh 3
Division of Floriculture and Landscaping, ICAR- Indian
Agricultural Research Institute, New Delhi, 110 012

ABSTRACT

Bioreactor is a system in which tissues or organisms are cultivated in a mechanical vessels with the liquid nutrient media under controlled environment. Conventional propagation from tissue culture techniques are still expensive and typically labour intensive method with low multiplication rate. Large scale culture of plant tissue, cell and organ using bioreactor system provide feasible approach in terms of reduction of production cost and labour activity due to possibility of automation. Bioreactor design has been primarily developed for specific requirement of embryogenic or organogenic suspensions by providing optimum growth condition. Several factors such as medium pH, temperature, dissolved oxygen, agitator speed, redox potential, CO 2 concentration and medium component influence the biomass production. Different bioreactor systems like shaking and nonshaking batchculture, temporary immersion system, bubble bioreactor, continuous and discontinuous gassing bioreactor can be used. The use of bioreactor for micropropagation was first reported in 1981 for Begonia propagation. Since then it has proved applicable plant propagation system for many ornamental plants like Lilium, orchid, gladiolus, narcissus, Chrysanthemum, cyclamen, Spathiphyllum, Ornithogalum, Boston fern and Nerine and plant organ including bulbs, bulblets, shoots, microtubers, corm and somatic embroys. The use of plant cell cultures is focused on the production of valuable natural products such as pharmaceuticals, nutraceuticals, flavours and fragrances. The use of bioreactors has led to development of rapid and efficient technology suitable for plant micropropagation but as yet are not fully exploited commercially for ornamental crops. Further basic and applied research can provide the information necessary for an efficient and economic use of bioreactors for ornamental plant propagation.

Keywords: Bioreactor, Nutrient media, Micropropagation, Ornamental

◆◆◆◆◆◆

Utilization of steel slag in horticultural crops

Alok Singh Jayara[1] , Rajeew Kumar[1], Priyanaka Pandey[2] and Ram Pravesh Rajbhar[1]
[1]Department of Agronomy, [2]Department of Molecular Biology and Genetic Engineering,
G. B. Pant University of Agriculture & Technology, Pantnagar-263145, U.S. Nagar, Uttarakhand

ABSTRACT

Steel slag is an important by product of steel industry. The average generation of steel slag is 150-180 kg per ton of steel produced and total generation of steel slag is estimated as 39mT in 2017-18. The major elemental composition of steel slag includes silicon, calcium, magnesium, phosphorus, iron, manganese and sulphur which

can pave way for the development of cheaper source multinutrient fertilizer in horticultural crops. The steel slag application has also resulted in the increased silica content in the treated fruit crops, thus can serve as effective silica fertilizer. The horticultural crops extend to 2.5 mha of the acidic soils in India. Steel slag can also serve as alternate liming agent in these acidic soils which is significant constraint in growing of horticultural crops. Steel slag can also prove effective in immobilization of heavy metals like cadmium and reduces its bioavailability to the crops especially vegetable crops which are more vulnerable to their accumulation. Steel slag is reported to increase the fruit quality in horticultural crops. In addition, there has been reduction in the disease incidence in fruit and vegetable crops with the application of steel slag owing to its silica content. However, there are potential drawbacks associated with its utilization including its chromium content and high pH which can cause overliming of soil.

Keywords: steel slag, multinutrient, silica, liming, heavy metals, fruit quality, disease incidence

◆◆◆◆◆◆

Gamma radiation and the surface edible coating have an impact on the litchi cv. Rose Scented to improve the fruit quality and shelf life

Nikesh Chandra[1] , Satish Chand[2] , Ranjan Srivastava[3] , Omveer Singh[4] , Vijay P. Singh[6] , Rajesh Kumar[6] and Sudhir K. Guru[7]

[1]Ph. D Scholar in Fruit Science, [2]S.R.O. Horticulture, [3,4,5] Prof. Horticulture,
[6]Assoc. Prof. Horticulture, [7]Prof. Plant Physiology
(G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand 263145)

ABSTRACT

The litchi fruit is the most important Sapindaceae (soapberry) family member and themost famous fruit suited for human eating. Its botanical name, *is Litchi chinensis*Sonn.. Researchers and businesses are under pressure to create cutting-edge techniques forpreserving fruit quality and prolonging shelf life because of the rising demand for fresh fruits.Fresh fruits without chemicals that are of the highest quality and nutritional worth are in high demand worldwide. Fruits and vegetables have been heavily treated with irradiation to extend their shelf lives and maintain quality standards while being stored. The permitted dose of up to 10 kGy during food processing has been approved by the joint expert committee of the FAO, IAEA and WHO because it has no harmful effects on microorganisms or nutrition . Aloe vera, sometimes known as a “medicinal plant” is well-known for its numerous medicinal benefits. Aloe arborescence and Aloe barbadensis are the two most widespread species. In the current study, it was attempted to increase the shelf life of litchi cv Rose Scented fruit using integrated gamma radiation and aloe vera gel treatments. The samples with the best shelf life overall were 20 days at 4 °C for 1 kGy irradiated samples and 50% aloe vera gel, respectively (shelf life at ambient temperature without any treatment being 3–4 days). To determine whether the stored litchi samples were acceptable, several biochemical parameters were examined and an organoleptic evaluation was performed. It was discovered that the radiation dose of 1 kGy and 50% aloe vera gel was the ideal dose for extending shelf life without degrading various quality attributes.

Keywords: Litchi chinensis Sonn, Gamma radiation, organoleptic, quality, post-harvest.

◆◆◆◆◆◆

In vitro approaches for vegetable crop improvements

Vinay Kumar, S. K. Maurya, Arjun Singh, Priyanka and Nikesh
[1,2,4] Department of Vegetable Science, [5]Department of Horticulture, G .B .Pant University of Agriculture and Technology, Pantnagar, US Nagar, Uttarakhand, India, Pincode-263145.
[3,]College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh

ABSTRACT

Plant tissue culture refers to growing and multiplication of cells, tissues and organs of plants on defined solid or liquid media under aseptic and controlled environment. The commercial technology is primarily based on micro-propagation in which rapid proliferation is achieved from in system cuttings, axillary buds and to a limited extent from somatic embryos, cell clumps in suspension cultures and bioreactors. The technique of hybrid production through fusion of isolated somatic protoplasts (plant cell without cell wall) under in vitro conditions is known as somatic hybridization. In potato somatic fusion helps to determine the aphid resistance, virus resistance and late blight resistance line. In embryo culture, young embryos are removed from developing seeds & are placed on a suitable nutrient medium to obtain seedlings. Embryo culture used to avoid overcoming incompatibility barriers in species for example embryo culture used to avoid overcoming sterility and unilateral incompatibility of Solanum lycopersicum × S. sitiens hybrids. Embryo rescue have great success for gene transfer from one species to another for example- embryo technique used for transferring the gene from Solanum lycopersicum to S. peruvianum and S. pimpinellofolium. The confirmation of hybridity of the embryo rescued plants from the interspecific crosses (S. lycopersicum var. MT-3 and S. lycopersicum var. Kashi Amrit with S. peruvianum (WIR-3957) was done using RAPD markers. Tissue culture is one of the most important parts of applied biotechnology. In the coming decades the world's population will increases more and accommodation space, agricultural lands will decrease significantly global climate change is also another consideration. Keeping these in mind we must ensure a peaceful, healthy and hunger free greener world for our next generation.

◆◆◆◆◆◆

Influence of Different Levels of Irrgation on Morphological Attributes and Yield of Mango tree cv. Langra.

Suman Kumari, Ravindra Kumar, Kumari Karuna, kumara Madhumala, Karanjeev Kumar, Ankur Kumar Rai, Roopendra Kumar Kumari Nandita, ,
Department of Horticulture (Fruit & Fruit Technology)
Bihar Agricultural university, Sabour, Bhagalpur -813210

ABSTRCT

Water is one of the most essential factor for cultivation of any crop. Artificial application of quality water to the effect root zone of crops, for an appropriate time gives significant result for crop production. Although mango being one of the partial drought tolerant crop and irrigated to ensure optimum and sufficient production. In order to understand the effects of soil moisture content in mango at three different growth stages irrigation experiment were carried out in AICRP on Fruits at Bihar Agricultural University, Sabour, Bhagalpur, with the objectives to study the effects of irrigation at different stages of fruit growth and yield of mango. Five irrigation treatments (relatives to soil evaporation) T 1 : No irrigation, T 2 : water requirement at 25%, T 3 : water requirement at 50%, T 4 : water requirement at 75% and T 5 : water requirement at 100% of evaporation. The results showed that different levels of irrigation at different growth stage significantly affected plant growth and yield. The maximum plant height of 8.33 m and numbers of fruits of 752.25 and fruit yield of 0.86kg/ m 3 and 19.3t/ha was recorded with the effect of treatment-T 4 . With respect to increasing percentage yield of 56.76per

cent over the control was also observed under the treatment T 4 . And fruit weight of 285.08 g was recorded maximum in treatment T 3 . Plant canopy spread of 13.03 m and 11.99 m East-West and North- South direction respectively and plant canopy volume of 1160.75 m 3 was maximum in T 5 treatment. In conclusion, treatment T 4 was the optimum irrigation level for mango cultivation.

Keywords- irrigation, growth stage, morphology, yield.

◆◆◆◆◆◆

Role of Living green walls to improve and enhance the microclimate of urban andsuburban areas

R.K. Dubey, Murali Krishna Ulli, Simrat Singh, Madhu bala, Kamal Kishor Nagar, Ravi Deepika
Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana.
Ludhiana-1414004, India.

ABSTRACT

"Liveable city" concept has emerged as a new urban approach in 21 st century as an innovative way to integrate nature into our new expanding cities. Vertical green walls are becoming one of the important aspects in improving the environment by reducing heat island effect and enhancing the air quality. The experiment was conducted on a vertical wall, planted with Syngonium and Scindapsus spp. in two different directions (North-East & South-West) and open conditions without plants as control at Landscape nursery PAU. Study investigates the effect of temperature and relative humidity on green walls in all the three seasons (summer, rainy & winter). Temperature and relative humidity of experimental area with plants obtained better results when compared to control. During summer months the lowest average temperature (37.0 o C) were recorded at North-East, followed by South-West (41.1 o C) and highest recorded in control without plants (45.5 o C). In winter season lowest average temperature (17.6 o C) were noticed at North-East, followed by South-West (21.4 o C) and highest was recorded in control (26.4 o C). In winter season highest average relative humidity was (81%) at North-East, (75%) at South-West and open in conditions was (70%) recorded respectively. In summer, average relative humidity were (22%) at North-East, (19%) at South-West and (17%) at open conditions. Thermal performance of the vertical green wall has positive effect on reducing the temperature inside the building and maintaining the microclimate. Among the two directions of vertical garden North-East green wall performed better due to minimal exposure to high temperatures.

Keywords: Living green walls, microclimate, thermal performance.

◆◆◆◆◆◆

Techniques of Meadow Orcharding in Guava for Yield Enhancement

Sonali Choudhary, Kalpana Choudhary [1] and Mahendra Choudhary [2]
Department of Horticulture, SKNAU, Jobner (Rajasthan)
[1]Krishi Vigyan Kendra Nagaur-1, AU, Jodhapur- 342 007 (Rajasthan)
[2] GBPUA&T, Pantnagar (Uttarakhand)

ABSTRACT

Guava is an important fruit crop in tropical and subtropical regions of the country due to the hardy nature of its tree and prolific bearing even in marginal lands. Meadow Orchard or Ultra high density planting is a modern approach of fruit cultivation, a system of planting at closer spacing leading to high density for higher fruit production through judicious canopy management and adoption of suitable training & pruning systems. Now a

days, it has become popular method among farmers to increases fruit productivity. Under this fruit cultivation using dwarf rootstocks like Psidium pumilum, P. molle with modified canopy for better light distribution within tree canopy, increases the number of well illuminated leaves. It promotes photosynthesis that leads to high yield per unit area and enhancing productivity coupled with reduction in production costs. The meadow orchard system accommodates 5000 plants/ ha planted at 2.0 × 1.0 m 2 spacing and managed with regular topping and hedging especially during initial stages. Topping and hedging in guava are helpful in controlling tree size and extending fruit availability. The height of plants is restricted to one meter with an average annual production of 10-12 kg/plant. As small canopy size ease in spraying of chemicals for pest and disease control and harvesting become easy so cost of picking is reduced and no damage occurs to the fruit. The ratio of fruit to shoots is higher than traditional orchards. Many cultivars evaluated under meadow orchard system such as Sardar, Shweta, Allahabad Safeda, Lalit, CISH-G-5, CISH-G-6 and hybrid (Lalit cross Sweta) showed positive impact of the technology.

Keywords: Meadow orchard, Productivity, Quality and Technology etc.

◆◆◆◆◆◆

Roof garden – A new era in crowded Urbanscape

Ashmita Sahu
Department of Horticulture, G.B Pant University of Agriculture & Technology,
Pantnagar (263145), Uttarakhand

ABSTRACT

Urban environments face many challenges related to the health and well-being of the citizens. The boom in real estate business, sky rise corporate buildings, malls, star hotels etc. have made us think about new landscape solutions. Hence, the concept of "roof gardening" has recently been embraced all over the world. A roof garden offers much welfare, especially in a crowded urban environment. Being able to go to the green roof building and be in the open air with plants and foliage provides a refreshing change from the glass, concrete and steel. Roof garden assists in increasing the expected roof life of the building and also reduces sound reflection by up to 3 dB and improve sound insulation by up to 8 dB. In addition, with the decorative benefit, roof gardening may provide food, temperature control (protection from UV radiation, Urban heat island mitigation), hydrological benefits (storm water runoff reduction- retains 70-90% rain water), architectural enhancement, habitats for wildlife, recreational opportunities and ecological benefits. It holds prodigious significance in aspects of modern advanced civilization. Green roofs are a substitute for natural landscaped areas at,ground level which are scarce in urban centers like Delhi.

◆◆◆◆◆◆

Aquatic Vegetables of Bundelkhand Region

Upasna Choudhary[1] , S.V. Dwivedi[2], Ajay Kumar Sharma[1] , R.K. Singh[2] , A.C. Mishra[2], Neetu[3] and Sunil Kumar[3]
[1]Ph.D. Research Scholar, Department of Vegetable Science.
[2]Professor, Department of Vegetable Science, [3]Assistant Professor, Department of Vegetable Science
College of Horticulture, BUAT, Banda- 210001 (Uttar Pradesh)

ABSTRACT

Where they are naturally abundant, aquatic vegetables are primarily in style. The majority of aquatic vegetables have their native habitat in areas with many water bodies, such as lakes, lagoons, ponds, ditches and

marshy wet areasas a result, year-round availability of green, lustrous aquatic edible greens, carbohydrate-rich rhizomes and nutritionally dense flowers and fruits suitable for a variety of vegetable uses is ensured. The majority of aquatic vegetables have remarkable health and culinary worth and they are all loved for their crisp, delicious features and distinctive flavour. Communities mostly found in wetland regions of the India do not only have their vegetable needs meet, but it has been indispensable part of their life. In Bundelkhand, the three main crops of aquatic vegetable plants are water spinach (Ipomea aquatica), Chinesewater chestnut(Eleocharis dulcis) and lotus (Nelumbo nucifera). In Bundelkhand, water spinach is most popular vegetable and young shoots and leaves are most probably used as leafy vegetable (Dry saag bhuraa) and it is locally known karemu. During rainy season it flourished in waterways and does not require much care. Across the Bundelkhand region, Chinese water chestnut also known as kusyal is mostly used as boiled corms. Edible tuber is rich in starch (7.3%). In india it is sold in Kolkata under the name of "Singapurikeysur. The Water chestnut is not a nut, but an aquatic vegetable that grows inmarshes, under water, in the mud. Aquatic vegetables are considered "The life line of the wetland ecosystem".

◆◆◆◆◆◆

Exploitation of heterosis in bitter gourd for various horticultural traits

Amit Nawani, S. K. Maurya and Vinay Kumar
[1,3,]Research Scholar and [2]Assistant Professor
[1,2,3,]G.B. Pant University of Agriculture and Technology Pantnagar, U.S. Nagar (Uttarakhand) 263 145,

ABSTRACT

The present study was carried out to assess the magnitude of heterosis for yield and its attributing traits during *zaid* season of 2022 at VRC of GBPUA&T, Pantnagar. Six parental lines of bitter gourd were crossed in half-diallel fashion to develop fifteen hybrids. It is evident from the analyzed data that the mean sum of squares was highly significant for all the characters indicated a wide genetic variation for the characters studied and there is a possibility of genetic improvement using such genetic pools in future breeding programme. The parental lines PBIG-10, PBIG-6 and PBIG-9 were observed to be the three top performing parents for fruit yield per plant. The best heterotic hybrids PBIG-6 × PBIG-18, PBIG-9 × PBIG-10 and PBIG-8 × PBIG-10 were observed 77.13 %, 66.04 % and 51.09 % heterosis respectively, over standard check Pant Karela-1 for fruit yield per hectare. It is concluded that those parental lines and cross combination will be exploited for commercial cultivation.

Keywords: Bitter gourd, Breeding, Genetic, Heterosis, Hybrids, Variation.

◆◆◆◆◆◆

Effect of different types of mulches on fruit quality and yield of pomegranate under rain-fed conditions

Bhawna Kaushal, D P Sharma, MA Kuchay
Department of Fruit Science, Dr. YSP University of Horticulture & Forestry,
Nauni, Solan, H.P, India

ABSTRACT

Inadequate summer precipitation might hinder pomegranate crop development and quality in dry regions. Pomegranate cultivars experience greater water stress during this season due to the high rate of evaporation and transpiration. Weeds diminish agricultural yield and fruit quality by competing for water, nutrients and sunlight. By reducing evaporation and retaining soil moisture, mulching is one of the most effective farming practises in

this region. Five different types of mulching were used in this study to keep the soil moist during the pomegranate's vital growth periods. The results showed that annual shoot growth, tree height, canopy spread and tree volume were recorded maximum with black polyethylene mulch. The maximum fruit length, fruit breadth, fruit weight and yield were recorded under silver polyethylene mulch film, followed by black polyethylene mulch. Black polyethylene mulch also recorded lower incidence of fruit cracking and the highest juice content. Regarding fruit quality attributes, maximum soluble solids, total sugar and minimum titratable acidity were observed under silver polyethylene mulch film. Inorganic mulch like black polyethylene film was found to be superior than organic mulch at retaining soil moisture and temperature and at promoting growth and quality of pomegranates.

Keywords: Mulching, Pomegranate, moisture, weed

◆◆◆◆◆◆

Aquatic Vegetables and its Role in Human Nutrition

Jitendra Singh, Rekha Singh and Versha Kumari
Professor Vegetable Science and Dean, CoH & RS, Rajnandgaon, C.G.
Senior Scientist, Krishi Vigyan Kendra, Raipur (IGKV) Chhattisgarh.
Guest Teacher (Vegetable Science), CoH & RS, Rajnandgaon

ABSTRACT

Aquatic vegetables are most popular in areas where they are naturally abundant for nutrition and several health related principles. In India, a number of aquatic vegetables *viz.*, water chest nut (*Trapa* spp.), water spinach (*Ipomoea aquatica* Forsk.), lotus root (*Nelumbo nucifera*), makhana (*Euryale ferox* Salisb) and Swamp Taro (*Colocasia serpentina*) etc. are grown sporadically/commercially. Apart from rich in diversity these aquatic vegetables are abundant source of dietary fibres, phyto-chemicals and antioxidants and may play a pivotal role in reducing the malnutrition. Aquatic vegetables with medicinal and nutritional versatility, like lotus, are employed as crucial raw materials in folk medicine and traditional medical systems like Ayurveda. It is a great source of dietary fibre, vitamins and minerals, all of which assist to lower blood pressure, sugar levels, body weight and constipation-related disorders. Very familiar green aquatic leafy vegetables Water spinach contains ample amount of minerals and vitamines like sodium, iron, vitamin C, vitamin A and other nutrients, accordance with the WHO-recommended pattern for ideal dietary protein. As a aquatic nutritious tuber, Water Chest nuts are rich source of carbohydrate, starch, dietary fiber, Riboflavin, Vitamin B6, Potassium and Magnesium. It also medicinally used for relieving cough, treat urine infection and have antibacterial, antiviral, anti cancerous and antioxidant, analgesic, anti-inflammatory and anti-diabetic property. As a high-value aquatic cash crop makhana (Fox nut) possessed plentiful nutritional and medical values as well as health protection effects. Popped makhana is one of the most common dry fruits utilized by the people due to low fat content, high contents of carbohydrates, protein and minerals. Above potentials of aquatic vegetables indicates that its production in wetland areas need to pay special attention to ensure the health and well-being of rural as well as urban people. These crops are becoming more and more popular among the states such as Chhattisgarh, Odisha, West Bengal and Uttar Pradesh. Considering the importance of aquatic vegetable crops, a number of agricultural techniques have been developed at IGKV, Raipur, Chhattisgarh for their commercial cultivation, marketing as well as area expansion in the state.

Keywords: Aquatic vegetable, Wetland, Medicinal and Nutritional

◆◆◆◆◆◆

Potential of Wild Fruits in Sustaining Farmers Income of Hilly Areas of Uttarakhand

Neema Pawar[1], Neha[1], Neha Verma[1], Deepak Praksah[1], H.S. Baweja[2]
Assistant development officer, Department of Horticulture and Food Processing, Uttarakhand.
Director, Department of Horticulture and Food Processing, Uttarakhand.
Email: pawarneema52611@gmail.com

ABSTRACT

The Himalayas in general and Uttarakhand in particular is a gold mine of flora and fauna diversity due to its climatic variation and higher rain fall. It has a wealth of horticultural, medicinal, food and feed, forestry and industrial genetic resources. The flora of Uttarakhand has been explored but wild fruits like Kaphal, Chest nut, Hazel nut, Sea buck thorn, Timla, Wild fig, Mehal, Bhamora and wild berries etc are still less explored. Wild edible fruits species can be used to produce fibre, fuel and a variety of processed products in addition to food. The antioxidant, mineral and vitamin content of wild edible fruits has been extensively researched and recommended. The State's rural inhabitant has a close relationship with the environment and the forests. Their regular needs, especially food, are met by forest products. The dietary needs of the rural population in the state are largely met by wild edible fruits. These fruits are frequently taken to market for sale, mainly as seasonal fruits and provide an additional source of income for local inhabitants.

The regional people are aware of the nutritional and therapeutic characteristics of wild edible fruits because they have been used for a long time. Despite their importance to rural people's economies, wild edible fruits have not been included in horticulture promotion programmes. They are neither grown commercially on a large scale nor traded widely. It is thus time to devise strategies for increasing production through domestication, overcoming constraints in the production of good seed material, planting material, in-vitro/tissue cultured material and so on. This would increase production, meet local needs, promote domestic markets and thus increase income generation in small farming communities in hilly areas of Uttarakhand.

Keywords: Wild fruits, farmer income, livelihood, cultivation

◆◆◆◆◆◆

Diara cultivation in Bundelkhand region

Upasna Choudhary[1], S.V. Dwivedi[2], Ajay Kumar Sharma[1], R.K. Singh[2], A.C Mishra[2] and Neetu[3]
[1]Ph.D. Research Scholar, Department of Vegetable Science.
[2]Professor, Department of Vegetable Science
[3]Assistant Professor, Department of Vegetable Science
College of Horticulture, BUAT, Banda- 210001 (Uttar Pradesh)

ABSTRACT

Climate change has recently had a negative impact on the agricultural sector, making the rural poor increasingly susceptible to unsustainable livelihoods. River valleys are referred to as "Diara"; The ancient way of cultivating the land in Diara is still used. Riverbed culture, a form of off-season vegetable forcing that mostly produces cucurbitaceous vegetables, ism possible. The primary purpose of the income created by river bed vegetable growers was to ensure the food security of their households. About 65% of total cucurbit cropped area of the country falls under riverbeds. With regard to land preparation, water management and other cultural practises, vegetable production on riverbeds is simple. Most of the cucurbits are having deep root system, which

enable the plant to survive in diara land. Crops which are usually practiced in riverbeds are cucumber, bottle gourd, bitter gourd, summer squash, round melon and long melon are typically grown together in North India subsequently Ridge gourd is only grown in Rajasthan, Madhya Pradesh and Uttar Pradesh. Bitter gourd, pumpkin is grown only Ken River and watermelon, muskmelon, pumpkin grown in Betwa River of Bundelkhand region. Farming in the Diara is challenged by stray animals, powerful winds and protracted droughts. Diara farming is a pro-poor initiative for the rural community in India that aims to raise household income and enhance food security for landless and land- poor people.

Keywords: Diara farming, Climate change, Cucurbits, Household income, Food security.

◆◆◆◆◆◆

Studies of grafting compatibility of tomato (*Solanum lycopersicum*) on brinjal (*Solanum melongena*) and its wild relative species through cleft grafting

Pradeep Kr. Yadav, Ankur Agarwal, Harendra Kumar, Om Prakash, Basant Ballabh and Devakant Pahad Singh

Defence Institute of Bio Energy Research (DIBER), DRDO, Goraparao,Haldwani, Distt. Nainital, Uttarakhand (India)-263139

ABSTRACT

The study of grafting compatibility of tomato (*Solanum lycopersicum*) on brinjal (S*olanum melongena)* and its wild relative species *i.e.*, *Solanum torvum* and *Solanum gilo*through cleft grafting method was carried out under the low-cost polyhouse condition at field testing facility of Defence Institute of Bio-Energy Research (DRDO) Haldwani, Nainital (Uttarakhand) during the year 2021-22, the aim to identify the best graft compatibility between the crops through cleft grafting method. The total 18 grafting combination were developed by using three different varieties of tomato as a scion and varieties of brinjal including two wild species i. e., *Solanum torvum* and *Solanum gilo*. Tomato var. DIBER Org, Kashi Adarsh and EC-97 and Brinjal varieties/accession/ wild species *i.e.*, Pant Samrat, Surya, DGG-01, SMSW-01, *S. gilo* and *S. torvum* used for this study. These grafting of rootstocks and scions were done in pot-trays and kept in mist chamber for compatible graft union. The experiment revealed that the plants are compatible with the grafting through cleft grafting method *viz.*, For graft combinations Surya x DIBER Org, Pant Samrat x DIBER Org, Surya x Kashi Adarsh, Surya x EC-97, DGG-01 x EC-97, Pant Samrat have observed greatest survival rate are (95.7%), (91.25%), (93.01%), (85.29%), (87.7%) and (92.10%) respectively, days to taken from grafting. For the wild species graft combination of brinjal *viz.*, *S. torvum* x DIBER Org, *S. gilo* x DIBER Org, *S. torvum* x Kashi Adarsh, S. gilo x Kashi Adarsh, *S. torvum* x EC-97 and *S. gilo* x EC-97 survival rate was observered (70.11%), (57.47%), (67.23%), (48.99%), (64.41%) and (41.87%) respectively, days taken from the grafting. When all These three selected varieties of tomato grafted on the rootstock of brinjal accession SMSW-01 the survival rate was recorded ranged between 61.74 to 87.45 %, days taken from grafting. This is the best method of grafting in all the solanaceous vegetable crops (tomato, brinjal and chilli) for graft compatibility.

Keywords: Tomato, Brinjal, *S. torvum*, *S. gilo*, Graft Compatibility, Survival rate

◆◆◆◆◆◆

Effect of Pinching, Growth Regulators and Zinc on Growth, Flowering, Yield and Quality of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda

Kanheya Lal Yadav[1], R S Meena[1], Ashok Choudhary[1], Omprakash Yadav[1] and\ Girdhari Lal Yadav[1]

[1]Division of Horticulture, Rajasthan Agricultural Research Institute, Durgapura, Jaipur (SKNAU, Jobner) -302018.

[2]Department of Horticulture, College of Agriculture, GBPUAT, Pantnagar- 263145

ABSTRACT

The present investigation entitled "Effect of Pinching, Growth Regulators and Zinc on Growth, Flowering, Yield and Quality of African Marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gainda"was conducted at Division of Horticulture, Rajasthan Agricultural Research Institute, Durgapura, Jaipur during 2020-21 and 2021-22. The experiment comprising of 36 treatment combinations with three levels of pinching, six levels of growth regulators and two level of zinc the treatments with their symbols are described T_1 ($P_0G_1Z_1$) No Pinching + GA_3 75 ppm + 0.2 % $ZnSO_4$, T_2 ($P_0G_1Z_2$) No Pinching + GA_3 75 ppm + 0.5 % $ZnSO_4$, T_3 ($P_0G_2Z_1$) No Pinching + GA_3 150 ppm + 0.2 % $ZnSO_4$, T_4 ($P_0G_2Z_2$) No Pinching + GA_3 150 ppm + 0.5 % $ZnSO_4$, T_5 ($P_0G_3Z_1$) No Pinching + NAA 25 ppm + 0.2 % $ZnSO_4$, T_6 ($P_0G_3Z_2$) No Pinching + NAA 25 ppm + 0.5 % $ZnSO_4$, T_7 ($P_0G_4Z_1$) No Pinching + NAA 50 ppm + 0.2 % $ZnSO_4$, T_8 ($P_0G_4Z_2$) No Pinching + NAA 50 ppm + 0.5 % $ZnSO_4$, T_9 ($P_0G_5Z_1$) No Pinching + Ethrel 450 ppm + 0.2 % $ZnSO_4$, T_{10} ($P_0G_5Z_2$) No Pinching + Ethrel 450 ppm + 0.5 % $ZnSO_4$, T_{11} ($P_0G_6Z_1$) No Pinching + Ethrel 700 ppm + 0.2 % $ZnSO_4$, T_{12} ($P_0G_6Z_2$) No Pinching + Ethrel 700 ppm + 0.5 % $ZnSO_4$, T_{13} ($P_1G_1Z_1$) Single Pinching + GA_3 75 ppm + 0.2 % $ZnSO_4$, T_{14} ($P_1G_1Z_2$) Single Pinching + GA_3 75 ppm + 0.5 % $ZnSO_4$ T_{15} ($P_1G_2Z_1$) Single Pinching + GA_3 150 ppm + 0.2 % $ZnSO_4$ T_{16} ($P_1G_2Z_2$) Single Pinching + GA_3 150 ppm + 0.5 % $ZnSO_4$, T_{17} ($P_1G_3Z_1$) Single Pinching + NAA 25 ppm + 0.2 % $ZnSO_4$, T_{18} ($P_1G_3Z_2$) Single Pinching + NAA 25 ppm + 0.5 % $ZnSO_4$, T_{19} ($P_1G_4Z_1$) Single Pinching + NAA 50 ppm + 0.2 % $ZnSO_4$, T_{20} ($P_1G_4Z_2$) Single Pinching + NAA 50 ppm + 0.5 % $ZnSO_4$, T_{21} ($P_1G_5Z_1$) Single Pinching + Ethrel 450 ppm + 0.2 % $ZnSO_4$, T_{22} ($P_1G_5Z_2$) Single Pinching + Ethrel 450 ppm + 0.5 % $ZnSO_4$, T_{23}($P_1G_6Z_1$) Single Pinching + Ethrel 700 ppm + 0.2 % $ZnSO_4$, T_{24} ($P_1G_6Z_2$) Single Pinching + Ethrel 700 ppm + 0.5 % $ZnSO_4$, T_{25} (P_2G_1Z) Double Pinching + GA_3 75 ppm + 0.2 % $ZnSO_4$, T_{26} ($P_2G_1Z_2$) Double Pinching + GA_3 75 ppm + 0.5 % $ZnSO_4$, T_{27} ($P_2G_2Z_1$) Double Pinching + GA_3 150 ppm + 0.2 % $ZnSO_4$, T_{28} ($P_2G_2Z_2$) Double Pinching + GA_3 150 ppm + 0.5 % $ZnSO_4$, T_{29} ($P_2G_3Z_1$) Double Pinching + NAA 25 ppm + 0.2 % $ZnSO_4$, T_{30} ($P_2G_3Z_2$) Double Pinching + NAA 25 ppm + 0.5 % $ZnSO_4$, T_{31} ($P_2G_4Z_1$) Double Pinching + NAA 50 ppm + 0.2 % $ZnSO_4$, T_{32} ($P_2G_4Z_2$) Double Pinching + NAA 50 ppm + 0.5 % $ZnSO_4$, T_{33} ($P_2G_5Z_1$) Double Pinching + Ethrel 450 ppm + 0.2 % $ZnSO_4$, T_{34} ($P_2G_5Z_2$) Double Pinching + Ethrel 450 ppm + 0.5 % $ZnSO_4$, T_{35} ($P_2G_6Z_1$) Double Pinching + Ethrel 700 ppm + 0.2 % $ZnSO_4$ and T_{36} ($P_2G_6Z_2$) Double Pinching + Ethrel 700 ppm + 0.5 % $ZnSO_4$as under in Factorial Randomize Block Design with three replications. The application of treatment T_{28} ($P_2G_2Z_2$) Double Pinching + GA_3 150 ppm + 0.5 % $ZnSO_4$ recorded significantly maximum primary branches (15.14), plant fresh weight (281.45 g), plant dry weight (86.77 g) , plant roo-shoot ratio (0.191 %), plant total biomass (67.04 q/ha), chlorophyll content (1.786 mg/g) and xanthophyll content (4.39 mg/gm) compared to treatment T_{11} ($P_0G_6Z_1$) No Pinching + Ethrel 700 ppm + 0.2 % $ZnSO_4$ Further, treatment were statistically at par with T_{13} ($P_1G_1Z_1$) Single Pinching + GA_3 75 ppm + 0.2 % $ZnSO_4$ and T_{19} ($P_1G_4Z_1$) Single Pinching + NAA 50 ppm + 0.2 % $ZnSO_4$.

Keywords: Pinching, Growth regulators, Zinc, Primary branches, fresh weight, Dry weight, Root-Shoot ratio,

◆◆◆◆◆◆

Total plant biomass, Chlorophyll content and Xanthophyll content Studies on effect of bagging and foliar application of different chemicals on post-harvest quality of Mango Fruits (*Mangifera indica* L.) CV. Amrapali

Rahmat Gul Hassanzai, Bhanu Pratap, Shubham jain
Department of Fruit Science, College of Horticulture and Forestry, Acharya Narendra Deva University of Agriculture & Technology, Narendra Nagar (Kumarganj), Ayodhya-224 229 (U.P.) India

ABSTRACT

The present investigation entitled "Studies on effect of bagging and foliar application of different chemicals on post-harvest quality of Mango Fruits (Mangifera indica L.) CV. Amrapali" was carried out during the year 2020-2021 at Main Experimental Station, Department of Fruit Science, College of Horticulture & Forestry, A.N.D.U.A. & T., Narendra Nagar (Kumarganj), Ayodhya, Uttar Pradesh, India. The treatments comprised of spraying of various chemicals and bagging with eco-friendly materials to study the various physico-chemical properties and effect of above treatments on quality and storage behaviour of mango fruits cultivar Amrapali. The experiment was laid down in randomized block design (RBD) with (08) treatments and (03) replications. The experiment consists of 8 treatments including control, T1 (Calcium Chloride @ 2%), T2 (Salicylic acid @ 0.03%), T3 (Calcium Chloride @ 2% + Salicylic acid @ 0.03%), T4 (Calcium chloride @ 2% + Bagging), T5 (Salicylic acid @ 0.03% + Bagging), T6 (Calcium Chloride @ 2% + Salicylic acid @ 0.03% + Bagging), T7 (Bagging), T8 (Control) were used for this study. The results revealed that the foliar application of Calcium Chloride @ 2% + Salicylic acid @ 0.03% + Bagging was most effective in increasing physico-chemical properties of mango fruits like fruit length, fruit width, fruit weight, pulp weight, stone weight, peel weight, Pulp stone ratio, fruit firmness, less insect damage fruit, Total Soluble Solids (TSS), Vitamin C (Ascorbic acid), reducing sugar, non-reducing sugar, Total sugars and less acidity in quality point of view, Shelf life, Organoleptic quality, Cost: Benefit ratio, minimized PLW and spotted fruits.

◆◆◆◆◆◆

Response of Strawberry (*Fragaria x ananasa* Duch) to Integrated Nutrient Management approaches for yield attributing characters

Fathema Zaman[1], Govind Vishwakarma[2] and Shaikh Rabbani[1]
[1]Department of Horticulture, Doon (PG) College of Agriculture Science and Technology, Dehradun (UK) 248011.
[2]Department of Fruit Science, Rani Lakshmi Bai Central Agricultural University, Jhansi (UP) 248003.

ABSTRACT

Uttarakhand comes under subtropical and temperate zonewhich is most favorable climate for theproduction of strawberry. It is observed that continuous use of chemical fertilizers destroy the fertility of the soil and give unhealthy fruits. With the use of integrated nutrient management, the toxicity created by chemical fertilizers can be minimized which will be the result of quality and healthy produce. Keeping in the view an experiment on "Response of strawberry (*Fragariaxananasa*Duch) to integrated nutrient management approaches for yield attributing characters" was conducted at Main experiment station, DCAST, Dehradun during 2019-20 to evaluate the different yield attributing characters in strawberry. The experiment was statistically conducted in a Completely Randomized Block Design (CRBD) with three replications. There were eight treatments of NPK, FYM, Vermicompost and Poultry manure either single or in combinations.The response of different combinations of organic and inorganic nutrients was found significantly superior for different yield parameter *viz*.Fruit length

(cm), Fruit width (cm), Fruit weight (g), Fruit volume (cm^3) and Yield per plant (g), in strawberry. Among all the nine treatments, treatment T_6: FYM 10t+NPK (50%) + Vermicompost (50%)was found best for all the yield parameters. Treatment T_8: Control did not have any nutrient application and was noted lowest results for all the characters.

Keywords: Nutrient, Organic manure, Inorganic fertilizer, Vermicompost

◆◆◆◆◆◆

Assessment of Strawberry to Integrated Nutrient Management for quality fruits

Govind Vishwakarma[1], Fathema Zaman[2]Dhiru Kumar Tiwari[3]and Devesh Tiwari[1]
Department of Fruit Science, Rani Lakshmi Bai Central Agricultural University, Jhansi (UP) 248003, India
Department of Horticulture, Doon (PG) College of Agriculture Science and Technology,
Dehradun (UK) 248011, India
SMS, KVK, Madhopur (Bihar) 845454, India

ABSTRACT

Strawberry is the well-known crop in Dehradun (Uttarakhand) and is highly appreciated by the consumers in this region. Modern intensive crop farming requires the massive application of chemical fertilizers, which are not only expensive and in short supply, but also contaminate the soil, water and ecosystem. Integrated nutrient management which includes the use of organic and inorganic sources of nutrients ensures balanced nutrition by enhancing nutrient response efficiency and maximizing crop productivity of desired quality.The present study was conducted at the main experiment station, DCAST, Dehradun during the years 2018-19 and 2019-20 for the optimization of chemical characteristics in strawberry fruit through organic manure and inorganic fertilizers with the aid of bio-fertilizers. The experiment was statistically conducted in a completely Randomized Block Design (CRBD) with three replications. There were nine treatmentsof NPK, FYM, Azotobactor and PSB either single or in combinations. These treatments were applied in the soil for the different chemical characters *viz* TSS, Acidity, Ascorbic acid, Reducing sugar, Non-reducing sugars, Total sugars and Anthocyanin. Among all the nine treatments, treatment T_5- 100% FYM+NPK (25:120:80) kg/hac+ *Azotobacter* (20kg/ha) +PSB (20kg/ha) was found statistically superior over all other treatments for improving the different quality parameters in strawberry fruits during both the year of experimentation 2018-19 and 2019-20.

Keywords: Organic manure, In-organic fertilizers, Bio-fertilizer, strawberry, INM, Azotobactor, PSB.

◆◆◆◆◆◆

Off season vegetables in Uttarakhand for farmer's perspective

S.S. Singh, S. K. Dwivedi and Rakesh Mer
G.B. Pant University of Agriculture and Technology, Krishi Vigyan Kendra,
Matela-263643, Almora, Uttarakhand (sssindia02@gmail.com)

ABSTRACT

Off season vegetables such as capsicum, cauliflower, tomato, vegetable pea and french bean are commercially important and extensively grown in hills of Uttarakhand. These vegetables are cultivated from March-April to October- November and plays significant role in strengthening of economic conditions of the farmers particularly small and marginal farmers. Considerable progress has been made in area, production and productivity of these vegetables but still average productivity of all the vegetables grown as an off season is comparatively low. The major factors responsible for low productivity in hills of Uttarakhand are poor adoption

of high yielding hybrids and varieties, improper nutrient management coupled with high incidence of various pest and diseases. The off season vegetables are cultivated in such a period where production and availability of these vegetables are almost nil in plains of Northern India. Thus, farmers of hills of Uttarakhand get remunerative price of their produce being as an off season. This is one of the most important factor influences the off season farming industry of vegetables in hills of Uttarakhand. In order to cater the increasing demand of off season vegetables in plains of Northern India, we need to expand area, production and productivity of these vegetables in the mountain region of Uttarakhand.

◆◆◆◆◆◆

Impact of integrated nutrient module s on growth, yield and economics of Potato (*Solanum tuberosum* L.)

Ankush Chaudhary[1] and Monisha Rawat[2]

[1]PhD Research Scholar, Department of Vegetable Science, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh (173230)

[2]Assistant Professor, Department of Horticulture (Vegetable Science), Lovely Professional University, Phagwara, Punjab (144410)

ABSTRACT

Potato (*Solanum tuberosum* L.) belongs to the family Solanaceae with chromosome number 2n = 48 and is the fourth important staple food crop. A field experiment was carried out in the year 2019 at Vegetable Research Farm, Department of Horticulture, Lovely Professional University, Phagwara, Punjab to study the effect of integrated nutrient management for horticultural and biochemical characteristics, yield of potato cultivar Kufri Chipsona-3 in sandy loam soils of Punjab.The experiment involved the integrated use of different chemical fertilizers,organic manures and biofertilizersi.e., NPK, FYM (Farm Yard Manure), vermicompost, bio-fertilizers (phosphorus solubilizing bacteria and Vesicular Arbuscular Mycorrhizae) and absolute control.The experiment comprised of 7 treatments with one control replicated thrice in a RandomisedBlock Design in 1.8 x 1.6 m^2plot size. The study revealed that maximum yield (27.9 t/ha) was obtained in the treatment T_4 which comprised integrated use of 75% recommended dose of NPK + FYM (Farm Yard Manure) @ 50 t/ha + PSB @ 10 kg/ha as compared to other treatments. The treatment also had positive effect on growth and quality attributes *viz.* plant height (39.85 cm, 48.73 cm and 51.62 cm at 30, 60 and 90 days after sowing respectively), number of compound leaves (41.84, 46.46 and 49.49 at 30, 60 and 90 days after sowing respectively), dry matter content (20.66%) and specific gravity (1.12 g/cm^3) but the treatment had no significant effect on chlorophyll content. Thebenefit: cost ratiowas also maximum (1:2.21) in the same treatment.

Keywords: Biofertilizers; Vermicompost; VAM.

◆◆◆◆◆◆

Effect of growing environment and propagation techniques on success of different cultivars of Aonla (*Emblica officinalis Gaertn.*)

Hari Baksh, Rajaneesh Singh, Aman Srivastav, Raj Pandey and Prince Mishra

Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur

ABSTRACT

The present investigation entitled “Effect of growing environment and propagation techniques on success of different cultivars of aonla (*Emblica officinalis* Gaertn)” was carried out during 2018-19 at the Experimental

unit, Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur. The experiment was designed in split-plot design with twelve treatment combinations comprising of factor A with two sources of scion *viz.*, NA-5 and NA-7, factor B comprised of two seasons, spring & summer and factor C included three methods of propagation, *i.e.*, softwood grafting, patch budding, T budding and these were replicated thrice under 30% net house and in open field. Number of days taken for bud sprout was found minimum *i.e.*, 14.32 and 12.20 days in open and net house condition, respectively in variety NA-5 during summer season. Regarding interactions of varieties, seasons and methods of propagation under both the growing conditions, best result was obtained under 30 per cent net house condition in summer season. Maximum number of leaves (40.00) at 120 days after grafting was recorded during spring season in softwood grafting under open condition. However, in net house, maximum leaves (36.33) were recorded in patch budding during summer season. Among the interactions of varieties, seasons and methods of propagation, higher number of leaves were recorded in open field condition as compared to net house. Maximum length (16.07 cm) of scion was obtained in NA-5 during summer season in softwood grafting in net house condition. The diameter of the rootstock was observed maximum 0.60 cm and 0.68 cm in open field and net house condition, respectively in cultivar NA-5 during summer season through softwood grafting. However, interaction of varieties, seasons and methods of propagation showed maximum rootstock diameter under 30 % net house environments. The grafts prepared under open field condition, gave the higher success in terms of maximum graft success and scion diameter. The minimum days taken for bud sprout, scion sprout length and maximum rootstock diameter were obtained in net house condition. Among the two different sources of scion, variety NA-5 gave better performance in both the growing conditions. The patch budding was recorded most successful method during summer season under eastern Uttar Pradesh conditions in both the growing environment.

Keywords: Shade net, Aonla cultivar, Open field condition, propagation

◆◆◆◆◆◆

Crop modeling in fruit crops

Ankit Gavri[1], G.S. Rana[2], Sanjay kumar[3]
Department of Horticulture
[1]Ph.D. Research Scholar, Department of Horticulture, CCSHAU, Hisar
[2]Principal Scientist, Department of Horticulture, CCSHAU, Hisar
[3]Ph.D. Research Scholar, Department of Horticulture, CCSHAU, Hisar

ABSTRACT

Modelling is the use of equations or sets of equations to represent the behaviour of a system. In effect crop models are computer programmes that mimic the growth and development of crops (USDA, 2007). Modelling represents a better way of synthesizing knowledge about different components of a system, summarizing data and transferring research results to users. Model simulates or imitates the behavior of a real crop by predicting the growth of its components, such as leaves, roots, stems and grains. Thus, it plays an important role in assessing the stress situation in plants. These models not only predict the final state of crop production or harvestable yield, but also contain quantitative information about major processes involved in the growth and development of the crop. Crop models can be used to understand the effects of climate change such as elevated carbon-dioxide changes in temperature and rainfall on crop development, growth and yield. Reactions and interactions at the level of tissues and organs are combined to form a picture of the crop's growth processes. For the purpose of crop weather modeling various models like statistical models, phonological model, crop simulation model etc. have been developed for achieving the precision in crop production.

Keywords: modeling, simulation, growth and deelopment

◆◆◆◆◆◆

Amaranth: Prospects as an Alternative Crop in the Bundelkhand Region

Ajay Kumar Sharma[1], S V Dwivedi[2], Vidya Sagar[3], R.K. Singh[2], Upasna Choudhary[1]and Jayshree Singh[4]

[1]Ph.D. Research Scholar, Department of Vegetable Science, BUAT, Banda (U.P.)
[2]Professor, Department of Vegetable Science, College of Horticulture, BUAT, Banda (U.P.)
[3] ICAR-Indian Institute of Vegetable Research, Varanasi, (U.P.)
[4] Post Graduate Scholar, Department of Vegetable Science, BUAT, Banda (U.P.)

ABSTRACT

Amaranthus, commonly known as chaulai, is a fast-growing, short-duration leafy vegetable crop grown worldwide that belongs to the family Amaranthaceae. It is a rich source of carbohydrates, protein, vitamins, calcium, iron, beta-carotene, dietary fiber and amino acids such as lysine and sulphur, which are not found in many other vegetables and cereals. Bundelkhand is one of the most important regions of India and consists of seven districts in UP. Due to the hot, semi-arid climate, infertility of the land, low productivity, improper land distribution, lack of rainfall and lack of irrigation facilities, only a limited number of agricultural crops are grown in this region. A large part of the population of Bundelkhand suffers from malnutrition and due to a lack of employment, the farmers here are forced to flee. But looking at the nutrients and other properties found in amaranthus, it can be said that if improved varieties of Chaulai are given to the farmers for cultivation, then it will definitely help in eliminating malnutrition and making the farmers self-reliant. Along with this, it will also be helpful in stopping the migration of farmers. Amaranthus is an underutilized vegetable crop; excellent production potential, is resistant to disease and pests, is an alternative source of income for farmers and has immense potential for commercialization, especially in the Bundelkhand region, where monocropping is in practise and cropping intensity is also very low due to semi-arid climatic conditions. Temperatures in this region during the summer exceed 40-45°C, making amaranthus, a heat and drought resistant vegetable crop, a promising option when no other green vegetables are available in the market during the extreme hot weather in the Bundelkhand region. However, as a minor vegetable crop, amaranthus has great potential to combat malnutrition and generate income in this region during extreme weather.

◆◆◆◆◆◆

Advances in Hot Arid Fruit Crops – A Review

V. D.Dangariya[1], B. M. Tandel[2], S. T. Bhatt[3], R. R. Jasani[4]and V.K. Patel[5]

[1,4]NAHEP-CAAST-M.Sc. Scholar, Department of Fruit Science, ACHF, NAU, Navsari
[2]Associate Professor, [3]Associate Professor, Dept. Floriculture and landscape Architecture, ACHF, NAU, Navsari
[5]Senior Research Fellow, CAAST Secretariat, Directorate of Research
Navsari Agriculture University (NAU), Navsari- Gujarat -396450

ABSTRACT

In India, the extent of arid area is about 38.73 million hectares and about 12 % of total geographical area is under hot arid zone. Dry land meets about 50 % of the annual production. Arid zone is characterized by extremes of temperature, high wind velocity, low and erratic rainfall, high evapotranspirational losses of water, low water holding capacity and poor fertility. Looking to the very dismal future scenario of water in hot arid zone, growing of less water requiring crops with high yielding efficiency is necessary. Drought-hardy crops especially perennial fruits with deep root systems are capable of surviving extreme radiation and temperatures and provide income, nutritional and food security. Ber, beal, pomegranate, custard apple, phalsa, karonda, date palm, aonla,

wood apple, fig and jamun are the important fruit crops which are commercially grown in hot arid regions. Owing to the strength such as vast area, ample solar radiation, low incidence of disease and pest population, hot arid regions have potential to become the horticultural bowl of India.Therefore, it is needed to approach in that area for more fruit production by different advance production technologies such as high yielding variety, propagation technique, different planting system, cropping system, mulching, antitranspirants, micro irrigation, fertigation, pruning, crop regulation, use of different plant growth regulators, shade nets and fruit bagging.

Keywords: Hot arid region, fruit crops, advance technology

◆◆◆◆◆◆

Necessity of biofortification in fruit crops to fight against hidden hunger in the human population

Vikas Kumar[1], A. K. Srivastava[1], Vikki[1] and Ankur Kumar[2]
[1]Department of Fruit Science, [2]Department of Entomology
Banda University of Agriculture and Technology, Banda, U.P.

ABSTRACT

Biofortification is a rural-based intervention that initially reaches the remote populations that comprise most of the undernourished and then penetrates into the urban populations. Deficiencies of vitamin A, iron, zinc and other micronutrient affect the world's population health. Biofortification can help to improve the nutritional value through agronomic practices, conventional plant breeding and using modern biotechnological techniques. Biofortification increases the human intake of essential micronutrients without impairing growth and yield parameters and it involves the synthesis or accumulation of nutrients by plants at the source. The challenge is to get producers and consumers to accept biofortified fruit crops and increase their intake of the target nutrients without impairing growth and yield. According to previous research; fruit plants (vitamin A in banana, iron and zinc in pomegranate/pineapple, selenium in strawberry, etc.) biofortified with minerals and vitamins provide evidence that how nutrients are present can affect how they are processed and utilized in the human body. Biofortification is necessary for developing countries, as most people cannot consume healthy fruit because of the higher cost of fruit. The increasing population day by day requires improvement in fruit quality with the increased nutrient availability in fruit crops through biofortification. It is a one-time investment after that seeds fortify themselves and are sustainable in the longer term, varieties will continue to be grown and consumed year after year.

Keywords: Biofortification, Malnutrition, Micronutrients, Fruits, Populations etc.

◆◆◆◆◆◆

Performance of Different Apple Cultivars for Fruit Quality and Its Attributing Traits in Mid Hill Conditions of Uttarakhand

[1]Arun Kishor, [2]Yogesh Kumar, [3]Raj Narayan, [4]Sovan Debnath and [5]Om Chand Sharma
[1],[2] ICAR-Central Institute of Temperate Horticulture, Mukteshwar, U ttarakhand, India
[3]ICAR- Agricultural Technology Application Research Institute, Jodhpur, Rajasthan, India
[4]ICAR- Central Agroforestry Research Institute, Jhansi, Uttar Pradesh, India
[5]ICAR-Central Institute of Temperate Horticulture, Srinagar, Jammu & Kashmir, India

ABSTRACT

An experiment was conducted to evaluate the physico-chemical parameter of thirty apple cultivars belonging to Delicious group, spur type and colour strains at ICAR- Central Institute of Temperate Horticulture,

Regional Station, Mukteshwar, Nainital, Uttarakhand. Among the all cultivars the highest fruit weight (209.35 g), fruit volume (226.67 cc), fruit length (7.27 cm) and fruit diameter (8.37 cm) was recorded in cultivar Mollies Delicious while the lowest fruit weight (54.46 g), fruit volume (53.33 cc), fruit length (4.46 cm) and fruit diameter (5.48 cm) was recorded in Early Shanburry cultivar. The highest T.S.S. was recorded in Stark Spur (13.60 °B) while lowest in Vermont Spur (8.20 °B), whereas highest acidity was recorded in Lord Lambourne (1.07%) and lowest in Chaubattia anupam (0.10%). The highest values for ascorbic acid (17.49 mg/100 g) were recorded in Red Chief, Rich-A-Red and Bright-an-Early while lowest in Red Spur (3.28 mg/100 g). The highest reducing sugar (7.58%) and total sugars (8.75%) was recorded in Tydeman Early Worcester. The highest carotene content (242.73 µg/100 g) was recorded in Lord Lambourne. The highest total anti-oxidant activity (45.11 mMTE/ L) was recorded in Royal Delicious while lowest in Golden Delicious (34.44 mMTE/L). From the investigation it can be inferred that the cultivar Mollies Delicious, Skyline Supreme, Red Chief, Starkrimson, Chaubatta Anupam, Prima, Bright-N- Early, Chaubattia Princess, Oregon Spur and Golden Delicious performed better in the region under prevailing climatic conditions.

Keywords: Apple, Physical-chemical parameter, evaluation, cultivar

◆◆◆◆◆◆

Physiological changes induced by source to sink manipulations in grape cultivars under mild tropics of India

Abhilash, K.,Satisha, J., Laxman, R. H., Shivashankara, K. S. andVenkat Rao
ICAR-Indian Institute of Horticultural Research, Benglauru – 560 089, Karnataka

ABSTRACT

Understanding source-sink relation provides key insight into concept of vine balance where one can mange cropping levels and vine growth. Over-cropping may result in lower leaf area to support their development while under-cropping allocates too much photosynthates to vegetative growth. Hence, there should be balance between source – sink to optimize yield and quality. Some of the management practices like shoot (cane) thinning, leaf removal and bunch thinning aims to keep a balance between vine's sources and sinks. Hence, this study was undertaken to study the effect to cane, leaf and bunch regulation on yield and quality of two grape varieties (Red Globe and Crimson Seedless) having different growth habit in terms of their vigour.The results demonstrated that the manipulation of the source sink with lowest shoot load of 20 canes along with 8 leaves shown increased photosynthetic rate, stomatal conductance and transpiration rate in both the cultivars. Maximum leaf area was obtained in vines having 30 canes along with 16 leaves in Red Globe whileit was in Crimson Seedless it is in vines having 30 canes along with 12 leaves. Similarly, maximum chlorophyll content was observed in lowest cane load (20 canes along with 8 leaves) in Red Globe while it was highest in vine having 30 canes with 12 leaves in Crimson Seedless.In all the canopy manipulations, maximum light penetration (55-82%) at bunch zone was in Red Globe indicating its sparse canopy and less vigour.In Crimson Seedless minimum (26%) light penetration was observed in fruit zone indicating very denser canopy with 40 canes and 16 leaves. Retaining 30 canes after back pruning and retaining 12 leaves per cane and 40 bunches per vine could improve the quality measured in terms of berry diameter and length, TSS, acidity, anthocyanin content and yield per vine in Crimson Seedless while in Red Globe retaining 30 canes after back pruning and retaining 16 leaves per cane with 30 bunches per vine could improve all the berry and bunch quality parameters.

Keywords: Cane regulation, leaf regulation, photosynthetic rate, leaf area and light interception

◆◆◆◆◆◆

Nano-fertilizers: 21st Century Fertilizer

Dixita Prajapati and P. D. Solanki
Department of Fruit Science, Aspee College of Horticulture and Forestry
Navsari Agricultural University, Navsari-396 450, Gujarat, india

ABSTRACT

The world of agriculture is facing many challenges, such as climate change due to greenhouse effect and global warming, rapid urbanization, rise of industrial belts, non-judicious use of resources like petroleum, high quality rock phosphate and soil erosion. These problems become intensified owing to world's population, which tends to increase up to 9.6 billion by the year 2050. An increase by 70% in global grain production is required to feed this increasing world population. Performance of traditional fertilizers remained constant for the past decades, for nitrogen 30-35 %, phosphorous 18-20 % and potassium 35-40 %. To improve soil fertility and increase crop productivity, huge amounts of fertilizer is required. Nanotechnology and nanofertilizers have been recently gaining importance in the horticulture field for improving plant growth, development and productivity with increase nutrient use efficiency; reduce wastage of fertilizers and cost of cultivation.Nanofertilizers provide more surface area for different metabolic reactions in the plant which increase rate of photosynthesis and produce more dry matter and yield of crop. Hence, nanotechnology has a high potential for achieving sustainable agriculture, especially in developing countries.

◆◆◆◆◆◆

Early Fruit Production through Reducing Juvenile Phase

R. R. Jasani[1], S. J. Patil[2], M. A. Patel[3], V. D.Dangariya[4] and A. D. Chaudhary[5]
[1, 4] NAHEP-CAAST-M.Sc. Scholar, Department of Fruit Science, ACHF
[2]Professor and Head (Hort.), N. M. College of Agriculture
[3]Assistant Professor, Dept. of Floriculture and Landscape Architecture, ACHF
[5]Senior Research Fellow, CAAST Secretariat, Directorate of Research
Navsari Agriculture University (NAU), Navsari- Gujarat -396450

ABSTRACT

Long juvenile phase is major problem in fruit crops. Shortening the juvenile period is highly important for earlyproduction of fruit crops.Asexually propagated plants have short juvenile phase and bear flowers in the early age than seedling plants. Cultural and biotechnological methods are used for reduction of juvenile phase in fruit crops. Grafting, dwarfing root stock and interstock and girdling are including in cultural method. Interstock of various clonal rootstocks M9, MM-106 and MM-111 are used to reduce the juvenile phase in apple.Seedling scions grafted onto certain clonal apple dwarfing rootstocks resulting 2-4 years earlier flowering than the seedlings plant.Use of vigour controlling rootstock is one method used to promote early fruit bearing, reduced vigour and increased yield.In Girdling, removal of a strip of bark from the trunk or major limbs of tree due to more carbohydrates accumulated above the girdle producing differential effect on root development. This is turn, leads to deferential effect on shoot growth. Gene like*LFY,AP1* overexpression of shortens the vegetative phase cause early flowering in citrus.*TFL1*induced the vegetative growth cause late flowering.*MdTFL1*is homologous to *TFL1* and function like *TFL1* involved in maintenance of juvenility in apple.Antisense expression of *MdTLF1* gene induced precocious flowering in Orin apple.

Keywords : Juvenile phase, interstock, grafting and flowering

◆◆◆◆◆◆

Effect of different biofertilizers with graded chemical fertilizers on growth and yield of papaya var. Red lady

Dixita Prajapati, T. R. Ahlawat, Lalit Mahatma and R. V. Tank
Department of Fruit Science, Aspee College of Horticulture and Forestry
Navsari Agricultural University, Navsari-396 450, Gujarat, india

ABSTRACT

The experiment was carried out at Regional Horticultural Research Station, ASPEE College of Horticulture & Forestry, Navsari Agricultural University, Navsari during the year 2017-18 to 2019-20. The experiment was laid out in Randomized Block Design having nine treatments which repeated thrice. The results revealed that among the different treatments maximum plant height (133.74 and 186.45 cm) obtained with T_9 at 3 and 9 month after planting. While, maximum plant height at 6 month was recorded in T_8 which was at par with T_9, T_1 and T_2. In pooled, the treatment T_9 recorded significantly highest stem girth (18.80 cm) at 3 months which was also at par with treatment T_8. Maximum stem girth (28.33 and 38.81 cm) at 6 and 9 month recorded in T_1 which was at par with T_9 and T_8. Number of leaves (23.04 and 29.01) at 6 and 9 months was found maximum with treatment T_9 which was found at par with treatment T_8 in pooled analysis. The highest number of fruits per tree (37.92), fruit diameter (33.56 cm) and yield (38. 93 kg/plant) were also obtained with T_9 which was found at par with T_1, T_6 and T_8 in pooled analysis.

◆◆◆◆◆◆

Phenology and Yield of Isabgol (*Plantago ovate* Forsk.) in Response to Varieties and Bio-Fertilizer

K.C. Meena, Manish Kumar, S.K. Dwivedi, Nitin Soni, D.K. Patidar and B.K. Patidar
College of Horticulture,
Mandsaur-458001, Madhya Pradesh

ABSTRACT

Isabgol (*Plantago ovate* Forsk.) belongs to family Plantaginaceae. It is a soft hairy or woolly annual herb with short stems with a height of 28-40 cm. It is grown commercially in Mandsaur and Neemuch districts of the Madhya Pradesh. Nowadays there are a wide range of microbial inoculants which are being used as bio-fertilizers in medicinal plants. Through biological processes, bio-fertilizers can move nutritive ingredients from an unusable state to a usable state.

An experiment was carried out at College of Horticulture, RVSKVV, Mandsaur (M.P.) during the *rabi* season 2020-21 in factorial randomized block design with three replications with four varieties viz; Gujarat Isabgol-1, Gujarat Isabgol-2, Vallabh Isabgol-1 and Jawahar Isabgol-4 as main plot with two biofertilizer (B_1-*Azotobacter* @5 kg ha^{-1} and B_2-PSB @3 kg ha^{-1}) as sub plot and one untreated control (B_0-control) on isabgol. Results revealed that variety JI-4 was recorded superior in number of seeds per spike (83.28), seed yield (13.09 q ha^{-1}), straw yield (44.21 q ha^{-1}), Biological yield (57.30 q ha^{-1}), test weight (2.08 g), harvest index (22.79 %) and seed husk ration (2.96) when compared with other varieties. An early germination (5.22), flowering (61.67) and maturity (110.44) were also recorded in the mentioned variety JI-4. However, higher number of seeds per spike (82.92), seed yield (10.88 q ha-1), straw yield (39.75 q ha-1) biological yield (50.63 q ha-1), test weight (1.99 g), harvest index (21.27%) and seed husk ratio (2.75) and early germination (6.06), flowering (64.00) and maturity (114.31) found with *azotobacter*. Under interactions, maximum number of seeds per spike (84.70), seed yield (14.57 q ha^{-1}), straw yield (46.95 q ha^{-1}), biological yield (61.52 q ha^{-1}), test weight

(2.11 g), harvest index (21.99 %) and seed husk ratio (3.18) and early germination (5.00), flowering (66.67) and maturity (109.33) also found in JI-4 with *azotobacter*.

Results concluded that the Jawahar Isabgol-4 and *azotobacter* are the best combination for better growth and yield of Isabgol under Malwa condition of Madhya Pradesh.

◆◆◆◆◆◆

Session-4

Organic and Natural Farming of Horticulture Crops

INVITED LECTURES

I-1 Agnihotra and Homa Organic Farming - Tools for a Sustainable Development on Planet Earth

Ulrich Berk
President, German Association of Homa Therapy

Horticulture as well as agriculture are facing two great challenges:

First, a growing number of people has to be fed and the available land cannot be increased.

Second is Environmental Pollution and Climate Change. All live on this planet – plant kingdom, animal kingdom and humans – are affected. Present day farming systems contribute to these problems:

Conventional agrochemical agriculture is not been sustainable. It has led to a degradation of soil, pollution of not only soil but also water resources and our atmosphere. This makes it clear that we cannot continue like that – alternative ways of farming are the need of the hour.

We have to change our lifestyles and find sustainable ways in order to basically save our planet.

Horticulture and agriculture are just one source of environmental pollution. Industrial waste, household waste, pollution by combustion engines (especially cars and trucks) etc. have created a of compounded pollution which now causes problems in yield and health of plants and leads to diseases of animals and humans.

What can be the solution for this universal problem?

One such solution is Homa Therapy with Agnihotra, a daily pyramid fire at sunrise and sunset, as its basic tool. It comes from ancient Vedic Knowledge and has wide-reaching beneficial effects on our whole environment, means on our atmosphere, on the soil and on our water resources and also biodiversity is increased.

Agnihotra purifies our environment and thus offers a solution for a sustainable future where humans live in Harmony with Nature, with plants and animals and keep this planet, our Mother Earth, alive and thriving.

In this presentation first the method of Agnihotra and Homa Therapy will be explained.

Then I will give an overview on the research done so far and the research currently being carried out about how Agnihotra and Agnihotra Ash help to mitigate problems of the pollution of our atmosphere, the soil and water resources and thus lead to sustainable agriculture and horticulture.

Also the prevailing paradigm of NPK will be discussed and it will be shown that it has no relevance for organic farming

Besides that, Homa Organic Farming can help a lot to sequester large quantities of CO_2 from the atmosphere which helps in controlling Climate Change.

Often there is the apprehension that when we move away from agrochemical farming, yields will go down – so farmers will have difficulties to sustain their families and it will also not be possible to feed the growing population.

Both fears will be shown to be unfounded. With Homa Organic Farming yields are increased and Homa Farming is more profitable than conventional farming.

This also is an important example of how we can bring ecology and economy together for a sustainable future.

◆◆◆◆◆◆

I-2 Impact of Homa Organic Farming in Mitigating Soil, Water and other Environmental Crises

Ulrich Berk

German Association of Homa Therapy, 78357-Mühlingen, Germany

Pollution of the atmosphere, the soil and water resources is one of the biggest problems of our time and it affects all areas of life including agriculture. In this situation it seems plausible to make use of every method including traditional knowledge which may help to overcome these problems (as it was suggested in the Convention on Biological Diversity, known also as the Rio Convention). Homa Therapy with Agnihotra as its basic tool comes from ancient Vedic Knowledge and has wide-reaching beneficial effects on our whole environment, means on our atmosphere, on the soil and on our water resources. The medicinal power of plants which is now reduced because of pollution is again restored in Homa Atmosphere and also biodiversity is increased. But this method has to be understood and evaluated in terms of modern science. This will be done in this article - the method will be explained and its application in solving environmental problems in different areas will be shown. We will give an overview on the research done so far and the research currently being carried out about how Agnihotra and Agnihotra Ash help to mitigate problems of the pollution of our atmosphere, the soil and water resources. Also the impact on agriculture and horticulture will be shown and there will be suggestions for further research on this subject.

◆◆◆◆◆◆

I-3 Vrikshayurveda: Perspectives for Prosperous Horticulture &Its Scientific Validation

Sunita T Pandey

GBPUAT, Pantnagar, 263145, US Nagar, Uttarakhand, India

Surpala'svrikshayurveda (Science of plant life) written during C. 1000AD and preserved at the Bodleian Library, Oxford University, UK. has a good deal of the knowledge on horticulture technologies. There are 325 systematically arranged verses including glorification of trees and composition on tree planting and production. Various chapter deal with the raising of orchards, agri-horticulture and tree planting near houses. Special references are made to locate groundwater; nourishment and fertilizers; diseases of plants and plant protection. Also includes spacing between trees; methods of propagation; preparation of pits for planting; seed treatments; plant nourishment; plant protection; and some other relevant information. Laying out of gardens and orchards, creation animal production; and description of sacred plants. Several botanicals (herbs) and other materials had been identified and recommended for application on ailing plants. This paper also shares some of the results on vrikshayurveda based technologies particularly of Poshnavidhi (crop nutrition)and Drum Raksha (plant protection)and quality. I am sure that horticulture scientists / researchers will take interest and conduct more experimentation on various horticultural crops to check validity of various tools and technologies of Surpala'svrikshayurveda based horticulture practices.

◆◆◆◆◆◆

I-4 Cowpathy for One Health

Prof. R. S. Chauhan
Department of Veterinary Pathology
G B P U A & T Pantnagar–263 145 (Uttarakhand)

In the thirst of modernization and industrialization man has contributed pollution to the life and ecology of plants, animals and microbes. Increased demand for food and fiber has lead to the chemicalization of agriculture and we have reached on such a stage that modern agriculture is dependent on high yielding varieties, which can only be grown under the influence of fertilizers and pesticides. With the advent of green revolution in India, since 1965, farmers and Govt. agencies have only emphasize their focus to maximize the yield of only two major grain crops *viz.* wheat and paddy. With use of indiscriminate chemical fertilizers and pesticides during their cultivation and afterwards harvesting them, farmers left with their huge dry biomass straw wastes in the forms of "Parali", which is mainly burnt by them before next sowing. This resulted in release of million tonnes of obnoxious poisonous gases, particulate matter and black carbon in the environment leading to increase temperature and damage of the top soil micro-flora. Loss of 'friendly' soil micro-flora invited the wrath of 'enemy' pests increases, making field crops more prone to harmful pests and disease. All these combined factors directly contributed to degradation of soil, thereby reducing their water percolating capacity, increasing environmental pollution mainly responsible for global warming. Therefore, for the survival of soil natural micro-flora and sustainability of Agril-horticultural farming system, the farmers need to utilize the divine Bio-energy of indigenous Indian "Desi Cow breeds for availability of precious Panchgavy for composting and increasing fertility of soils for practicing "Sajeev Javik Krishi Farming" and to save the Earth from global warming. Cowpathy has immense potential of being used as an health promoter particularly for soil, plant, animal, human and environment. Cowpathy products are being prepared and marketed by several organizations which are well accepted in the society. However, the efforts should be made to prepare various products scientifically without loosing their activity but enhancing the activity and changing the delivery system.

◆◆◆◆◆◆

Oral Presentation

Response of Different Organics Spray on *Sapota* Fruit

A.K. Pandey,Zala Vijay, Dev Raj[1] ,Parth J. Jadhav and Tulsi Gurjar
Department of Fruit Science, [1]Centre of Excellence on Post Harvest Technology
ASPEE College of Horticulture and Forestry, Navsari Agricultural University,
Navsari-396 450 (Gujarat), India

ABSTRACT

The investigation find out to the effect of foliar spray of organics on yield and quality of sapota cv. Kalipatti. at Instractional Farm ASPEE College of Horticulture and Forestry ,NAU, Navsari, during 2020-21. The foliar spray of Cow Urine 2 % (3 Spray), Cow Urine 2 % (3 Spray), Cow Urine 2 % (5 Spray), Panchagavya 3 % (3 Spray), Panchagavya 3 % (4 Spray), Panchagavya 3% (5 Spray), Novel Organic Liquid Nutrients 5% (3 Spray), Novel Organic Liquid Nutrients 5% (4 Spray).Among Novel Organic Liquid Nutrients 5% (5 Spray)recorded significantly the maximum physical and yield parameters namely, fruit weight (83.60 g), fruit length (6.15 cm), fruit diameter (5.78 cm), fruit volume (76.19 cc), number of marketable fruits tree-1 (2553.00), marketable fruit weight (170.30 kg tree-1), total fruit yield (174.30 kg tree-1) and total fruit yield (17430 kg ha-1),While minimum number of damage fruit (49.75) and fruit weight (3.56 kg tree-1) was recorded in T_3 (five spray of 2 % cow urine). The foliar application of five sprays of 5 % Novel Organic Liquid Nutrients recorded significantly the maximum physico-chemical attributes *viz.*, minimum PLW (%) at 2nd day, 4th day and ripening stage (3.34 %, 5.09 %, 8.09 % respectively), acidity (0.121 %), spoilage (6.25 %), while maximum fruit firmness (13.81 kg cm-2), TSS (23.84ÚBrix), ascorbic acid (10.80 mg 100 g-1), total sugars (19.47 %), reducing sugars (11.28 %), total phenol (133.87 mg 100 g-1) and shelf life (7.80 days).

◆◆◆◆◆◆

Spacing and Manuring Effect on Banana Growth, Yieldand Soil Properties Under Organic Farming

A. R. Kaswala, P.K. Dubey A.P. Italiya and K.G. Patel[1]
ASPEE Collage of Horticulture.
[1] Agricultural Chemistry, N. M. Collage of Agriculture,
Navsari Agricultural University, Navsari, 396 450, Gujarat, India

ABSTRACT

A field experiment was conducted at organic farm during *Kharif* season of 2018-19 to 2020-21 on spacing and manuring effect on banana growth, yield and soil properties under organic farming. The experiment was conducted in soil having high initial SOC, available P_2O_5 and K_2Ocontent while available N was medium. The soil was clayey in texture and slightly alkaline but non-saline in nature. In this soil conditions, nine treatment combination containing three spacing (S_1: 2.4 m X 1.5 m X 1.2 m (pair row system), S_2: 2.1 m X 1.5 m and S_3: 1.8 m X 1.5 m) along with three manure levels (M_1: 100% RDN through NADEP compost, M_2: 75% RDN through NADEP compost and M_3: 50% RDN through NADEP compost) were imposed to grow banana crop in randomized block design with factorial concept. The results showed in the pooled analysis that the spacing S_3 (1.8 m ×1.5 m) and manure level M_1(100% RDN) has achieved significantly highest pseudostem girth whereas, significantly the lowest days to 50 % flowering (288.5) was achieved by the spacing S_2. The yield attributing character (number of hands/plant)and bunch yield was found significantly higher with the spacing S_2 which was at par with S_3 in all the years of experiment and in pooled analysis. Similarly application of M_1 was at par with M_2 which produced

significantly higher bunch weight in all the three years and in pooled analysis. The soil parameters after harvest of the crop, OC contentwas found non-significant with spacing in all the years of experiment while application of manure showed significant effect. The spacing did not significantly influenced on available N, P_2O_5 and K_2O of soil at harvest during the whole experimental period whereas, significantly the highest value for available N was observed with the application of M_1 (100% N through NADEP) in the year 2018-19 and 2019-20. While significantly higher available N was recorded by the treatment M_2 which was at par with M_1 in the year 2020-21. The interaction effect of treatments were found non-significant for available N, P_2O_5 and K_2O of soil at harvest in the year 2018-19, 2019-20, 2020-21 and in pooled analysis.

◆◆◆◆◆◆

Effect of Organic Manures on Growth, Production and Quality of Strawberry (*Fragaria x ananassa* Dutch) in western UP

Girja Shanker Tewari[1] and Swapnil Pandey[2]
[1] Director, Project SNEH, C.L.Gupta Farms, Moradabad- 244001
[2]Fruit Scientist, PAU- Regional Research Station, Ballowal Saunkhri, Punjab- 144521

ABSTRACT

Strawberry one of the most delicious, attractive, nutritious and refreshing soft fruits of the world are gaining popularity among the commercial growers due to its ease in cultivation and short growing period. Since, the fruits are consumed fresh; use of chemical fertilizers restricts its acceptance among the consumers.Keeping into view this aspect, the present experiment was conducted at the Organic farming unit of Project SNEH (An NGO) comprising of ten treatments having formulations of organic manures in Randomized Block Design with three replications in 2021-22. In this experiment, strawberry cv. Winter Dawnwas evaluated for its growth, production and quality parameters.The maximum crown height (24.22 cm), Plant E-W (45.39 cm) and N-S spread (42.66 cm), fruit weight (36.74 g), fruit length (54.00 mm), fruit diameter (42.59 mm), TSS (7.3 °B), fruit yield (536.55g/plant) and minimum acidity (0.66 %) has been recorded from the treatment T_9 (Ghanjeevamrit (50%) + Poultry manure (50%) + Vermicompost (50%). From the experiment, it can be concluded that organic farming practices have accelerating effect on growth, production and quality of strawberry. Organic manures are not only providing quality produce but they also enrich the soil and improve its physical, chemical and biological properties.

◆◆◆◆◆◆

Impact of Organic Seed Treatments on Seedling Growth and Development of Cucurbits

S. Ramesh Kumar and Utpal Das
VIT School of Agricultural Innovations and Advanced Learning
Vellore Institute of Technology, Vellore-632 014, Tamil Nadu.

ABSTRACT

The present investigation was conducted with the objective of studying the influence of seed treatment with tree leaf extracts on seed attributes in bottle gourd, ridge gourd, cucumber and bitter gourd. The experiment was carried out in a Completely Randomized Block Design (CRBD) with three replications. It consists of 7 treatments *viz.,Vitex negundo* (T_1)*, Pongamia pinnata* (T_2)*, Azadirachta indica* (T_3), *Acacia nilotica* (T_4), *Prosopis juliflora* (T_5)*, Cassia auriculata* (T_6), *Peltophorum ferrugineum* (T_7) and along with untreated

seeds as control. The results indicated that there were significant differences in seed attributes.Among the seed treatment practices *Cassia auriculata* (T_6)wasfound to maximize the germination percentage, root length, shoot length and vigour index of the seed in all the crops. The increase in germination by this botanical is not very much known due to a lack of information on the active principle involved in it. However, it is presumed that these botanicals contain some of the micronutrients which are conducive to seed invigoration.The leaf extract also contains gibberellins-like substances and micronutrients the zinc, which have synergistically activated to form the Indole Acetic Acid (IAA). An increase in seed quality parameters may be due to enlarged embryos, higher rate of metabolic activity and respiration, better utilization and mobilization of metabolites to growing points and higher activity of enzymes.

◆◆◆◆◆◆

Diversification of Temperate Fruits in Western Himalayas: An alternate to Climate Change

Desh Beer Singh
Former Director, ICAR-Central Institute of Temperate Horticulture
Old Air Field, Rangreth, Srinagar-07. J & K.

ABSTRACT

Variation in climatic conditions and short term abrasions in weather parameters has raised levels of uncertainty, vulnerability and risk of investments in horticulture. In the face of warmer temperatures due to climate change, winter chill requirements will become harder to meet in many important temperate-fruit and nut-producing areas. There is large scope for diversification of temperate fruits which can fit in to changing climatic situations and can tolerate biotic and abiotic stress under fragile Himalayan ecosystem. The identification of new species, their characterization, conservation and sustainable utilization is the key to improve agricultural productivity and sustainability, therefore contributing to national development, food security and poverty alleviation. Variation in climatic conditions and short term abrasions in weather parameters has raised levels of uncertainty, vulnerability and risk of investments in horticulture. In the face of warmer temperatures due to climate change, winter chill requirements will become harder to meet in many important temperate-fruit and nut-producing areas. Future fruits like black berries, raspberries, persimmon, rose hips, Chinese jujube, cape gooseberries, currants, kiwi fruit, nectarines, olive and un tapped nuts like hazel nut, chest nut having nutraceutical, ecological and economical importance special attention in respect of introduction, collection, evaluation, production technology, sustainable exploitation.Majority of these future fruits, such as strawberry, blackberry, blue berry, currants, crane berry, gooseberry, rosehips, kiwi, lingon berry, red currant, rasp berry, sour cherry, apricot, peach etc contain phytochemicals of nutraceutical importance. These phytochemicals, either alone and/or in combination, have tremendous therapeutic potential.

◆◆◆◆◆◆

Tree Risk Assessment and Management for a Sustainable Urban Green Cover

Manish Kapoor
Department of Botany, Punjabi University, Patiala-147002 Punjab

ABSTRACT

Trees are the principal part of landscaping. It involves bio-aesthetic values in landscape architecture. Though, there are a number of benefits from trees but most of us have witnessed the destruction a tree can cause when it fails and strikes a physical structure. We have all heard about a lot of cases of personal injury and

death caused by falling trees or branches. Trees can become hazardous over time and come to pose significant risks to personal safety and property. Most trees fall during storms and every year countless storms rage through the country. They cause deaths and loss to the tunes of millions of rupees in property damage annually. Post-storm surveys of damaged trees provide forensic evidence about tree failure patterns and structural defects that are associated with tree failures. By knowing more about how and when trees fail, we can more accurately assess the degree of risk associated with specific tree defects and make well founded tree risk management decisions. 84 per cent of the trees damaged during high wind storm events had pre-existing defects that resulted in tree failure. Most of these defects can be prevented through proper tree planting and pruning practices and can be detected and corrected if the trees are inspected time to time. Tree risk management involves the process of inspecting and assessing trees for their potential to injure people or damage property. Traditionally the term "hazard" (or hazardous) has been used in the context of evaluating trees for their failure potential. "Hazard" trees are defined as trees with structural defects that may cause the tree or tree part to fail, where such a failure may cause property damage or personal injury. Trees will vary, ranging from low to high-risk for failure and may require attention immediately or in the near future. There are several categories of major defects that can cause tree failure are decayed wood, cracks, root problems, weak branch unions, cankers poor tree architecture, dead trees, tops or branches.Tree risk inspections provide a systematic method of examining trees, assessing defects present and estimating the degree of risk. A visual inspection of individual tree is sufficient for detecting most defects and assessing the probability of tree failure. Some defects, however, do not have external signs or symptoms and their detection requires in-depth inspections and the use of specialized diagnostic tools. Every tree risk management program must include regularly scheduled tree risk inspections.Proper tree planting and pruning practices and to inspect trees on a regular basis to detect, assess and correct hazardous tree defects before they cause tree failures. Inappropriate species composition and improper planting and maintenance practices in urban and suburban areas resulted in extensive and unnecessary tree losses and associated property damage.

The fundamental goal of tree risk management is to prevent development of hazardous tree defects and reduce the risks hazardous trees pose to public safety. Development of many hazardous defects in trees can be prevented through effective planning and the implementation of sound arboricultural practices. Designing a species-diverse, uneven-aged forest, matching tree species to site conditions, purchasing high quality nursery stock, implementing proper planting and pruning techniques and protecting trees from construction damage help to promote healthy trees and reduce development of hazardous tree defects.

◆◆◆◆◆◆

Controlling of Fruit Drop and reaping higher yield in Mango cv. Sonpari using Novel Organic Liquid Nutrient

Y. N. Tandel, Roja H. S. and Nikita Patel
Department of Fruit Science, ASPEE College of Horticulture and Forestry
Navsari Agricultural University, Navsari - 396 450

ABSTRACT

In mango, inspite of profuse number of panicles and high initial fruit set, the ultimate retention and yield are low mainly due to heavy fruit drop. Therefore, the experiment was undertaken to study the effect of foliar application of banana pseudostem sap (Novel Organic Liquid Nutrients) onSonpari mango at NAU, Navsari. The study was was laid out in Completely Randomized Design with four repetitions and five treatments*viz.,* control (T_1), Novel organic liquid nutrients (NOLN) 1% (T_2), NOLN 2% (T_3), NOLN$^+$1% (T_4), NOLN$^+$ 2% (T_5). Two foliar spray were done at the time of initiation of flowering and 50% flowering. The observation on pollen attributes, yield and quality parameters of fruits were recorded and statistically analysed. The foliar spray of NOLN$^+$1% recorded significantly higher pollen viability percentage and pollen germination percentage. The fruit set percentage at pea,

marble, maturity stage and fruit retention at harvest were also noted highest in NOLN^{+}1% which was at par with T_3 at pea stage; T_3 and T_5 at marble stage; T_3 at maturity stage and T_3 in fruit retention at harvest. Yield parameters were found maximum in treatment T_4 (NOLN^{+} 1 %) which was at par with T_3, T_5 and T_2 in number of fruit per tree and T_5 in yield. The average weight of fruit was recorded significantly highest in T_5 (NOLN^{+}2 %) which was at par with T_4, T_3 and T_2. Among quality parametrs, the maximum TSS (20.29ÚBrix) and shelf life of fruitswith the minimum physiological loss in weight (15.09%) were recorded in T_4 which was at par with T_3 and T_5. The highest net return with maximum BCR value was obtained with the treatment of 1 % Novel plus organic nutrients. The trend of net income and BCR due to treatments of Novel organic nutrients were found as $T_4 > T_5 > T_3 > T_2 > T_1$.

◆◆◆◆◆◆

Response of broccoli (*Brassica oleracea* var. italica) to integrated nutrient management under foot hill condition of Nagaland

S. P. Kanaujia
Department of Horticulture, School of Agricultural Sciences and Rural Development, Medziphema Campus, Nagaland University, Nagaland- 797106

ABSTRACT

A field experiment was conducted at Experimental Farm, Nagaland University, Medziphema campus, Nagaland during rabi season of 2019-2020 to study the response of broccoli (*Brassica oleracea* var. *italica*) to integrated nutrient management. The 12 treatments were evaluated in RBD with three replications. Results revealed that application of different levels of fertilizes and organic manures either alone or in combination significantly increased the growth, yield and quality of broccoli as compared to control. Application of full dose of RDF exhibited maximum plant height (52.3 cm), number of leaves (18.2), stem diameter (20.7 mm), plant spread (69.2 cm), ascorbic acid content (60.9 mg 100^{-1} g), protein content in head (1.58%) and yield (8.20 t ha^{-1}). However, these parameters were found statistically at par with treatment T_9 (Poultry manure 2.5 t ha^{-1} + ½ of RDF). There was a significant build up of organic carbon and available nutrients except available nitrogen in post harvest soil with INM practices and maximum values of organic carbon (19.0 g kg^{-1}), available P (26.9 kg ha^{-1}) and available K (201.2 kg ha^{-1}) with Poultry manure 2.5 t ha^{-1} + ½ of RDF. While maximum value of available nitrogen (221.6 kg ha^{-1}) in post harvest soil was recorded with full dose of RDF as inorganics. The highest net return (Rs. 1,96,145.51) along with benefit: cost ratio (2.16) were recorded in T_1 (Full dose of RDF) followed by treatment T_9 (Poultry manure 2.5 t ha^{-1} + ½ of RDF) with net return of Rs.1,81220.35 and cost benefit ratio of 1.90.

◆◆◆◆◆◆

Performance of Lettuce (*Lactuca sativa* L.) cv. Red revolution under the Influence of bio-fertilizers and their Consortia

Rajesh Kumar Meena and Deepa H. Dwivedi
Department of Horticulture, Babasaheb Bhimrao Ambedkar University
(A Central University, Lucknow 226025(UP)

ABSTRACT

Application of *Pantoea agglomerans*, significantly affect the vegetative performance, yield and the quality characters of lettuce (*Lactuca sativa* L.), independently as well as in consortia. However, their effectivity varied depending on the parameter, such as vegetative and morphological characteristics, qualitative parameters

and root growth studies in lettuce (*Lactuca sativa* L). *Pantoea agglomerans* was found to be the most effective in improving vegetative growth characters and final yield on its own (910.74 g). The use of *Rhizobium radiobactor*, however, considerably improved the root growth of lettuce, both independently and in combination with FYM and vermi-compost, which were all statistically almost equivalent. The different treatments had varying effects on the quality characterstics tested. *Rhizobium radiobactor* was found to be the most effective in improving the quality parameters antioxidants, nitrate and carbohydrate on its own. *Rhizobium radiobactor* + FYM additionally boosts flavonoid and protein levels. However, further trials may be needed to substantiate the result in Lettuce (*Lactuca sativa* L.).

◆◆◆◆◆◆

Effect of biofertilizers and bioinoculants on yield and qualityof mango cv. Mallika

K. D. Rathod, M. J. Patel and A. J. Patel
Department of Horticulture, BACA, AAU, Anand

ABSTRACT

Introduction: Continuous use of inorganic fertilizers ishazardous to the soil health in respect ofphysical, chemical and biological properties ofsoil. Therefore, the cost effective, sustainable and alternative organic sources are required to fulfill the nutrient requirements.

Methods: The experiment was conducted at Horticultural Research Farm, BACA, AAU, Gujarat, Indiaon mango cv. Mallika during the year 2019-20 and 2020-21in factorial CRD with three repetitions and sixteen treatment combinations comprising two factors *i.e.*, biofertilizers *viz.*, D_1: Bio NPK Consortium (10 ml/tree), D_2: VAM (10 g/tree), D_3: Bio NPK Consortium (10 ml/tree) + VAM (10 g/tree) and D_4: No biofertilizers which were given as drenching at pea stage and bioinoculants *viz.,* S_1: Seaweed extract (0.2 %), S_2: Novel organic liquid nutrient (2 %), S_3: Jeevamrut (10 %) and S_4: No bioinoculants which were sprayed twice at 2nd week of April and 1st week of May.

Experimental Result: Results indicated that among the biofertilizers,D_3recorded maximum fruit weight, length, diameter, number of fruits per tree, yield, pulp: stone ratio, TSS, ascorbic acid, total sugar, shelf life, lower acidity with increased N, P and K content of leaf.Among bioinoculants, S_2showedbetter results forsame parameters. Combine application *i.e.*, D_3S_2found significant in case of fruit yield, acidity, ascorbic acid, total sugar, shelf life, N, P and K content of leaves, soil microbial count with higher BCR.

Keywords: Biofertilizers, bioinoculants, foliar spray, soil drenching

◆◆◆◆◆◆

Influence of organic stimulants on growth and flowering of Chrysanthemum (*Chrysanthemum morifolium Ramat.*) var. Punjab Shingar

Madhu Bala, Shaik Rehana and Mohini Prabha Singh
Department of Floriculture and Landscaping, Punjab Agricultural University,
Ludhiana, Punjab, India, 141 004.

ABSTRACT

Chrysanthemum (*Chrysanthemummorifolium* Ramat.) commonly known as autumn queen or queen of east belonging to family Asteraceae is one of the leading commercial flower crop grown for diverse uses like cut

flower, loose flower, pot culture and also in garden decoration. There is substantial scope to enhance the productivity of chrysanthemum by adopting proper crop nutrition practices which have got wide popularity in recent times. Keeping this in view, an experiment was undertaken to evaluate the effect of organic stimulants on performance of chrysanthemum var. Punjab Shingar at PAU, Ludhiana during 2021-22. The experiment was laid out inrandomized block design consisting of two factors and replicated thrice.Treatments comprised of varied concentrations of recommended doses of fertilizers (100:150:100NPK kg/ha) *i.e.*, 100%, 75% and 50% RDF along with organic stimulants humic acid, fulvic acid and sea weed extract sprayed on concerned variety at 30, 60 and 90days after planting. Phenotypic observations on plant height (cm), plant spread (cm), days to bud initiation, flower diameter (cm), flowering duration (days), flower yield/plant (g) and shelf life (days) were recorded. It was observed that the treatment of 75%RDF + Humic acid recorded maximum plant height (61.33cm), plant spread (41.18cm), flower diameter (7.90cm), flowering duration (44.08 days) and flower yield/plant (381.88g) whereas, the earliest bud initiation (91.71 days) was noticed in RDF 50% + Fulvic acid treatment. Hence, it can be recommended that applying RDF 75% + Humic acid would enhanceflowering, yield along with prolonged shelf life in chrysanthemum var. Punjab Shingar.

Keywords:*Chrysanthemum*,fertilizers, organic stimulants, Humic acid, Fulvic acid

◆◆◆◆◆◆

POSTER PRESENTATION

Organic and Natural farming of Horticulture Crops

Jitendra Gurjar
Ph.D Horticulture, SKRAU Bikaner

ABSTRACT

Indian horticulture has generally emphasized increasing productivity, several fertilizers and insecticides have been applied for this purpose. The horticulture sector is just one of several that was influenced by technological advancements in the 21th century and with time, their negative impact on plant nutritional and medicinal quality, as well as the environmental changes including greater weather variability, soil degradation, water scarcity and water bodies have been polluted, is becoming more apparent. Organic horticulture is associated with the use of compost, cocopeat, perlite, coir, pine bark, rockwool, vermiculite, inorganic nutrient solutions and manure relative to food safety and the quality of produce. Most organic production systems are based on improving and maintaining the physico-chemical and biological properties of soil. Different organic production systems are widespread in India, such as biodynamic agriculture, rishi krishi, panchagavya krishi and kitchen organic farming. The goal of natural farming is to fully utilize nature's capacity to provide ecosystem benefits. Natural farming, also referred to as "traditional farming," uses no chemicals. It is an agro-ecologically based, diversified farming system that combines crops, trees and livestock with useful biodiversity. Natural farming is distinct from biodynamic farming but comparable to fertility farming, organic farming (though not required with organic certification), sustainable agriculture, agro-ecology, agro-forestry, eco-agriculture and permaculture.

Keywords: Fertilizers, Compost, Cocopeat, Perlite, Coir, Pine Bark, Rockwool, Vermiculite, Biodynamic Agriculture, Rishi Krishi, Panchagavya Krishi, Kitchen Organic Farming, Agro-Ecology, Agro-Forestry, Eco-Agriculture and Permaculture.

◆◆◆◆◆◆

A review on effect of biofertilizers on vegetable production

Satish Kumar[1] and M. D. Ojha[1]
[1]Dept. of Vegetable Science, Nalanda College of Horticulture, Noorsarai, Nalanda

ABSTRACT

Biofertilizer is a natural product carrying living microorganisms derived from the root or cultivated soil. So they don't have any ill effect on soil health and environment. Biofertilizers enhances the soil fertility, seed germination and plant growth. Since past 50-60 years, soil management practices are mostly reliant on inorganic fertilizers, which decrease soil fertility and increased soil pollution resulting human health problems. Chemical fertilizers supply over nitrogen whereas bio-fertilizers provide in nitrogen along with certain growth promoting substances like hormones, vitamins, amino acids, etc, to the crops. Bio-fertilizers application in agriculture will have greater impact on organic agriculture and also on the control of environmental pollution, soil health improvement and reduction in chemical input use. The use of chemical nitrogen and phosphorus fertilizers at high levels had an adverse effect on the accumulation of $NH4^{+}$, NO_3^{-}, NO_2^{-} and PO_4^{-} in vegetable product tissues. The effects of chemical fertilizers are that they are toxic at higher doses. Bio-fertilizers, however, have no toxic effects. Bio-fertilizers are commonly called as microbial inoculants which are capable of mobilizing important nutritional elements in the soil from non-usable to usable form by the crop plants through their biological processes. Nitrogen fixing microbes comprises of symbiotic nitrogen fixing biofertilizers (including *Rhizobium, Azolla* etc.), free living nitrogen fixing biofertilizers such *Azotobacter, Cyanobacteria* blue green algae etc. and associative

symbiotic nitrogen fixing biofertilizers (*Azospirillum*) whereas Phosphorus Solubilizing Bacteria (PSB) solubilise the fixed phosphorus. Application of biological fertilizer greatly involved in the accumulation of soil enzymes, which directly reflects on soil fertility index. The effective utilization of bio-fertilizers for crops not only provide economic benefits to the farmers but also improves and maintain the soil fertility and sustainability in natural soil ecosystem. Therefore, quality vegetable production directly depends upon using bio-fertilizers as well as organic in order to produce high yields with the best commodity quality without contamination and less accumulation with heavy metals.

Keywords: Biofertilizers, vegetable production, chemical fertilizer, soil fertility

◆◆◆◆◆◆

Integrated fish cum Horticulture farming: Natural farming approach for sustainable rural livelihood

Sonal Pathak[1] and Maneesh Kumar

[1]Ph.D Research Scholar, G.B. Pant University of Agriculture and Technology Pantnagar-263 145, Uttarakhand, India.

ABSTRACT

India's farming community accounts for 80% marginal and small farmers. These farmers are economically poor, they are working in risk prone environments with hardly sufficient to sustain their family. In India,continuous declining trend of land holding per capita is a major challenge that questions the sustainability and profitability of farming system. In order to tackle these challenges, sustainable agriculture has received a major attention at global level to increase the productivity along with nutritional security by adopting ecofriendly and natural farming techniques. Holistic and integrated farming approach aligns with sustainable development goals (SDGs), inproviding various livelihood options in rural setting. The integrated fish cum horticulture approach proves to be one of the solutions to emerging problems of livelihood such as food & nutritional security, year-round employment with increase in per capita income of marginal & small farmers. Through integrated fish cum horticulture approach, commercial level natural farming can be done in almost zero budget only by using locally available and farm-based resources, which indirectly caters the problem of farm waste management. The horticulturecumfish farming system includes the culture of fruits, vegetables and flowers on the embankment of the pond. Considering the efficacy of this viable production system, better production and sustainable economic return can be achieved through integrated fish production technology along with horticultural crops cultivation.

◆◆◆◆◆◆

A review on role of decomposers in agricultural waste management

M. D. Ojha[1] and Satish Kumar[1]

[1]Dept. of Vegetable Science, Nalanda College of Horticulture, Noorsarai, Nalanda

ABSTRACT

India produces more than 620 million tonnes agricultural waste annually. Agricultural wastes are generated from a number of agricultural activities and they include cultivation, livestock production and aquaculture. Agricultural waste contains 0.5% nitrogen, 0.2% phosphorus and 1.5% potassium as a source of plant nutrient. Most of the Indian farmers are practicing residue burning practices to clear the field in Rice-Wheat cropping system for timely sowing of the next crop. Crop residue burning releases harmful gases like CO_2, CH_4, N_2O, H_2S, O_3 and smog which causes air pollution and also create poor air quality index. It largely affects public life

and disturbs soil physical, biological and chemical properties by destroying beneficial soil microorganism. Implementation of effective agricultural waste management can not only solve the air pollution problem but also provide better inputs to crop. The main objective of any waste management system is to maximize the economic benefit from the waste resource and maintain acceptable environmental standards. Management that puts into practice the principles of the four Rs of Reduce, Reuse, Recycle and Recover is the best first option. Agricultural waste residue management is decomposed by microbe such as bacteria, fungi, nematode etc. By successive catabolic reactions of microbes, all the organic matters are mineralized into soil essential constituents, which will be the most effective sources of macro- and micronutrients for the soil fertility. There are a variety of bio-decomposers such as bacteria, fungi, protozoa, etc. and they are capable to degrade cellulose by depolymerising cellulases which hydrolyze lignocelluloses. Most commonly known bio-decomposers are fungi which include Humicola, Trichoderma, Aspergillus, sclerotium, white-rot fungi, Trichoderma and Penicillium.The cellulose-producing bacteria are the potent bacterial cell lines in hydrolytical cleavage of agricultural residue in decomposition process which includes bacillus spp., pseudomonas, cellulomonas, etc. Researchers are working to improve the efficiency and storage of multiple types of microbes in an effective formulation product in one package which would have a high commercial value to sustainable agriculture.

Keywords: Agricultural Waste Management, air pollution, decomposer, Microbes

◆◆◆◆◆◆

Effect of Organic manures and Bio-fertilizers on Physico-Chemical Constituents in Strawberry (*Fragaria* × *ananassa* Duch.) cv. Chandler

Aman Srivastav, Hari Baksh, Rajaneesh Singh and Bijendra Kumar Singh
Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur (U. P.) 222 002
Department of Fruit Science, CoH, BUA&T, Banda, India

ABSTRACT

A field experiment was conducted during 2017-18 to study the effect of organic manures and biofertilizers on Physico-chemical constituents in Strawberry (*Fragaria* × *ananassa* Duch.) *cv*. Chandler. The experiment was laid out in Randomized Block Design with ten treatments and three replications. The maximum fruit size [length (32.79 mm) and width (24.93 mm)], weight (10.49g) and volume (11.21cc) were recorded in the plants treated with Vermicompost + *Azotobacter* + PSB followed by FYM + Vermicompost + Poultry Manure + *Azotobacter* + PSB and minimum found in untreated (control), whereas maximum specific gravity (0.990) was found in treatment having Poultry Manure + *Azotobacter* + PSB followed by Farm Yard Manure. However, the maximum TSS (12.66 ^{0}Brix), Reducing Sugar (4.88%), non-reducing sugar (4.62%), Total Sugar (9.51%), pH (4.93) and TSS/Acid ratio (21.10%) contents were recorded in the berries produced from the plants treated with Vermicompost + *Azotobacter* + PSB followed by FYM + Vermicompost + Poultry Manure + *Azotobacter* + PSB treatment. The minimum acidity (0.60%) was recorded in Vermicompost + *Azotobacter* + PSB treated plants, whereas, the maximum acidity (0.82%) were recorded in control. The highest ascorbic acid (69.79%) was recorded in control whereas; the lowest amount of ascorbic acid (53.85%) content as recorded in the treatment having Vermicompost + *Azotobacter* + PSB treated plants.

Keywords: Physico-chemical properties, organic manures, biofertilizers, vermicompost, poultry manure.

◆◆◆◆◆◆

Effect of Organic Manures and Bio-Fertilizers on Growth and Yieldof Papaya

Prince Mishra, Hari Baksh, Rajaneesh Singh, Raj Pandey and Aman Srivastav
Department of Horticulture, Tilak Dhari Post Graduate College Jaunpur (UP)

ABSTRACT

An experiment was conducted at Experimental unit (Pili kothi) Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur during 2019-20 to assess the effect of organic manures and bio-fertilizers on growth and yield of papaya (*Carica papaya* L.) *cv*. Red Lady. The saplings of papaya were transplanted at 15th October with a spacing of 1.8 × 1.8 m^2. The experiment was laid out in Randomized Block Design with eleven treatments replicated thrice. Result indicated that the maximum plant height (260.48 cm), stem girth (46.52 cm), petiole length (80.38 cm), leaf area (1406.15 cm^2) and plant spread (193.32 cm) was recorded with T_9 (Neem cake + *Azotobacter* + PSB) application fallowed by plant height (255.28 cm), stem girth (42.24 cm), petiole length (76.15 cm), leaf area (1388.22 cm^2), plant spread (189.49 cm) with T_7 (Vermicompost + *Azotobacter* + PSB) and minimum in control. Observations recorded on yield and yield contributing characters revealed that the fruit length (35.48 cm), fruit diameter (16.22 cm), fruit volume (1272.45 cc), fruit weight (1274.82 gm), fruit yield per plant (58.4 kg), fruit yield per plot (467.2 kg), fruit yield per hectare (72.6 q) was recorded maximum with T_{10} (Farm yard manure + Vermicompost + Poultry manure + Neem Cake + *Azotobacter* + PSB) the minimum values of these characters were recorded T_{11} under control.

Keywords: Growth and yield, organic manures and bio-fertilizers, vermicompost, neem cake, *Azotobacter*

◆◆◆◆◆◆

Efficacy of Organic Farming Practices on Okra

Harsh S. Hathi and Dr. M. V. Patel[1]
Department of Vegetable Science, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat.
Department of Horticulture, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat.

ABSTRACT

The modern intensive agriculture practices have considerably raised the output but created problems like land and environmental degradation and pollution.Organic farming in recent years is gaining impetus due to realization of inherent advantages as it confers in sustaining crop production and also in maintaining dynamic soil nutrient status and safe environment. An investigation entitled "Effect of liquid organic substances, spray frequency and levels of fertilizer on okra (*Abelmoschus esculentus* (L.) Moench)" was conducted at College farm, College of Horticulture, S. D. Agricultural University, Jagudan, during *Kharif*-2021, laid out in Factorial Randomized Block Design with eighteen treatments comprising of three factors *viz.*, liquid organic substances (o) *viz.*, *panchagavya* 3 % (o_1) and *jeevamruta* 5 % (o_2); spray frequency (s) *viz.*, two spray at 20 & 40 DAS (s_1), three spray at 20, 40 & 60 DAS (s_2) and four spray at 20, 40, 60 & 80 DAS (s_3) and levels of fertilizer (f) *viz.*, 100 % RDF (f_1), 80 % RDF (f_2) and 60 % RDF (f_3). The treatment (T_7) *i.e.* combination of ($o_1s_3f_1$) was found superior in the terms of growth, flowering, yield, quality and economics of okra. It could be concluded that for higher yield with good quality and maximum economic return, okra should be sprayed four times with 3 % *panchagavya* at 20, 40, 60 and 80 DAS along with 100 % RDF. Further, foliar application of *jeevamruta* could reduce 20 % RDF,aswith the *jeevamruta* there was no significant yield reduction upto 80 % RDF.

◆◆◆◆◆◆

Effect of time of planting and bio inoculants on no. of leaves and leaf length of Gladiolus

Divya[1], Arvind Kumar[2], Sakshi[2], Neha[2] and Pawan Kumar[2]
[1]Maharana Pratap Horticultural University, Karnal, 132001
[2]CCS Haryana Agricultural University Hisar, Haryana, 125004

ABSTRACT

The experiment was conducted at Agri-tourism Centre, CCSHAU, Hisar (Haryana) during 2020-21 to study the effect of time of planting and bio inoculants on growth of Gladiolus cv. White prosperity. The experiment was laid out in randomized block design with three replications. The observations were recorded for vegetative parameters. The data recorded for all the parameters were analysed by using OPSTAT software. This experiment was done to explore the best planting time and best bio inoculant treatment. The experiment consists of growing white prosperity cultivar of gladiolus at four different planting times (1st fortnight of October, 2nd fortnight of October, 1st fortnight of November and 2nd fortnight of November) and with eight different treatments of bio inoculants, T_1: Recommended dose of fertilizers (RDF), T_2: RDF + Azotobacter, T_3: RDF + PSB, T_4: RDF + Mycorrhiza, T_5: RDF + Azotobacter + PSB, T_6: RDF + PSB + Mycorrhiza, T_7: RDF + Azotobacter + Mycorrhiza and T_8: RDF + Azotobacter + PSB + Mycorrhiza. The data recorded revealed that 1st fortnight of October was the best planting time for gladiolus performed better results in terms of maximum number of leaves and leaf length. Among the different bio inoculants treatment, T_8 treatment (RDF + Azotobacter + PSB + Mycorrhiza) proved better with respect to superior vegetative, flowering, yield and corm characters when compared to other treatments.

◆◆◆◆◆◆

Sustainable Technique of Seed Treatment: Beejamrit

Bhawana Dhami and Sakshi Verma
Doon Group of Institutions, Shyampur Rishikesh

ABSTRACT

Beejamrit, an ancient organic low cost and effective method to treat seeds, or any planting material. It is an effective method to protect the seeds and saplings from various fungal and seed borne diseases. Seed treatment is necessary because many diseases make their foot prints during germination only.This method of treating the plantsis considered to be the climate smart agriculture (CSA) practices which can help in coping up with the negative impacts of climate change. Technically, Beejamrit is a fermented microbial solution, having lots of plant beneficial materials as bacteria, P-Solubilizers, N-fixers and actinomycetes. We need few easily available ingredients such as Cow dung, Cow urine, Water, Lime and Soil. It can be prepared in few days and after fermentation we can use it in gardens and farms. Due to the presence of microbial masses,it helps during seed germination, nourishment, seed vigour, seed length and overall growth and development of the crop which contributes in uplifting the livelihood of an individual and enhancing food security. The seeds treated with Beejamrit are more resistant, which increases their chance of germination. It can also protect young roots of seedling from fungal diseases.Hence such organic practices should be promoted for better crop growth results and sustainable environment.

◆◆◆◆◆◆

Organic Farming in Indian Agriculture

Souradip Das
Department Of Seed Science and Technology
HNBGU, Pauri Garhwal Uttrakhand, 246174

ABSTRACT

Organic farming is the production system which avoid chemical application in the agricultural land like synthetically compound (Fertilizer, Pesticides, Growth regulators, genetically modified organism, livestock food additives. *It is a new revolution in agriculture.* Organic farming mostly contribute in *sustainable agriculture*. It increases soil fertility through crop rotation, microorganism and leguminous crop (N2 fixation) by organic substance. Repair environmental damage and balance between ecosystem. An organic farming in India vision towards the healthy nation. It is a modern techniques of agriculture which helps to produce healthy vegetables, fruit. The origin of organic farming goes back, in its recent history, to 1940s. During this period, the path breaking fiction on the subject published by J.I. Rodale in the United States, Lady Balfour in England and Sir Albert Howard in India added to the cause of organic farming. Organic farming is one of a number of methodologies found to meet the purposes of sustainable agriculture. Many techniques used in organic farming like inter-cropping, mulching and mixing of crops and livestock are not unknown to various agriculture systems including the traditional agriculture practiced in countries like India. Although India was far behind in the assumption of organic farming due to several reasons, presently it has achieved rapid growth in organic agriculture and now becomes one of the largest organic makers in the world. In other word says that Organic farming is a method of farming system which primarily aimed at promoting the land and raising crops in a ordinary way. It aims to keep the soil alive and in good health by use of organic wastes (crop, animal and farm wastes, aquatic wastes) and other biological materials along with beneficial microbes (biofertilizers) to release nutrients to crops for increased sustainable production in an eco-friendly pollution free environment. It increases food safety in vegetable, fruit and cereal crops.

◆◆◆◆◆◆

Organic Horticulture

Garima Yadav, Prabha Siddharth and Vishwa Vijay Raghuvanshi
CSAUA&T, Kanpur, Uttar Pradesh
ANDUA&T, Kumarganj, Ayodhya, Uttar Pradesh

ABSTRACT

Organic horticulture farming represented the practice of cultivation of plants for their fruits, flowers or vegetables but naturally, that means with minimal usage of chemical fertilizers or any other artificial tools and methods. Horticulture mainly involves the application of eco- friendly practices of soil building and pest management like the application of organic manures, compost, biological pest control agents. Mulches, cover crops, compost, manures, vermicompost and mineral supplements are soil-building mainstays that distinguish this type of farming from its conventional counterpart. Through attention to good healthy soil condition, it is expected that insect, fungal, or other problems that sometimes plague plants can be minimized. However, pheromone traps, insecticidal soap sprays and other pest-control methods available to organic farmers are also utilized by organic horticulturists. Horticulture involves five areas of study: floriculture (includes production and marketing of floral crops), landscape horticulture (includes production, marketing and maintenance of landscape plants), olericulture (includes production and marketing of vegetables), pomology (includes production and marketing of fruits) and postharvest physiology (involves maintaining quality and preventing spoilage of horticultural crops). All of these can be and sometimes

are, pursued according to the principles of organic cultivation. Organic horticulture (or organic gardening) is based on knowledge and techniques gathered over thousands of years. In general terms, organic horticulture involves natural processes, often taking place over extended periods of time and a sustainable, holistic approach – while chemical-based horticulture focuses on immediate, isolated effects and reductionist strategies. It performs the vital role in the Indian economy by generating employment and higher farm profitability due to higher crop production and export earnings from foreign exchange. KEYWORD: Organic, Horticulture, Fruits, Vegetables, Flowers, Spices, Medicinal, Aromatic and Post- harvest.

◆◆◆◆◆◆

Organic Horticulture in India

Kumari Nandita, Sanjay Sahay and Priyanka kumara
Bihar Agricultural University, Sabour-813 21

ABSTRACT

Over the past three decades, an increasing number of people worldwide who are concerned with their health have been interested in organic produce. Agrochemical residues, produce quality and food safety are all issues that are growing more prominent in both the worldwide and domestic societies. Organic farming is done on more than 37.5 million ha of land (0.87% of all agricultural land) by 1.9 million producers in 164 countries. In addition, there are another 31 million ha that are certified for wild harvesting. U.S. and Europe are the largest consumers of organic products, at $75 billion. Global organic food sales are predicted to reach $849.7 billion by 2028. Organic farming is not a new idea for farmers in India. Organic farming is conducted successfully in a variety of climates, particularly in rain-fed, tribal mountains and mountainous regions of the country. By default, many of the economically important forest products, such as herbs and medicinal plants, are in this category. Total area under organic certification (registered under National Programme for Organic Production) on 31 March 2021 is 4339184.93 hectares (2020-21). This includes 2657889.33 ha of farmland and 1681295.61 ha of wild harvest. India produced 3496800.34 MT (2020-21) of certified organic products, including oil seeds, sugar cane, cereals & millets, aromatic & medicinal plants, tea, coffee, fruits, spices, dry fruits, vegetables, processed meals, etc. The study of the Task Force on Organic Farming created by the Government of India recognised the wide areas of the country where little amounts of synthetic chemicals are employed, but which offer unexploited potential for organic agriculture. The creation of the National Program for Organic Production (NPOP) by the Agriculture and Processed Food Export Development Authority (APEDA), Ministry of Commerce, gave institutional backing for organic exports from India. The NPOP helps support promotional efforts, accreditation by inspection and certification agencies and gives help to agri-business enterprises to help them export. India now has 26 certified certification agencies that have been approved by the government to help growers get certified.

◆◆◆◆◆◆

Effect of Organic Treatments on Fruit Length and Number of Fruits per Plant of Guava

Sakshi, Suresh Kumar, Sumit and Divya
CCS Haryana Agricultural University, Hisar-125004 (Haryana), India

ABSTRACT

The present investigation entitled “Effect of organic treatments on fruit lengthand number of fruits per plant of guava (*Psidium guajava* L.)” was carried out at PG lab of the Department of Horticulture, CCS

Haryana Agricultural University, Hisar during rainy and winter season of 2020. As the productivity rate of guava has started to decline because of the excessive use of chemical fertilizers, pesticides and insecticides in the field. Hence there is a need to find out an alternative sustainable system of farming, which is ecologically sound and economically acceptable. The answer to the problem is the traditional agricultural practices, which are based on natural and organic methods of farming. In this experiment, various organic sources (FYM, vermicompost, poultry manure and jeevamrit) along with various biofertilizers (Azotobacter and PSB) combinations were evaluated to study their effect on yield parameters like fruit length and number of fruits per plant of two years old guava cv. VNR bihi in completely randomized design. It is concluded that 80% replacement of nitrogen through FYM + 20% replacement of nitrogen through poultry manure + Azotobacter + Phosphate Solubilizing Bacteria resulted in maximum fruit length and number of fruits per plant in both rainy and winter season. This might be attributed to continuous supply of nutrients, the higher concentration of soil microorganisms, more friable and porous soil due to the application of poultry manure and biofertilizers.

◆◆◆◆◆◆

Horticulture in the Indian Himalayas

Rahul Dev, NK Hedau, Lakshmi Kant
ICAR-Vivekananda Paravatiya Krishi Anusandhan Sansthan, Almora

ABSTRACT

The Himalayan region is inhabitant of 39 million people (~4% of the total population), a large percentage (~75%) is of the hill farming communities. Therefore, the development of mountain peoples is primarily linked to the development of agriculture and its allied activities. The Indian Himalayas cover an area of 53.7 Mha, which is ~17% of the total geographical area of the country. The availability of land for cultivation in the hilly region of Himalaya is just ~ 0.17 ha per capita and it continues to shrink further.Irrigated farmlandsoccupying only 15.8 per cent of the total area of the Himalayas. After land and water, the third ecological driver of change is the increasing domination of wild animals over the farmers, which is presently increasing its disruptive value to mountain agriculture in all the northwest Himalayan states. The climate in Uttarakhand is characterized by vagaries of weather. Unpredictable climate events (dry spells/aridity, natural calamities) have already affected the productivity of major cereal crops. Due to its over-dependency on seasonal rains, the impacts of climate change on crop production and farmers' livelihoods are considered to be very high. Additionally, current crop profile of state does not suffice the daily nutritional requirement of hilly farming communities. A large number of populations are out-migrating along with families from the hill regions for alternative employment and to eke out their livelihoods.Promotion of potential horticultural crops and their value addition for the development of ready-to-use products can be a strategy to sustain the livelihoods of rural communities and stop out-migration. Traditional food grains and cereals, pulses and local vegetables are being abandoned or have already been abandoned by many farmers. The climatic conditions in the Himalayas, range from subtropical (low-lying river valleys) to Alpine and cold (highly elevated regions) and are suited for diverse fruit/ vegetables cultivation. Horticulture has its advantage in the Himalayan ecosystem due to its particular ecologicalcondition and numerous micro-situations. The percentage share of horticultural crops in the total agricultural income of mountain farmers is increasing in the Himalayan states. Presently, variety of fruits are in cultivation in this basin, ranges from mango-guava, papaya and citrus (lemon, orange, malta, kinnow) to apple, pear, walnut, kiwi, pomegranate, plums, peach and apricot in the different elevations. Vegetable (tomato, cauliflower, cabbage, beans, potato, capsicum, cucumber and pumpkins) cultivation is also carried out on the slopes of the hilly basin at different altitudes. These potential horticultural crops are rich in nutritional and nutraceutical properties along with the ability to grow in harsher agro-climatic conditions. Moreover, their cultivation is also easy and does not require much care. Still, sufficient progress is not achieved so far, due to certain inhibiting factors, especially poor transportation and marketing that hinder the rapid growth of the horticulture sector in these hilly regions. The

state of Himalayan farming highlights the fact that business as usual cannot continue. For economic upliftment of the rural community inhabiting Himalayan regions, proper land use planning has to be done with different horticultural crops. This region faces several sectoral, institutional and policy challenges which need to be addressed systematically, if the potential is to be realized and translated into a sustainable development impact. To meet the purpose, significant research, improvement and development efforts are needed which will be discussed.

◆◆◆◆◆◆

Zero Budget Natural Farming

Neha, Deepa H. Dwivedi , Krishna Jat , Shipra Kumari
Department of horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow,
Uttar Pradesh 226025, India

ABSTRACT

In India after green revolution, the use of chemical fertilizers and pesticides in India has increased. The excessive application of chemicals having adverse impact on environment, soil, human health and purity of ground water. In this situation, ZBNF system was adoptedto reducethe use ofchemical fertilizers and pesticides. Zero Budget Natural Farming (ZBNF) was practiced and promoted by Subhash Palekar in India. The 4 pillars of ZBNF are 1. Jivamrita, which helps to prevent harmful bacterial and fungal growth. This pillar also acts as a catalytic agent which increase the useful activity of bacteria and organic matter. 2. Bijamrita, which protect seedlings from soil borne diseases, 3. Mulching (also called as Acchadana), this soil mulching provided by ZBNF protect the topsoil by avoiding tiling, 4. Moisture (also called as Whapasa), it is a condition in which both water and air molecules are present in the soil. In such type of farming pest control is done by homemade preparations such as neemastra, brahmastra and agnistra which are insect pest which functions as fungicides also as tonics. As a result of this natural farming every farmer turns into a researcher in his own fields. Also with the help of such farming savings on the cost of fertilizers, chemicals and seeds has been adequate

Keywords: Acchadana, Bijamrita, Jivamrita, Mulching and Whapasa

◆◆◆◆◆◆

Prospects of Value Addition in Under-Utilized Fruit Crops

[1]VANI N.U, [2]P.C. TRIPATHI and [3] PARVATHI BENNURMATH
[1] Department of Horticulture with Specialization in Fruit Science, IGKV, Raipur
[2]Division of Fruit crops, ICAR-IIHR, Bengaluru Bengaluru
[3]Division of flower and medicinal crops, ICAR-IIHR, Bengaluru

ABSTRACT

India is one of the world's top producers of fruits but we lack in value addition of fruit crops as post harvest losses are very high. There is a high demand for value added fruit products worldwide due to nutrition and to meet the requirements of growing population.Value addition creates a new product by altering its current location, time and characteristics that are more preferred in the marketplace to obtain higher returns. Every plant and every component of a plant has a specific use, unless we realize the value of that product they are underutilized.The cultivation of underutilized fruits is less widespread and their trade and consumption are still less common butthese are negligently grown in wastelands, naturally available, seasonally inexpensive fruits can be used to create nutrient-rich, therapeutic worth, inventive value added foods that are more affordable.Hence research organizations must concentrate on these crops to develop production even during off seasonsto avoid

seasonal market fluctuations.The potentialities of underutilized fruits are not exploited however, several efforts have been undertaken by researchers to develop value-added processing technology. Value addition must be considered from a wider perspective than merely processing to assure higher returns, but to increase off-farm employment prospects, increased commodity supply and shelf life and improve technology to boost the nation's trade and economy and acquirea means of escaping povertyby supporting both economic sustainability and human nutritional needs. Therefore, value addition in underutilized fruit crops is the need of the hour.

◆◆◆◆◆◆

Response of integrated nutrient management on seed germination, vigour and yield of *Amaranthus* (*Amaranthus tricolor* L.)

Saurabh Yadav[1], K. P. Asati[2] and Swati Barche[2]
[1]Department of Vegetable Science, Punjab Agricultural University, Ludhiana, Punjab, India
[2]Department of Horticulture, College of Agriculture, Indore, Madhya Pradesh, India

ABSTRACT

Growth, yield and quality of Amaranth depend on nutrient availability in soil, which is released to the judicious application of manures and fertilizers. Increased use of inorganic fertilizers in crop production deteriorates soil health, causes a soil health hazard and creates an imbalance in the environment by polluting nature. The continuous use of chemicals degrades the soil texture and composition reduces manure content and kills useful microbes. The Integrated Nutrient Management approach is utilized to maximize the advantages from all potential sources of plant nutrients in order to maintain the soil fertility and plant nutrient supply to an optimal level for maintaining crop productivity. Therefore, the present study was conducted to find out the effect of different levels of manures, fertilizer and biofertilizers application, either alone or in combinationon seed germination, vigour and yield of Amaranthus. Recommended rates of organic manures *viz.*, farmyard manure (5 t/ha) and vermicompost (2.5 t/ha) biofertilizers *i.e.*, *Azotobacter* and *Phosphate solubilizing bacteria* @ 200g per 10 kg of seed were integrated with the recommended dose of fertilizer @ 60: 40: 20 kg/ha NPK.The experiment was designed with twelve treatments with three replications that were laid out in a randomized complete block design. Results revealed that the treatment T_{12} which consists of half dose of NPK + half dose of vermicompost + Azotobacter and PSB observed early emergence of seeds (3.60 days) along with higher germination percentages (84.53 percent) as well as vigorous seedlings in terms of vigour index-I (5.75) and vigour index II (5.56). The crop was harvested three times at a height of 20 cm and by the application of treatment T_{12} plants take minimum time for harvest *i.e.*, 21.65, 30.65 and 41.16 days along with the highest yield *i.e.*, 0.50, 1.15 and 0.85 kg per plot at first second and third harvest respectively. Therefore, it is clear that combining inorganic fertilizers with organic.

◆◆◆◆◆◆

Effect of mycorrhization and different growing medias on morphological traits of seedlings growth in greenhouse tomato

Amit Kumar[1] and Indu Arora[1]
[1]Dept. of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004

ABSTRACT

Tomato is cultivated worldwide and is famous for its nutritive and medicinal values. Due to shortcomings in the traditional nursery production techniques such as poor germination, poor quality seedlings, farmers are

facing problem of quality planting material in vegetables under soilless pro-tray nurseries to take production in hi-tech greenhouse. Moreover, due to expensive growing media, this vegetable nursery industry becomes less renumerative. Therefore, standardized nursery production technique along with crops and varieties is the need of the hour. The study was conducted on "Effect of mycorrhization and different growing medias on morphological traits of seedlings growth in greenhouse tomato" at CCSHAU, Hisar, during 2022 for evaluating different media like cocopeat, spent mushroom substrate (SMS), vermicompost, perlite and vermiculite alone and in combination with and without Arbuscular mycorrhiza (AM) to examine their effect on the quality of tomato seedlings for greenhouse cultivation. Maximum seed emergence (100 %) was observed under treatment T_3(SMS + Cocopeat in 1:1 ratio along with *mycorrhiza*) and T_9(SMS + vermiculite + perlite in 1:1:1 ratio)at 30 DAS, while seedlings height (10.5 cm), dry shoot weight (0.0686 g) and fresh shoot weight (0.7195 g) were observed in T_{10} (Cocopeat, Vermicompost and SMS in 1:1:1 ratio) at 30 DAS. Optimum growth of indeterminate tomato seedlings (Pusa Ruby) was observed when Cocopeat, Vermicompost and SMS were used in equal proportions (1:1:1) as growing media.

◆◆◆◆◆◆

Nutritional Feasibility through Fruit Crops in Bundelkhand Region

Bijendra K. Singh, Anand Singh and Rajaneesh Singh
Department of Fruit Science, College of Horticulture,
Banda University of Agriculture and Technology, Banda-210 001 (U.P.)
Department of Horticulture, T.D.P.G. College, Jaunpur 222 002 (U.P.)

ABSTRACT

The people of Bundelkhand region are severely malnourished along with multiple nutrient-deficiency disorders due to ignorance about importance of fruits in their diets. Horticulture serves as an avenue for sustainable nutrition production fruit crops play an important role in overcoming vitamins and minerals deficiency. Nutritional feasibility comprises of production of nutrient enriched fruits and their processed products. India is second largest producer of fruits in the world India is currently producing about 107.10 MT of fruit crop produce (NHB-2021-22), but loss of fruit crop produce due to insufficient storage capacity measure about 10-40% and loss due to lack of post harvest processing is also high, post harvest losses are very high in fruit because they are highly perishable due to the presence of high moisture and plant metabolites. Nutritional sustainability relies on economic viability, social acceptability and environmental soundness for its success.

Also growing horticultural crops of short duration act as a supplement source of income to farmers and also ensure regular supply of fruit and vegetables in the market. Horticultural crops are main component of a healthy nutritional diet. In Bundelkhand regions fruit plants like Aonla, Bael, Ber, Karonda, Lasora, Jangal Jalebi, Wood apple, Chironji, Tamarind, etc. which are lesser-known plant species. These fruits are the rich source of nutrients, vitamins, minerals and dietary fibers which have the nutritional and medicinal potential to prevent and cure the malnutrition problem and become a solution to the eliminate poverty and unemployment of the rural people. Thus, they have the nutritional capacity to prevent and cure various diseases like diabetes, night blindness, anemia, cancer, hypertension and hidden hunger. These crops have many advantages like easier to grow and hardy in nature, producing a crop even under adverse soil and climatic conditions. It is also established fact that seasonal, locally available and cheap fruits can also keep the population healthy and nutritionally secure rather than costly off-season ones. Also, the fruit crops have the potential to give economic security to the rural people by giving employment and by fetching good returns from their sale in raw form as well as value-added products.

Keywords: Feasibility, nutrition, vitamins, minerals, diseases and Bundelkhand region, etc.

◆◆◆◆◆◆

Influence of OrganicMulching on Plant Growth of Khirniand Soil Nutrient Status

Mukesh Chand Bhateshwar[1], Jitendra Singh[1], Pooja Sharma[2],
[1]Department of Fruit Science, College of Horticulture and Forestry, Jhalawar, Rajasthan, India .[2]Department of Horticulture, College of Agriculture, Kota, Rajasthan, India

ABSTRACT

Khirni (Manilkara hexandra Roxb.) is one of the important underutilized fruit crops of tropical and sub-tropical region of India.An experiment was conducted during the year 2019-2020, at the Instructional Farm, Department of Fruit Science, College of Horticulture and Forestry, Jhalawar for the study of effect of different mulch treatments on plant growth and soil nutrient status of *Khirni*. Among different thickness of mulch treatments, application of T_6- 12 cm thickness of dry grass to individual plant was found significantly superior over all other treatments, but it was found at par with T_5 treatment (10 cm thickness of dry grass). In treatment T_6 the increase in plant height (32.61%) was recorded at the time of final observation during February. In respect to soil nutrient status also T_6 treatment (12 cm thickness of dry grass) also recorded comparatively better effect over other treatments. However, T_5 treatment (10 cm thickness of dry grass) was noted at par with T_6 treatment (12 cm thickness of dry grass). In this treatment (T_5) all soil parameters like soil pH (7.13), electrical conductivity (0.44 dSm-1), organic carbon (0.52%), available N (289 kg ha-1), available P (29 kg ha-1), available K (342 kg ha-1), water holding capacity (48%), bulk density (1.32 Mgm-3), particle density (2.63 Mg m-3), porosity (46.80%) and soil temperature (18.25ºC) were recorded better nearing T_6 treatment (at par) at the time of final observation during February. Overall, the treatment T_6 was found better as far as its impact on plant growth of *Khirni* plant besides soil parameters which formed part of the study.

Keywords: *Khirni*, Thar Rituraj, Mulching, Growth.

◆◆◆◆◆◆

Biostimulants increase survival percentage and stimulate growth characteristics of Litchi air layers

Sushree Suchismita Meher[a], Ratna Rai[a], Pratibha[a] ,Sunita T. Pandey[b], Omveer Singh[a], Yeshpal Singh[c] , Purnita Raturi[a] ,Yusra Suhail[a], Nitin Panwar[a] and Saurabh Tamta[a]
[a]Department of Horticulture, [b]DepartmentofAgronomy, G. B. Pant University of Agriculture and Technology, Pantnagar, USNagar, Uttarakhand 263165, India
[c]Krishi Vigyan Kendra, Muzaffarnagar II, SVPUA&T, Meerut

ABSTRACT

The present experiment was conducted at Horticulture Research Centre, Patharchatta, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar (Uttarakhand) during the year 2021-2022 to study the effect of various biostimulants on survival percentage and growth characteristics of air layers in litchi cv. Rose Scented. The experiment was carried out in Completely Randomized Design (CRD) having three replications. The experiment comprised of eleven treatments *viz.* ,control (water), seaweed extract @ 5 ml/L , seaweed extract @ 10 ml/L ,triacontanol@ 5 ml/L, triacontanol @ 10 ml/L ,*kunapajala* 1 @ 50 ml/ L , *kunapajala* 1 @ 100 ml/L ,*kunapajala* 2 @50ml/L ,*kunapajala* 2 @100ml/L, *kunapajala* 3 @50ml/L and *kunapajala* 3 @ 100 ml/L. The observations were recorded at 120 and 180 days after planting (DAP). The results revealed that maximum survival percentage (90% at 120 DAP and 88.33 % at 180 DAP), shoot length (30.38 % at 120 DAP and 43.29 % at 180 DAP), number of leaves (22.23 at 120 DAP and 25.46 at 180 DAP),

number of primary roots (19.15 at 120 DAP and 23.48 at 180 DAP), length of primary roots (7.8 cm at 120 DAP and 9.86 cm at 180 DAP), were found in the plants applied with herbal *kunapajala* 2 @ 100 ml/L. Lowest values for all these traits were observed in triacontanol @ 10 ml/L. The study concludes that application of herbal *kunapajala* 2 @ 100 ml/L significantly improved the survival percentage and vegetative growth of air layers in litchi cv. Rose Scented while the doses of tricontanol proved to be toxic.

◆◆◆◆◆◆

Organic Horticulture and Natural Farming

Parveen
Chaudhary Charan Singh Haryana Agricultural University, Hisar 125004

ABSTRACT

Natural farming/ Zero budget natural farming entails using only natural methods and no chemicals, with this strategy, the price of seeds, herbicides and fertilizers is completely eliminated. Zero Budget Natural Farming (ZBNF) is an integrated agro-ecological alternative. Masanobu Fukuoka lists four fundamentals (no plant protection, no weeding, no chemical fertilizers, no ploughing) of natural farming in his book One-straw Revolution, similarly, a production management technique known as organic farming relies on on-farm agronomic, biological and mechanical means instead of any synthetic off-farm inputs. Organic farming has numerous environmental benefits and is need to reduce the amount of pesticides and chemicals in the environment, increases the fertility of the soil, resists the erosion of the land and so on. Since 2015–16, the Government of India has been promoting organic farming in the nation through two specific programmes, Paramparagat Krishi Vikas Yojana (PKVY) and Mission Organic Value Chain Development for North Eastern Region (MOVCDNER), in response to the rising demand for organic food and growing awareness of the benefits of chemical-free farming for the environment and human life. Both programmes have a strong emphasis on providing organic farmers with full support, ranging from production to certification, marketing and during the year 2020-21, 9.86 lakh farmers have been brought under Organic Farming. Under the schemes PKVY and MOVCDNER, 9.48 lakh ha area in India is under organic farming (Ministry of Agriculture & Farmers Welfare). By adoption of these more standardized horticulture production procedures that aid farmers in using their knowledge and abilities to increase production and more private companies

◆◆◆◆◆◆

Organic Horticulture

Badri Lal Nagar and Homeshvari
[1]Ph.D. Scholar, Department of Horticulture (Vegetable Science), College of Agriculture,
RVSKVV, Gwalior (M.P.) - 474002.
[2]Ph.D. Scholar, Department of Horticulture (Fruit Science), College of Agriculture,
JNKVV, Jabalpur (M.P.) - 482004.

ABSTRACT

Organic horticulture farming represents the practice of growing plants for their fruits, flowers or vegetables, but naturally, that means with minimal use of chemical fertilizers or any other artificial tools and methods. Organic horticulture mainly involves the application of eco-friendly practices of soil construction and pest management like the application of organic manures, compost, biological pest control agents. Organic fruit and vegetables are the main consumer entry point for purchasing organic produce and they continue to be the area of shortest supply in the organic sector, with most produce imported. Over the past three decades, organic

products have attracted the attention of a growing health-conscious population around the world. Many economically important forest products, such as herbs and medicinal plants and fall into this category by default. Institutional support for organic exports from India was created by the launch of the National Program for Organic Production (NPOP) by the Agriculture and Processed Food Export Development Authority (APEDA), Ministry of Commerce. The NPOP supports promotion initiatives, accreditation by inspection and certification agencies and offers support to agro-industrial companies to facilitate export. India now has 26 accredited certification agencies to facilitate the certification of producers. Organic fruit and vegetable production is therefore an ongoing profitable business sector, which for those with the requisite skills, offers a financially and professionally rewarding venture. As a guide, moving to organic horticulture is likely to result in an overall 20-50% reduction in yield compared to conventional production. A price premium of 30% to 100% over the conventional sale price would be expected, depending on the point of sale, *i.e.* wholesale or direct.

Keywords: Organic horticulture,Fruit and vegetable, Manures.

◆◆◆◆◆◆

The Multifunctional Role of Chitosan in Organic Horticulture

Mahendra Kumar Gora
Department of Horticulture, Rajasthan College of Agriculture, MPUA&T, Udaipur (Rajasthan)

ABSTRACT

In the perspective of return to nature, using scientific and technical progress for improved living standards, people began to search for solutions to alleviate environmental pollution. Researchers intend to make clean, affordable products that are gentle yet effective. Chitosan is a naturally occurring compound and is commercially produced from seafood shells. It has been utilized in the induction of the defense system in both pre and post-harvest fruits and vegetables against fungi, bacteria, viruses and other abiotic stresses. In addition to that, chitosan effectively improves the physiological properties of plants and also enhances the shelf life of post-harvest produces. The chitosan effects on fruit physiology and agronomic traits have been highly studied using different concentrations of chitosan over a variety of fruits. In line with that, foliar spraying of 5 mL L^{-1} chitosan over mango trees improved the number of fruits $tree^{-1}$, weight and size of fruit and vegetative growth. In grapes, chitosan was sprayed at 500 L per hectare during the pre-bunch closure and veraison stage and effectively increased the POX and PAL activities, polyphenol content and SOD activities. Moreover, an increase in the weight of fresh fruit of the kiwi plant was observed after spraying with chitosan in field conditions. Furtherly, chitosan in combination with calcium chloride reduced the early swelling of peach trees, maintained freshness and firmness of fruits and decreased the weight loss percentage. In nectarine, chitosan improved the soluble solid content and also helped maintained the post-harvest firmness of the fruit.

◆◆◆◆◆◆

Evaluation of organic nutrients management practises on growth, yield and quality of cabbage (*Brassica oleracea* var. capitata) cv. "Kranti"

Uttam Shivran and S.S. Lakhawat
Department of Horticulture, Rajasthan College of Agriculture, Udaipur

ABSTRACT

The current investigation entitled "Evaluation of organic nutrients management practises on growth, yield and quality of cabbage (*Brassica oleracea var. capitata*) cv. Kranti" was conducted at Horticulture farm,

Department of Horticulture, Rajasthan College of Agriculture, Udaipurduring winter season 2020- 21. The experiment was made up of the ten treatment of different combination of organic inputs and those were replicated thrice before applied randomly in 30 plots underRandomized Block Design (RBD). The crop's recommended nitrogen dose (RDN) was 150 kg/ha. Results showed that among organic nutrients management practises application of T_4 treatment(T_1 *i.e.* enriched compost as 100 % RDN + Fortified *Panchagavya* spray @ 4 % at 10 to 20 days after transplanting and 15 days after 1st spray + Fortified *Jeevamrut* @ 500 litres /ha twice at 15 days interval)was recorded with significantly highest plant height (30, 60 DAT and at harvest), leaf area, plant spread, leaf length (cm), number of non-whorled leaves per plant (30, 60 DAT and at harvest), leaf width (cm), with minimum days taken to head formation (DAT) and days taken to head harvest, along with maximum polar diameter of head, equatorial diameter of head (cm), fresh weight of head (g), volume of head (cm^3), head compactness (%), yield per plot while, lowest was found in control.

◆◆◆◆◆◆

Significance of Beneficial Microorganisms Isolated from Different Organic Concoctions and Their Role in Organic Farming

Surpura, Rahemanali M.[1]; Bhimani H. D.[2]; Singh, Susheel[3] and Dewada, Rahul[4]

[1,4]Department of Agricultural Microbiology, NMCA, Navsari Agriculture University, Navsari- Gujarat -396450

[2]ASPEE Shakilam Biotechnology Institute, NAU, Surat – 395 007

[3]Co-PI, Unit IV, NAHEP-CAAST

ABSTRACT

Use of natural and eco-friendly concoctions like Jeevamrutham, Ghanjeevamrutha, Brahmastram, Panchagavya *etc*. are commonly being used in concurrent organic farms all across the india. These concoctions are generally prepared from rhizospheric soil of banyan tree, jaggery, ghee, specific tree leaves, fermented curd, cow dung, milk and cow urine. Numerous scientific studies are available where the efficacy of concoctions against the pests and pathogens of different economical crops are being evaluated. Among these some natural concoctions like Jeevamrutham, cocopit and Ghana Jeevamrutham contain one or more beneficial microorganism which are *Trichoderma* spp., *P. fluorescence* and entomopathogenic fungi. Thus, the concoctions prepared by traditional method contains beneficial microbial biopesticides that have proven virulence and antagonistic ability against pathogens and pests. Henceforth, these concoction could be used as growth enhancers and plant protectants in organic farming.

◆◆◆◆◆◆

Isolation and Evaluation of IAA producing plant growth promoting Rhizobacteria (PGPR) from the papaya rhizosphere

Jyoti Bajeli[1], P.N. Rai[1], A.K. Sharma[2], Aakansha Verma[2], Akhilesh Negi[2], Sugandha Pant[2], Sheeba Belwal[1]

[1]Department of Horticulture, [2] Department of Biological Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar

ABSTRACT

The rhizosphere is the soil around plant roots, which is directly affected by soil microbes and exudation of plant roots have an essential role in plant health and soil fertility. Papaya rhizosphere is a very rich zone

supplemented with a variety of beneficial bacteria. The soil samples were collected from the rhizosphere zone of papaya planted in Pantnagar under natural conditions. The serial dilution of soil samples was carried out in laminar flow under sterilized conditions. The colony forming unit (CFU) count of samples was 1.17x 10^3 and 1.75x 10^3. Isolation and purification of morphologically different bacteria was done in 60 mm petri-plates. The functional activity test was carried out for purified bacteria for plant growth promoting activity such as phosphorus solubilisation, potassium solubilisation, sidrophore production and Indole acetic acid (IAA) production. Eleven potassium solubilising bacteria were found positive for IAA production with highest IAA production of 532.85ppm by potassium solubilizing bacteria. Nine phosphorus solubilising bacteria showed positive trend for IAA production and two sidrophore producing bacteria showed positive trend for IAA production. Moreover, there was a positive correlation between the IAA production, sidrophore production, phosphorus and potassium solubilisation and promoted the growth of papaya plant, showing a potential use in horticulture productionsystems.

◆◆◆◆◆◆

Effect of organic supplements on legume vegetables crops and its residual effect on amaranth crop under foot hills of North Eastern Himalayan region system

Suprava Biswal, Ambika Prasad Mishra
Correspinding id : supravabiswalchc2@gmail.com
Organic Supplements in Legume-Vegetable – Amaranth Cropping system

ABSTRACT

Organic amendments being both solid and liquid manures act as a store house of different plant nutrients. They played a significant role in supplying basic macro & micronutrients which improves the soil physio-chemical and biological properties. With the increasing awareness about the safety and quality of foods, long term sustainability of the system and accumulatingevidences of being equally productive, the organic farming has emerged as an alternative systemof farming which not only addresses the quality and sustainability concerns, but also ensures adebt free, profitable livelihood option. The experiment was comprised of four different main plot factor include enriched organic amendments such as farmyard manure, vermicompost andpoultry manure with liquid biostimulants (no spray, jeevamrut (3%), vermiwash (3%), liquidmustard cake (3%)) in a split plot experimental design by using legume vegetable crop like garden pea cultivar Azad Pea-3, french bean cultivar Arka Komal and amaranth local cultivar Jawa Kusum during the year 2020. Enrichment of organic manure was done with biofertilizers like Azotobacter and phosphorous solubilizing bacteria (PSB) @ 10gm of each starin of biofertilizers/kg of manure. The results of this study concluded that application of enrichment vermicompost along with jeevamruth in foliar spray resulted in good response in garden pea cultivation whereas, used of enriched poultry manure with vermiwash foliar spray gave betterresult in french bean cultivation although application of farmyard manure (control) gave better yield in amaranth cultivation as well as the economic return also making more profitable for the cropping land.

◆◆◆◆◆◆

Need of organic mulching in Horticultural crop production

Dharmendra Kumar Gautam[1] and Om Prakash[2]
College of Horticulture. Banda University of Agriculture and Technology, Banda, U.P.-210001

ABSTRACT

Mulching is a technique in which the use of organic is involved. Organic mulching is widely utilized in modern-day horticulture especially in fruits and vegetable crops throughout the world. The need for modernization

and improvement of cultivation technologies is always present and organic mulching is one such technique that improves the ecological environment of the soil, growth and yield of vegetable crops. This technique is very useful in protecting the roots of the plants from heat and cold. It also restricts weed growth because if the soil is covered with an organic mulch layer, then the light will not reach the soil surface, which also improves the soil characteristics. It improves the soil's physical, chemical and biological properties. After some time, this mulch slowly decomposed and the increased organic content in the soil helps to keep the soil loose. These organic contents provide food for earthworms and other microorganisms available in the soil. Theorganic mulches also improve the quantity of organic carbon in the soil. More the organic carbon, most of the soil organic mulches are derived from plant and animal materials such as straw, hay, peanut hulls, leaf mold, compost, sawdust, wood chips, shavings and animal manures. Organic mulch is efficient in the reduction of nitrates leaching, improving soil physical properties, preventing erosion, supplying organic matter, regulating temperature and water retention, improving nitrogen balance, taking part in a nutrient cycle as well as increasing biological activity. water scarcity becomes a serious problem for the future and its most probable solution can be the use of organic mulching for

◆◆◆◆◆◆

Bio-fortification in vegetable crops

Shani Kumar [1] , G. C. Yadav, Subhash Verma[2], Lav Kumar[1] and Mritunjay Rai[1]
[1]Ph.D research schoolers, Professor, Department of vegetable science
Kumarganj Ayodha, 224229
[2]Ph.D research schoolers, Department of vegetable science, BAU Sabour, Bhagalpur

ABSTRACT

In the current scenario, people are suffering from vitamin and mineral deficiencies, which cause very serious constraints to human health and economic development. This is associated with the term "hidden hunger." Malnutrition is the cause of men's due to zinc, iron, provitamin A and iodine deficiency. One third of the world's population is at risk of these deficiencies. So, to overcome this problem in an easy way, bio-fortification works as a tool. Bio-fortification means enrichment of vitamin minerals through plant breeding or agronomic practices. So people must be required to maintain a healthy balance with the help of bio-fortified food. Plant breeders and biotechnologists are working on a new Green Revolution to make crops produce more nutrients through a process of bio-fortification. There are three common methods of bio- fortification: agronomic, conventional and transgenic. Recently, there have been several reports on the development of transgenic crops to enhance levels of pro-vitamin A content in crops like tomato, potato, cassava, and other vegetable crops. A number of biofotified varieties have been developed, such as Pusa Betakesari, Bhu Sona, Bhu Krishna, etc. Finally, the purpose of bio- fortification is to help overcome nutrient deficiency in rural areas and also be helpful in nutrient security. Nassar NM et al. (2007) worked on Amino acid profile in cassava and its inter-specific hybrid and found that among the sample of the inter-specific hybrid ICB 300 sample 1 would be more interesting for human consumption based on such nutritional character. The most effective form of se bio-fortification was foliar application as selenateWeng et al. (2013) reported that the Iodine bio-fortification of vegetable plants—An innovative method for iodine supplementation. Found that the bioavailability of iodine in vegetable within a reasonable range by changing the application amount of iodine fertilizer to meet the need of human body for iodine.

Keywords Bio-fortification, Vitamin, Amino acid, Mineral, Iodine.

◆◆◆◆◆◆

Herbal Garden: A Storehouse of MAP's

S. Ramesh Kumar and Utpal Das
VIT School of Agricultural Innovations and Advanced Learning
Vellore Institute of Technology, Vellore-632 014, Tamil Nadu.

ABSTRACT

Out of the 18000 species of higher plants that have been reported in India, approximately 7000 plant species are known to provide therapeutic benefits.Indians have used a variety of medicinal plants to treat a wide range of human and animal illnesses from time immemorial.

According to estimates from the World Health Organization (WHO), traditional plant-based medicines are used to treat 80 percent of the population in both developed and developing countries.The main threats to medicinal plants come from industrialization, forest fires, animal grazing, habitat specialization, climate change, rapidly increasing human population and genetic deterioration.However, due to their lack of side effects and accessibility in both developed and developing countries, the demand for herbal medicines has increased significantly over the years.Thus, the conservation, cultivation, maintenance and sustainable consumption of medicinal plants are important.Herbal Garden refers to growing Medicinal and Aromatic plants (MAPs) which are having preventive and curative properties against diseases or ailments.Herbal Gardens are established in different places to serve as a germplasm collection of important herbs for their conservation and to use them for educational and research purposes besides promoting health or medical tourism.The establishment of herbal garden will bring awareness on local medicinal plants for common ailments and encourage the small and marginal farmers to cultivate them for raising their income resources. Cultivation and propagation will help to conservation of medicinal plants.

◆◆◆◆◆◆

Effect of Biostimulants and Biofertilizer on Growth, Flowering and Postharvest Quality of Rose cv. Rose Sherbet

Lolla Rachana and Dr. VK Rao
Department of Horticulture, G.B. Pant University of Agriculture and Technology,
Pantnagar, Distt. U.S. Nagar (Uttarakhand)

ABSTRACT

The present investigation entitled "Effect of Biostimulants and Biofertilizer on Growth, Flowering and Postharvest Quality of Rose cv. Rose Sherbet" was carried out at Model Floriculture Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, during December, 2021 to May 2022. The experiment was laid out in RBD with nine treatments *viz.*, T 1 (100 % Recommended dose of fertilizers (RDF), T 2 (RDF 75 % + Fulvic acid), T 3 (RDF 50 % + Fulvic acid), T 4 (RDF 75 % + Humic acid), T 5 (RDF 50 % + Humic acid), T 6 (RDF 75 % + Sea weed extract-IFFCO Sagarika), T 7 (RDF 50 % + Sea weed extract-IFFCO Sagarika), T 8 (RDF 75 % + IIHR- Arka microbial consortium) and T 9 (RDF 50 % + IIHR- Arka microbial consortium) and three replications. Among all the treatments plant height (63.53 cm), plant spread (55.57 cm), number of branches (5.93), number of leaves (189.33) and stem diameter (1.31 cm) were found maximum in plants treated with humic acid @ 3 mL L -1 and 75% RDF *i.e.* T 4 after 150 days of application. T 4 also exhibited maximum leaf area per plant (1023.75 cm 2), early flower bud appearance (31.47 days), days taken for bud to bloom (12.47 days), 50 per cent flowering (49.33 days), maximum number of flowering shoots per plant per month (3.8) and earliest days to harvest (44.40 days), maximum bud length (3.19 cm), bud diameter (1.85 cm), flower diameter (5.44 cm), number of petals per flower (46.73) and longest flower longevity (5.73 days), highest weight of single

flower (3.97 g) and 100 flowers (398.87 g), number of flowers per plant per month (18.13), flower yield per plant per month (61.72 g) and flower yield per plant per hectare (5693.17 Kg), maximum shelf life (29.20 hr). The available N (191.30 kg ha -1), P (25.76 kg ha -1), K (178.08 kg ha -1) in soil, N (2.00 %), P (0.40 %), K (1.44 %) content in plants and soil's bacterial population (23.73× 10 4 CFU) were also enhanced by T 4 and it also recorded highest benefit – cost ratio (2.62) whereas lowest values were noticed in T 9 (Arka microbial consortium + 50 % RDF) . On the basis of these findings, it may be concluded that T 4 (humic acid @3 mL L -1 and 75% RDF) was found to be the best and it may be recommended for commercial cultivation of rose cv. Rose Sherbet for loose flower production in open condition under Tarai region of Uttarakhand.

◆◆◆◆◆◆

Influence of Integrated Nutrient Management on Gladiolus (*Gladiolus grandiflorus* L.) cv. 'Shagun'

Dhawani A. Patel and Kiran Kumari
Department of Floriculture and Landscape Architecture, College of Horticulture,
Sardarkrushinagar Dantiwada Agricultural University, Jagudan 384 460

ABSTRACT

Gladiolus (Gladiolus grandiflorus L.) is one of the most popular ornamental bulbous plants grown in many parts of the world for its bewitching flowers. Internationally it is known for its dazzling florets colour, sturdy spike, size, attractive appearance and keeping quality. Considering the recent concept of bio-fertilizers along with different sources of organic and inorganic fertilizer, an investigation on nutrient management in gladiolus var. 'Shagun'was carried out at College of Horticulture, S. D. Agricultural University, Jagudan for three consecutive years during the winter season of 2018-19, 2019-20 and 2020-21. The experiment consisted of eight treatments which were laid in Randomized Block Design. Total eight treatments were given to the corms having different combinations of inorganic fertilizer *viz*. 100 % RDN, 75 % RDN and 50 % RDN and organic fertilizer *viz*. 25 % and 50 % N through FYM along with PSB + Azotobacter. From the study of different years it was found that maximum plant height, maximum number of tillers, minimum days to flowering, maximum spike length, rachis length, flower diameter and vase life were recorded with T 7 treatment *i.e.* 75 % RDN + PSB + Azotobacter. The flower yield was also found maximum with the same treatment. So from the following experiment it can be concluded that by applying 75 % RDN (150 kg/ha) + PSB + Azotobacter @ 2.5 l/ha as corm soaking treatment along with recommended dose of Phosphorus (200 kg/ha) and Potash (200 kg/ha) gave higher yield of flower spikes and improved the quality of flowers.

◆◆◆◆◆◆

Organic Farming for Healthy and Nutritional Fruit Production

Raushan Kumar, Shikha Jain, Shubham Jaggaand Poonam Maurya
[1]ICAR-Indian Agricultural Research Institute, Division of Fruits and
Horticultural Technology, New Delhi, India-110012

ABSTRACT

The biggest problem India has faced since gaining its independence has been producing enough food to feed its expanding population. As a result, high-yielding genotypes are utilized along with irrigation water, fertilizer, or pesticide infusion. This combination of high-yielding production technology has both contributed to the nation's food surplus and raised worries about the sustainability of agricultural output as well as the health of the land and the environment. So, in order to maintain horticultural yield, soil health and a healthy ecosystem, it is necessary to adopt

a different farming system, perhaps organic farming. Manures, green manures, intercropping, mulching, vermiculture biotechnology, biofertilizers, homa farming/agnihotra, biodynamic farming, biocontrol etc. are significant components of organic farming. Fruit growth parameters were improved more by using bio-fertilizer than by using organic manures. To meet the nutrient needs of fruit crops and improve sustainability in yield and quality, various organics can be applied in combinations and cumulatively. The overuse of chemical fertilizers and pesticides, especially on fruits like strawberries, guava, grapes, jamun etc. that can be eaten without peeling them, is harmful for human health and has a negative impact on conventional cropping systems and the environment. These problems can be mitigated by switching to organic farming. Compared to more conventional and processed foods, organic fruits are not only appealing but are also found to be of high-quality and nutritious. The concentrations of carotenoids, lycopene, ascorbic acid and other fruit quality traits like TSS, average fruit weight and ascorbic acid were reported to be enhanced when organic farming practices were adopted. Even soil health in terms of soil respiration and dehydrogenase activity is improved with adoption of organic farming practices.

Keywords: Organic Fruit, FYM and Manure, Human health, Fruit quality, Soil health

◆◆◆◆◆◆

Growth, flowering and post-harvest life of chrysanthemum (*Dendranthema grandiflora Tzvelev.*) cv. Thai Chen Queen in response to organic and biodynamic manures

Syed Khudus, Ajit Kumar, Sanchita Ghosh, Ranjan Srivastava, B.D. Bhuj and Satish Chand
Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, Distt. U.S. Nagar (Uttarakhand)

ABSTRACT

The present investigation was carried out at Govind Ballabh Pant University of Agriculture and Technology, Pantnagar to assess the impact of organic and biodynamic manures on growth, flowering and post-harvest life of chrysanthemum cv. Thai Chen Queen. Different combinations of biodynamic manures (Panchagavya and Jivamrita) were used in this experiment ranging from 1-10% concentrations levels of Panchagavya and 10-50% concentrations levels of Jivamrita along with common basal dose of biofertilizers which includes *Azotobacter, Azospirillum,* phosphorous solubilizing bacteria and potash bacteria along with vermicompost and farmyard manure. Results demonstrated that 6% Panchagavya + common basal dose was found most superior than other treatments and resulted in higher plant height (35.6, 46.2 and 51.7 cm) at 30, 60 and 90 days after planting, plant spread (37.2 cm), higher number of branches (6.9), longest length of branches (15.6 cm) and maximum chlorophyll content (a, b and total). This treatment also exhibited with improved flowering traits like days to first bud initiation (45.0 days), bud diameter (2.54 cm), No. of buds/plant (40.0), No. of cut flowers/plant (7.49), flower diameter (12.04 cm), days to flowering (51.7 days), No. of cut flowers/ha ('000 Nos.) (299.5), flower weight (14.4 g), duration of flowering (36.0 days), length of flower stalk (24.90), stem diameter (35.70 mm), days taken from colour showing stage to harvesting stage (25.5 days). The significant differences were obtained in post-harvest attributes in the treatment T_7 (6% Panchagavya + common basal dose) which includes initial weight after harvesting from field (30.1 g), final flower weight (16.9 g) after keeping in vase solution, initial flower diameter in vase solution (10.9 cm), final flower diameter (13.1 cm) in vase solution, increase in flower diameter (2.1 cm), water uptake by flowers (64.0 mL) and vase life (23 days) of cut flowers. Effect of biodynamic manures on soil physico-chemical properties, nutrient status N, P and K (286.3, 25.1 and 214.1 kg h^{-1}) and microbiological attributes like bacterial (289 x 10^5), fungal (140 x 10^5) and actinomycetes (146 x 10^5) populations along with N-fixers (72.5 x 10^4) and P-solubilizers (161.5 x 10^3) were also enriched with the treatment of T_7 (6% Panchagavya + common basal dose).

◆◆◆◆◆◆

Effect of Soil Application of Nutrients and Tricodermaon Growth, Yield and Quality Parameters of Pomegranate (*Punica granatum* L.)

Om Prakash Jitarwal[1], Satpal Baloda[2],Keshar Mal Choudhary[3] and Babu Lal Dhayal[4]
[1&2]Department of Horticulture , CCSHAU, Hisar, Haryana, India
[3]Department of Agronomy, SKNAU, Jobner , Jaipur , Rajasthan, India
[4]Department of Extension Education , CCSHAU, Hisar, Haryana, India

ABSTRACT

A field experimentwas conducted at Horticulture Farm, College of Agriculture, CCS HAU Hisar during 2018-19 to analyze the effect of soil application of nutrientsand Tricodermaon growth, yield and quality parameters of pomegranate crop on loamy sand soil. The experiment consists of four levels of nutrients and Tricoderma @ control, 75 % RDF, 75% RDF + FYM and 75 % RDF + FYM + Tricoderma. The total 4 treatment combinations were tested in randomized block design with three replications on a pomegranate var. Ganesh of seven year old plant having 5 x 5m spacing. Results of the study revealed that the soil application of 75 % RDF + FYM + Tricoderma significantly increased the plant height (m), leaf area (cm), tree spread (m), fruit set percentage, number of fruits per plant, fruit density and yield, average fruit weight (gm), fruit length (cm), fruit diameter (cm), total sugar, reducing sugar, non reducing sugar and TSS along with reduced peel and fruit cracking percentage as compared to preceding levels.Whereas, results are also statistically at par with 75 % RDF + FYM. It was also concluded that soil application of75 % RDF + FYM + Tricodermawas found significantly better for pomegranate crop in terms of growth yield and quality for farmers of semi arid zone of Haryana.

Keywords: Pomegranate, nutrient,Tricoderma,RDF (Recommended dose of fertilizer), growth, quality and yield parameters.

◆◆◆◆◆◆

Organic Horticulture: A Healthy Approach

Gayatri, B. K. and Ramya S.,
Division of vegetable science, ICAR-IARI New Delhi-110012

ABSTRACT

Keywords: organic farming, chemical fertilizers, bio-pesticides, biodynamic agriculture

Horticultural crops, mainly fruits and vegetable sare consumed on daily basis and are called as protective food but the trends of high yielding varieties (require lot of fertilizers) and newly emerging pests and diseases are changing this title. These made farmers to use more chemical fertilizers and pesticides which are harmful to environment as well as human. Farmers haveno idea regarding thisharmful impact and chemicals are being used indiscriminately. The best solution to combat this problem is promoting organic farming (organic agriculture or organic horticulture) among the farmers. Presently India holds 6th position in terms of largest certified organic area having 30% of the total organic producers in the world with 2.30 million hectare of organic farming land.The National Project on Organic Farming (NPOF) and National Horticulture Mission (NHM) scheme of Department of Agriculture and Cooperation is significantly contributing to growth of Organic farming.

Organic farmingor Organic horticulture is the integrated and sustainable approach where all the aspects of farming system are interlinked with each other and produce nutritious, healthy, palatable and safe food (fruits, vegetables, spices and medicinal crops) by utilizing on-farm inputs like crop residues, organic formulations (eg.: jeevamrutha, panchagavya), animal waste, botanicals, bio-fertilizersand bio-pesticides, with complete exclusion

of off farm inputs. Biodynamic agriculture, rishi krishi, panchagavyakrishi and homa organic farming are the prevailing organic production systems in India.

Since organic farming keeps away with almost all synthetic inputs like chemical fertilisers and chemical pesticides, also shows a superior environmental performance per unit area than conventional agriculture therefore it can be adapted for sustainable agriculture and healthy lifestyle.

◆◆◆◆◆◆

Comparative economic analysis of organic and inorganic vegetable production in low hill zone of Himachal Pradesh

Atul Chaudhary[1], Ravinder Sharma[2]and Samriti[3]
Department of Social Sciences, Dr Yashwant Singh Parmar University of Horticulture and Forestry Nauni Solan, Himachal Pradesh

ABSTRACT

The present study conducted in Bilaspur and Una districts assess the comparative economic analysis of organic and inorganic vegetable production in low hill zone of Himachal Pradesh. Simple random sampling was used to draw a sample of 100 farmers from Sadar and Amb blocks of the selected districts. Socio-economic characteristics of vegetable growers have been analyzed. Comparative analysis of returns from organic and inorganic vegetables was carried out by using Levine's independent't' test and the results concluded that the returns of organic cauliflower farming group were higher by Rs.50,712.65/ha than the inorganic group. However, the variability in returns was found higher in inorganic cauliflower (29.84%) than organic crop (17.06%). It is also concluded that the returns of organic potato farming group were Rs.71, 325/ha higher than that of inorganic group. Hence, organic farming is a key to sustainable agriculture and serves as an alternate way of achieving the economic development.

Keywords: Organic farming, Returns, Sustainable agriculture

◆◆◆◆◆◆

Effect of inorganic fertilizers and organic manures on storability of onion bulb

Vikas Raa, Satya Pal Singh and Sudesh
Department of Vegetable Science, MHU, Karnal

ABSTRACT

The present experiment was carried out at the research farm of Regional Research Centre, Raiya (Jhajjar) of Maharana Pratap Horticultural University, Karnal during Rabi season 2021- 22. The treatment combination comprising of eight different organic and inorganic nutrient sources (T1 : Recommended dose of fertilizer (125:50:25 kg/ha), T2: RDN supplied through FYM, T3: RDN supplied through Vermi-compost, T4: RDN supplied through Poultry manure, T5: 50% Recommended dose of NPK + 50% RDN supplied through FYM, T6: 50% Recommended dose of NPK + 50% RDN supplied through Vermi-compost, T7: 50% Recommended dose of NPK + 50% RDN supplied through poultry manure, T8: control) that were laid out in a randomized block design (factorial) with four replications on two varieties of onion. The observations were noted for threeparameters physiological weight loss(%), rotting (%) and sprouting (%) pertaining to the shelf-life after two days curing in onion. At 80 days after storage least rotting (2.45%) was observed in control (T8) which was statistically at par with T3 (100% RDN through VC) where rotting was 2.63%, while the maximum rotting was reported in treatment RDF (3.72%). After 80 days of storage, significantly least sprouting (1.10%) was observed

in control (T8), whereas the maximum sprouting (2.07%) recorded in T1 (RDF). Minimum physiological loss in weight at 80 days after storage (9%) was found in control treatment where no manure or chemical fertilizer was applied which was significantly lower than all other treatments except at par with the application of 100% RDN through VC (9.36%). The better storage life of bulbs was estimated in T3 *i.e.*, physiological loss in weight (9.36 %), sprouting (1.18 %) and rotting (2.63%). The results reveal that among the different treatment combinationsRDN supplied through Vermi-compost resulted in better storage life in onion.

◆◆◆◆◆◆

Evaluation of rhizospheric microbes for eco-friendly management of *Ralstonia solanacearum* causing bacterial wilt of brinjal

Rajashree Chetia[1], Dr. P.K. Borah[1] and Dr. B.C. Nath[1]
[1]Department of Plant Pathology, Assam Agricultural University, Jorhat-785013

ABSTRACT

Brinjal (*Solanum melongena* L.) is one of the economically important solanaceous vegetables widely cultivated in India. This crop is severely affected by bacterial wilt caused by *Ralstonia solanacearum.* The management of the disease is difficult and the chemicals are least effective and are hazardous. Hence, an alternate method of control needs to be developed which is effective, cheap and eco friendly. In this present study, a total of 34 rhizospheric microbes were screened *in vitro* for their antagonistic activity against the bacterial wilt pathogen *R. solanacearum.* The results showed that six rhizospheric isolates showed antagonistic activity against the pathogen, out of which the bacterial isolate St4 showed highest zone of inhibition with 10.6mm. Based on molecular identification and phylogenetic analysis the antagonistic bacterial isolate St4 was identified as *Bacillus velezensis,* which showed the potential to control bacterial wilt disease caused by *R. solanacearum*.

Keywords: Rhizospheric microbes, antagonistic activity, bacterial wilt, management

◆◆◆◆◆◆

Bio-dynamic farming: an ancient way of fruit production

J. S. Chaudhari[1], P. D. Solanki[2], R. R. Jasani[3], V. D.Dangariya[4] and A. D. Chaudhary[5]
[1,3, 4] NAHEP-CAAST-M.Sc. Scholar, Department of Fruit Science, ACHF
[2]Dept. of Fruit Science ACHF, [5]CAAST Secretariat, Directorate of Research,
Navsari Agriculture University (NAU), Navsari- Gujarat -396450

ABSTRACT

The usage of inputs derived from fossil fuels, such as chemical fertilisers, insecticides, herbicides and energy-intensive agricultural machinery, is a major component of modern agriculture. The residual amounts of these deadly pesticides in fruits and vegetables are harmful to humans. There are several well-established approaches to environmentally friendly farming systems. Biodynamic farming was spawned by the late Australian philosopher and anthroposophist Rudolf Steiner has grown and developed in popularity since 1922. The term biodynamic is taken from the Greek word bios, meaning life and dynamic, meaning energy. Placing a focus on achieving harmony between the holistic growth and relationships of the soil, plants and animals as a closed, self-sustaining system. Biodynamics has a broader ecological focus and includes the Sun, Moon, planets, subterranean features and mental factors. There are five elements, which include fire, earth, water and air. All-natural things in the world are formed by these transformations and intimate combinations. This farming system has a significant

impact on the enhancement of the yield and quality of several fruit crops like mango and guava.It's crucial to plant during certain moon phases.

Keywords : Organic farming, Bio-dynamic farming, Moon rythem, Planting Calendar, BD-501 to 507 preperation

◆◆◆◆◆◆

Foliar application of biostimulants promote yield and fruit quality of Jackfruit (*Artocarpus heterophyllus* L.) cv. Pant Garima

Rakshit Malik, Pratibha, Ratna Rai and Priyanka Upreti
Department of Horticulture, College of Agriculture, G. B. Pant Univ. of Agriculture and Technology, Pantnagar- 263145, U. S. Nagar, Uttarakhand

ABSTRACT

The present investigation was carried out at Horticulture Research Center, Pattharchatta G.B. Pant University of Agriculture and Technology, Pantnagar. The experiment was laid out in Randomized Block Design with ten treatments and three replications comprising biostimulants which were sprayed *viz.* T_1 : Control, T_2 : Triacontanol @ 2.0 ml/l, T_3 : Triacontanol @ 5.0 ml/l, T_4 : Triacontanol @ 8.0 ml/l, T_5 : Brassinosteroid @ 0.5 ml/ l, T_6 : Brassinosteroid @ 1.0 ml/l, T_7 : Brassinosteroid @ 1.5 ml/l, T_8 : Sea weed extract @ 2.0 ml/l, T_9 : Sea weed extract @ 5.0 ml/l and T_{10} : Sea weed extract @ 8.0 ml/l. Treatments were applied twice as foliar spray at flower initiation and a fortnight after flower initiation respectively. The result of study revealed that reproductive characters like number of fruit set per tree, number of fruits at the time of harvest, percent fruit set had highest value under treatment T_{10}(Sea weed extract @ 8.0 ml/l) with lowest percent fruit drop was also recorded under treatment T_{10}. Highest fruit yield was obtained in the treatment $T_{10.}$ Physical characters of the jackfruit *i.e.* fruit length, fruit width, average fruit weight, pulp weight, rind weight and rachis weight were recorded highest with the treatment T_{10}(Sea weed extract @ 8.0 ml/l) With respect to quality parameters *i.e.* TSS, TSS/acid ratio, reducing sugars, non reducing sugars, total sugars and sugar/acid ratio were highest in treatment $T_{10.}$

On the basis of the experiment it can be concluded that foliar application of sea weed extract @ 8ml/l enhanced the yield and fruit quality of jackfruit cv. Pant Garima and may be recommended twice starting from flower initiation and at the fortnight interval.

◆◆◆◆◆◆

Residue - Free Cultivation of Fruit crops: Strategies and the Way Forward

Shikha Saini[1], Bhupendra Sagore[2], Shikha Jain[3] and Poonam Maurya[4]
[1-4]Ph.D. Student at ICAR-Indian Agricultural Research Institute, Division of Fruits and Horticultural Technology, New Delhi, India-110012.

ABSTRACT

The use of pesticides has greatly enhanced agricultural production. But this is only one side of the coin; the other side showed that the presence of these pesticides has resulted in serious threats to the environment, human and animal health. Exposure to pesticides through consumption of food is considered to be five times higher in magnitude as compared to other exposures like air and water. Moreover, it is expected that fruit and vegetables contain higher amounts of pesticide residue levels in comparison to other food groups of plant origin because they are consumed raw or semi-processed. Presence of pesticide residues causes the interruption in export and import. Fruits such mangoes, table grapes, pomegranate and cashew nuts etc. have faced rejections and bans in markets such as the US, EU, Vietnam and Bhutan. Residue free farming techniques entail the

protection and growth improvement of seedlings and plants by using organically procured bio-fertilizers and biocides. The produce is also grown using synthetic pesticides, which are applied at predetermined intervals so that the residue is not present in enormous quantities, conforming to the Maximum Residue Level (MRL). With this background, the presentation is based on the pesticide residues impacts, strategies for residue-free cultivation of fruit crops, challenges in adoption of these strategies and the way forward. Indiscriminate and non-judicious use of agrochemicals, non-observance of prescribed waiting period, use of non-recommended pesticides and wrong advice and supply of unapproved pesticides to the farmers are some of the reasons behind pesticide residues in fruits. Agricultural practices like GAP, IPM, Biopesticides, etc. can reduce the need of agrochemicals and thus these should be promoted at farmer's level. The IPM based module was found best module when compared conventional in terms of pest population reduction, residual level, average yield and cost-benefit ratio. More use of safer green chemicals in an integrated pest management approach, employing microbes and plants for chemical degradation and can slow down the accumulation of harmful chemicals in both the food and environment but the changing climate and high rate of resistance to chemicals can intensify the current problem.

Keywords: Residue free, IPM, Biopesticides, Pre-harvest Interval

◆◆◆◆◆◆

Response of vermiwash on growth and yield of cucumber under protected conditions

R.K. Yadav, M.C. Jain, V.K. Yadav and Rajendra Kumar Yadav[1]
College of Agriculture, Ummedganj-Kota (Agriculture University, Kota) Rajasthan
[1]Agricultural Research Station, Ummedganj-Kota (Agriculture University, Kota) Rajasthan

ABSTRACT

Vermiwash is a liquid extract produced from vermicompost in a medium where earthworms are richly populated. It comprises a massive decomposer bacteria count, mucus, vitamins, different bioavailable minerals, hormones, enzymes, different antimicrobial peptides, etc. Earthworms establish symbiotic relations with microbes, produce an essential product that supports the growth of plants and suppress root disease. It is recommended that earthworm should be inoculated in an agricultural field, or prepare and apply its vermiwash as a spray or as additive bio-fertilizer in the soil to enhance the productivity of cucumber crop. It is the organic fertilizer decoction obtained from units of vermicompost as drainage. It is the liquid extract collected after the passage of water through the different layers of worm culture unit. This decoction contains excretory products of earthworm secretions, the worm coelomic fluid oozing through the dorsal pores, mucus, enzymes secreted by the worm & microorganisms, plant nutrients, vitamins and plant growth promoting substances. This contains lot of nutrients particularly soluble K, Ca and Mg which find their way into vermiwash. It contains beneficial microbes which helps in plant growth and prevent infections. It contains sugars, phenols, amino acids, hormones and plant growth substances like IAA,GA_3,Cytokinin andhumic acids etc. It is an eco-friendly natural fertilizer prepared from biodegradable organic wastes and is free from chemical inputs. Vermiwash helps to develop resistance against various diseases and pests in plants. It helps in initiating good flowering and produce good yield in some vegetable crops. It is a liquid fertilizer and reported that at 20-30% dilution inhibits the mycelial growth of pathogenic fungi. Acts as a biopesticide when diluted with 10%cowurine or neem extract or garlic extract. It does not have any adverse effect on soil, plant and environment. It improves soil aeration, texture and tilth thereby reducing soil compaction. It improves water retention capacity of soil because of its high organic matter content. It promotes better root growth and nutrient absorption. It improves nutrient status of soil-both macro-nutrients and micro-nutrients. Vermiwash is the coelomic fluid extraction, which have enzymes, which stimulate the growth and yield of cucumber.

Keywords: Earthworm, Disease, Pest-pests, Vermiwash

◆◆◆◆◆◆

Session-5

Precision Horticulture and Geo Spatial Tools

INVITED LECTURES

I-1 Future horticulture utilizing spatial, Ai and Iot technologies

Dr Shailendra Rajan
Ex-Director, Central Institute for Subtropical Horticulture, Lucknow
Consultant (Tropical Fruits): Alliance of Bioversity International and CIAT

Horticultural production has increased significantly due to various technologies; however, the industry faces significant challenges worldwide, such as the sustainable utilization of arable land, energy, water, supply chain management, product quality, traceability and an increasingly extreme climate. Nevertheless, future development needs in horticulture includeapplying cutting-edge technologies such as spatial analysis, artificial intelligence and the Internet of Things (IoT). These developments can radically transform how we approach horticulture in the future, potentially resulting in more efficient and sustainable approaches to crop management and higher yields. This paper discusses the value and potential applications of GIS, IoT, cloud computing, AI, blockchain and big data in horticulture to improve upon established methods of biotic stress detection, water management, fertilizer management, harvest maturity identification, marketing, supply chain, soil fertility and post-harvest storage environment. Robotics, drones equipped with vision technology and AI for detecting pests, weeds, plant diseases and malnutrition and edge-computing portable devices that can be developed with IoT and AI for predicting and estimating crop diseases, are all important areas of future horticulture. Maps of arable land created with spatial technologies like GIS and remote sensing will help in specialized production of high-value crops and increase their harvests by pinpointing the most productive planting zones and applying of right amount of inputs. It is also possible to use these technologies to keep an eye on the crops as they grow and spot any signs of biotic and abiotic stress so one can act before the crop is damaged. In the past ten years, hyperspectral imaging has emerged as a promising scientific tool for non-destructive quality evaluation of fresh produce. Hyperspectral imaging (HSI) is a powerful tool that can provide detailed information about the health and growth of plants, as well as detect pests and diseases. It can optimize crop growth, increase yields, reduce costs and environmental impact and support precision farming. It has a wide range of applications in horticulture and its use is growing daily. Using cutting-edge technology like precision horticulture holds great promise for maximizing productivity while decreasing operational expenditures. Yet it's been criticized for how it might harm biodiversity, how much it would cost, how much it would rely on technology and how it might end up erasing farmers' ability to use traditional farming techniques. Farmers and policymakers should consider and address these concerns when deciding whether or not to implement precision horticulture.

◆◆◆◆◆◆

I-2 Irrigation techeniques, water requirement and irrigation scheduling under protected cultivation

P. K. Singh
Department of Irrigation & Drainage Engineering
G. B. Pant University of Agriculture & Technology, Pantnagar – 363145, Uttarakhand

In recent decades, greenhouse area has risen worldwide, mainly due to the increased use of polyhouses for growing horticultural crops particularly cut flowers and vegetables. In India, it is estimated that over 2.5 lakh ha area have been covered under protected cultivation (greenhouse, shade net house, plastic tunnel etc). Most of these polyhouses are naturally ventilated, without active climate control systems, in which drip irrigation is used with soil-grown crops. Currently, more than 90% of cropping within greenhouses in India is in soil and drip irrigation is used in about 75 % greenhouses. The replacement of furrow irrigation with drip irrigation appreciably improved overall irrigation efficiency. However, given that the irrigation management is mostly based on experience, considerable scope remains for improved irrigation management practices at the farm-level under the concept of precision irrigation and fertigation towards the significant improvement in water and nutrient use efficiency. In the present paper efforts have been made to discuss various aspect of irrigation under protected cultivation.

◆◆◆◆◆◆

I-3 High value secondary metabolites from local plants of himalaya: a biological panorama

A.K. Gaur
Molecular Biology and Genetic Engineering
G.B. Pant University of Agriculture and Technology,
Pantnagar-263145, Udham Singh Nagar, Uttarakhand

Hyper diversity and extreme degree of variability inbioactive principles from herbal products for pharmaceutical sectors are many of times not favoring these important commodities in the market. Since,all the bioactive principles are secondary products and as a result are influenced by changing climate(s), therefore, invariably influenced for their exactly required lead substance in terms of their efficiency and efficacy. Northwest Himalaya presents a mosaic of microenvironment owing to variation of topography, geography and ecological conditions. Where inthe secondary metabolites produced by rich plant diversity of diverse geo-climatic habitats shall be of immense use if their chemical nature is well characterized under defined set of parameters for their specific biosynthesis prior to their formulation for wide marketability.

The present talk highlights the in depth of varied nature of secondary metabolites of some valuable plant species growing in varied geo- climatic habitats of Northwest Himalaya visa-vis cultivated in precise environment involving tissue culture practices.

◆◆◆◆◆◆

I-4 Protected and precision farming strategies for enhanced productivity of horticultural crops

M.C. Singh, Neelam Patel, P. K. Singh, JugendraKapasia, Lokendra Singh, Abhishek Mishra and Arun Kumar Dwivedi

Centre for Protected Cultivation Technology,
ICAR-Indian Agricultural Research Institute, New Delhi-110012

Precision and protected agriculture envisages the provisions to protect the crops against extreme temperatures, wind, rain, hailstorms, birds and inspect-pests for sustained plant growth, yield and quality of horticultural crops. A greenhouse (polyhouse) comprised of its design, shape, the orientation, the structure, it's foundation, cladding material and the ventilation it can permit together with the proper function of technical equipment needed to control the climate inside the structure. The system must protect plants against low and high temperatures, wind, rains, hailstones, birds and insects allowing modern work routines and logistics in the production chain. The incident solar radiation (the visible and adjacent portions of the infrared and ultraviolet ranges of the spectrum) passes through the plastic/glass roof and walls and is absorbed by the floor, earth and contents, which become warmer and re-emit the energy as longer wave length infra-red radiation. The cladding materials used for greenhouse walls do not transmit infrared radiation, so the infrared cannot escape via radiative transfer.

Greenhouse cultivation is widely spread all over the world to produce quality and high value vegetables, flowers and fruits, seedlings/plants, herbs and or ornamentals. Besides, the structural design, prevailing climate, most important factor affecting plant growth is solar radiationgoverning plant growth from photosynthesis. Characteristics of the cladding material that can affect the level and quality of the transmitted radiation are of primary concern for greenhouse cultivation. Cladding materials need to be anti-drift, anti-dust, uv-resistant and >98% transparent, relates to their condensation characteristics. Such problems can be addressed by using a cladding material equipped with surface-active additives to create an anti-drop property and cooling additives to provide a shading effect. Not only it provides shades but also reduce the temperature values (- 4 ^{0}C), UV radiation (-26 W/m^2) and increase relative humidity (18-22 %) significantly. The highest advantage being the moderate values (180-260 µmol sec^{-1}m^{-2}) of photosynthetically active radiation (PAR) resulting in an increase in the productivity by 17 % in winter and 21% in summer. Light irradiance is an important factor in crop regulation especially in photosensitive crops. Vernalization from temperature and light is going to play a crucial role in having a possibility of growing 5 crops without compromising the yield and quality an year's time.

Plastic mulching of different colored films composed of degradable and bio-degradable polymer can be a boom for transient crop protection against input stress and mitigation of effects of hot and cold weather. Wherein water loss can be saved up to 27% and temperature sustained by 7^{0}C in summer and 4^{0}C in winter.An extra thin sheet of plastic film up to 15µ does not resemble traditional types of thick (e"25µ) plastic mulches, organic mulches, such as straw or leaves. Due to an advent of mechanical ease convenient rolls can beapplied to the length of field rows to seal the upper layers of the soil. Crops are allowed to grow up through holes that are cut into the plastic. A wide array of plastic mulch products varying in color, thickness, dimensions, plastic type and intended purpose as per crop requirements. Mulch materials and techniques significantly affect the microclimate around the crop canopy by changing the radiation budget of the soil top, soil water transformation, evapotranspiration (ET) and water use efficiency (WUE). WUE (kg/Ha-mm) was calculated as economic yield (kg/h) divided by the total ET (mm) from sowing to harvest. Unlike other field crops its evident that the plastic mulches are used in the cultivation of horticultural crops to modify the soil temperature and moisture regimes, control weeds, deter the immigration of insects and possibly alter the photobiology of the plant. Not only this,but function of plastic mulch can also insulate and maintain a consistent temperature and humidity of the soil,

preventing evaporation of moisture from the soil, minimization of seed time and harvest, prevent weed growth and to prevent erosion.

These microclimate factors strongly affect the soil temperature and soil moisture in the root zone, which, in turn, may influence plant growth and productivity. In technological verification of agricultural films and their optical properties, experiment will be done in different crops *i.e.*, in polyhouses high value flowers (chrysanthemum, lilium and rose etc) and vegetable crops (cucumber, tomato and capsicum) and under mulching in open fields selected vegetables (broccoli, cabbage, cauliflower, lettuce, marigolds, tomato, potato and brinjaletc) in conjunction with drip irrigation in the selected flowers and vegetables in comparison with open field and control system without precision farming strategies

◆◆◆◆◆◆

I-5 Future Horticulture Utilizing Spatial, AI and IOT Technologies

Shailendra Rajan
Ex-Director, Central Institute for Subtropical Horticulture, Lucknow
Consultant (Tropical Fruits): Alliance of Bioversity International and CIAT

Horticultural production has increased significantly due to various technologies; however, the industry faces significant challenges worldwide, such as the sustainable utilization of arable land, energy, water, supply chain management, product quality, traceability and an increasingly extreme climate. Nevertheless, future development needs in horticulture includeapplying cutting-edge technologies such as spatial analysis, artificial intelligence and the Internet of Things (IoT). These developments can radically transform how we approach horticulture in the future, potentially resulting in more efficient and sustainable approaches to crop management and higher yields. This paper discusses the value and potential applications of GIS, IoT, cloud computing, AI, blockchain and big data in horticulture to improve upon established methods of biotic stress detection, water management, fertilizer management, harvest maturity identification, marketing, supply chain, soil fertility and post-harvest storage environment. Robotics, drones equipped with vision technology and AI for detecting pests, weeds, plant diseases and malnutrition and edge-computing portable devices that can be developed with IoT and AI for predicting and estimating crop diseases, are all important areas of future horticulture. Maps of arable land created with spatial technologies like GIS and remote sensing will help in specialized production of high-value crops and increase their harvests by pinpointing the most productive planting zones and applying of right amount of inputs. It is also possible to use these technologies to keep an eye on the crops as they grow and spot any signs of biotic and abiotic stress so one can take action before the crop is damaged.In the past ten years, hyperspectral imaging has emerged as a promising scientific tool for non-destructive quality evaluation of fresh produce. Hyperspectral imaging (HSI) is a powerful tool that can provide detailed information about the health and growth of plants, as well as detect pests and diseases. It can optimize crop growth, increase yields, reduce costs and environmental impact and support precision farming. It has a wide range of applications in horticulture and its use is growing daily. Using cutting-edge technology like precision horticulture holds great promise for maximizing productivity while decreasing operational expenditures. Yet it's been criticized for how it might harm biodiversity, how much it would cost, how much it would rely on technology and how it might end up erasing farmers' ability to use traditional farming techniques. Farmers and policymakers should consider and address these concerns when deciding whether or not to implement precision horticulture.

◆◆◆◆◆◆

ORAL PRESENTATION

Bio-fortification of guava (*Psidium guajava L.*) through pigment enhancement

Madhubala Thakre, Akshay, Pooja, Poonam Maurya, Nayan Deepak G., A. Nagaraja, M.K. Verma, O.P. Awasthi, Shalini Gaur, SupradipSaha, EldhoVerghese, Gopala Krishnana S., Amitha S.V. Mithra

Division of Fruits and Horticultural Technology,
ICAR-IARI, New Delhi 110 012

ABSTRACT

Guava (*Psidium guajava* L.) is known as 'super fruit' because it is the third richest source of vitamin C and also contains other minerals like Ca, Fe etc. Guava is having additional nutritional benefits as it contains pigments like lycopene, anthocyanins and carotenoids which are known for their potential antioxidant activities and prescribed to the patients affected by many chronic diseases like cancer, eyes related diseases, skin diseases, various types of inflammations etc. These pigments are associated with coloured guavas and provide them attractive pulp colours. Pulp colour in guava majorly belongs to red/pink, white, yellow and purple colour group. The pink/red pulp colour is due to the presence of lycopene and/or anthocyanins. The white pulped guava mainly contains carotenoids. The yellow pulp colour is due to lutein and purple pulp colour is due to the presence of anthocyanins like delphinidin-3-glucoside, petunidin-3-glucoside and cyanidin-3-glucoside. Hence, incorporation of coloured pulp trait in progeny using pigment rich guava parents in hybridization is a way forward towards bio-fortification of guava. This will result in the nutritionally rich guava varieties which are suitable for fresh consumption and also for processing to produce antioxidant rich foods/ formulations.

◆◆◆◆◆◆

Crop modeling in fruit crops

Ankit Gavri[1], G.S. Rana[2], Sanjay kumar[3]

Department of Horticulture, [1&3]Department of Horticulture, CCSHAU, Hisar
[2]Principal Scientist, Department of Horticulture, CCSHAU, Hisar

ABSTRACT

Modelling is the use of equations or sets of equations to represent the behaviour of a system. In effect crop models are computer programmes that mimic the growth and development of crops (USDA, 2007). Modelling represents a better way of synthesizing knowledge about different components of a system, summarizing data and transferring research results to users. Model simulates or imitates the behavior of a real crop by predicting the growth of its components, such as leaves, roots, stems and grains. Thus, it plays an important role in assessing the stress situation in plants. These models not only predict the final state of crop production or harvestable yield, but also contain quantitative information about major processes involved in the growth and development of the crop. Crop models can be used to understand the effects of climate change such as elevated carbon-dioxide changes in temperature and rainfall on crop development, growth and yield. Reactions and interactions at the level of tissues and organs are combined to form a picture of the crop's growth processes. For the purpose of crop weather modeling various models like statistical models, phonological model, crop simulation model etc. have been developed for achieving the precision in crop production.

Keywords: modeling, simulation, growth and development

◆◆◆◆◆◆

Using hi-tech horticulture as modern intervention for mitigating impact of changing climate on productivity of temperate fruits - a case study of apple in indian himalayas

K K Jindal
UGC Emeritus Scientist & Former Director Research Dr YS Parmar Univ of Horticulture & Technology, Solan Himachal Pradesh

ABSTRACT

The phenomenon of global warming has now become fairly well entrenched. The hither to set climatic pattern has become erratic affecting productivity of agricultural crops. Temperate fruits trees have been most affected group. In their annual growth cycle these crops have a specific requirement of chilling during the winter months. This requirement of late not being fully satisfied in most of the areas that were only marginally suitable for the temperate fruit cultivation. The productivity of temperate fruits especially apple in Himalayas is declining at a faster rate. Average yield of apple in India has been estimated at about 6 tonnes per hectare which is far below the level of 30 tonnes per hectare in most of advanced countries. The productivity has also not kept pace with the expansion in area under temperate fruits due to various biotic and abiotic problems faced by the farmers in the Himalayas have been discussed in details. The low productivity of apple has become a serious concern for the farmers, research workers and development agencies at national and state level for the last two decades. Several factors have been visualized which attributed to the declining trend in productivity like expansion of apple cultivation to marginal areas, monoculture of Delicious varieties, declining standards of orchard management and the fluctuating abnormal climatic conditions. The shift in climate pattern has made it clearly imperative to constantly monitor winter chilling being received in the various agro-climatic regions. Fruit growers can thus be attracted timely about the need to spray dormancy breaking chemicals. If the quantum of chilling is far less year after year, there may be need to consider a diversification towards low chill fruit crop or cultivar that can be grown in the region. The chill unit estimation models are available, but they are not applicable universally. Studies indicate need for location specific chill unit models. The measures to adapt to climate changes is critical for sustainable production. Increased temperature and weather vagaries will have more effect on reproductive biology. In the present studies, strategies have been identified and addressed to mitigate the adverse efforts of weather and development of climate resilient plant species, like low chill crops, improved cultural practices and efficient use of water resources. Concerted and integrated technological approach can convert challenges into opportunity.

◆◆◆◆◆◆

Integrated weed management in marigold (Tagetes erecta L.)

Gurpinder Singh, Ashna Acharya and Parminder Singh
Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, Punjab -141004, India)

ABSTRACT

The present study entitled "Integrated weed management in marigold (*Tagetes erecta* L.)" was conducted during summer and rainy season of 2019 at Research Farm, Punjab Agricultural University, Ludhiana, Punjab. The study aimed at finding out the best and economically feasible method for weed control in marigold. In summer season, spreading of paddy straw mulch 6.25 t ha-1 at planting and directed application of paraquat dichloride 0.30 kg ha-1 after 50 days of transplanting and, in rainy season, combination of paddy straw mulch 9.40 t ha-1 and paraquat dichloride 0.30 kg ha-1 after 50 days of transplanting had the lowest total weed density.

Total weed dry biomass was lowest under hand weeding (at 30 and 60 days). Hand weeding treatment recorded the highest marigold plant spread, stem diameter and branches per plant which were followed by paddy straw mulch 9.40 t ha-1 plus paraquat dichloride 0.30 kg ha-1. To conclude, spreading paddy straw mulch 9.40 t ha-1 at planting followed by directed application of paraquat dichloride 0.30 kg ha-1 after 50 days of transplanting was found to be the best treatment in terms of weed control, flowering parameters (took minimum number of days to bud visibility, from bud to flower opening, first flower production with maximum number of flowers per plant, average flower diameter and average weight of flower) and net returns.

◆◆◆◆◆◆

Solutions for soilless production systems using hydroponics: challenges and opportunities from a smart agriculture perspective

Nitin Yadav, Akhilesh Kumar Pal,Dhaneshvari Arya
Department of Horticulture, Institute of Agricultural Sciences,
Banaras Hindu University, Varanasi (221005), Uttar Pradesh, India
e-mail: nitinyadavsy519@gmail.com.

ABSTRACT

For the agricultural production industry, soilless agriculture represents a viable possibility, particularly in regions with significant soil degradation and few water supplies. Additionally, this agronomic technique represents a positive reaction to environmentally friendly agriculture and a useful tool in the context of a broader problem with regard to food security. Therefore, the goal of this review is to identify the drawbacks and potential of hydroponic systems employed in soilless cropping systems with a focus on the process of plant mineral feeding. Processes and mechanisms that take place in hydroponic solutions to ensure an adequate nutrient concentration and, consequently, an optimal nutrient uptake without causing nutritional disorders, which in turn affect crop quality, include the solubilization and precipitation of nutrients and other elements in the hydroponic solution, substrate specificity in the nutrient uptake process, nutrient competition and antagonistic relationships and interactions between nutrients; (2) on new, developing technologies, such as the usage of nanoparticles and helpful microorganisms like plant growth-promoting rhizobacteria, that might enhance the management of soilless farming systems (PGPRs); (3) focuses on tools (multi-element sensors and interpretation algorithms based on machine learning logics to analyse such data) that could be used in a smart agriculture approach to track the availability of nutrients and other elements in the hydroponic solution and to change its composition in real time. These factors are explored in light of contemporary scientific research that has been used in an industrial setting.

Keywords: Soilless culture, hydroponics system, nutrient acquisition, biofortification, nutrient interaction, nanoparticles, sensors, smart agriculture

◆◆◆◆◆◆

Precision farmingto enhance productivity and quality and incomeof vegetable farmers

B. Balakrishna, Shankar S Hebbar, B. B. Supriya, G. Senthilkumaran and Uma Maheshwari
Corresponding Author email: Balakrishna.B@icar.gov.in

ABSTRACT

Precision farming is a developing field in India, more specifically applicable in horticulture, where science is directly put into application in the form of technology in multiple areas of crop production, crop protection and

post-harvest management in horticulture crops to achieve higher productivity, better quality with optimal use of resources (water, nutrient, soil, labour and time).Yield and productivity is a determinant of effective management of crop with optimizing the methods and techniques in management of nutrients, water, pests and diseases with precise and accurate estimation of crop requirement and providing all necessary ambiance to crops to grow, flower, fruit and yield as designed / expected. This process of precision and holistic package was promoted among > 100 farmers in a cluster of villages under Farmer FIRST Programme (FFP) of ICAR-IIHR, Bengaluru,which aims at integrating various enterprises in the farm and ensures, recycling of farm wastes and utilizing all the available resources most economically and efficiently through integration of technologies and institutions. After analyzing the production situation, resource condition, needs of farmers to enhance productivity and quality of vegetables holistic and precision farming package was designed, which comprised of use of multiple disease resistant hybrids / improved varieties, mulching sheet on raised beds,need based drip irrigation and fertigation, foliar nutrition, integrated pest, disease and nematode management, etc. along with need based, time controlled plant protection chemicals. Precision farming package resulted in enhancing productivity by >2 times, quality by >60%, income of farmers by >200% in many vegetable crops.

Key words:Precision farming, Productivity, FFP, Holistic package and Resource management.

◆◆◆◆◆◆

Development of standard protocols for assessment of cropped area in mango using Sentinel MSI

B. Balakrishna, S. N. Harshitha, M. Sankaran, T. R. Rupa, Neeraj Verma
Corresponding Author email: Balakrishna.B@icar.gov.in

ABSTRACT

Mango is one of the geographically and socio-economically most important commercial fruit crop of India. Our country ranks first among world's mango producing countries accounting for about 50% of the production. The study was undertaken to develop the standard protocols for quick and accurate estimation of crop acreage in mango in Kolar, which is one of the leading Mango producing district in Karnataka. A stratified sampling method of survey was conducted in the study area to collect ground truth points for mango areas. A total of 500 points consisting of mango orchards areas were collected from four blocks of Kolar district during the year 2021, which includes latitude and longitude of the place, age of orchard, area in acre, planter information. This ground truth data has been incorporated for mapping of mango area in Kolar districts using satellite data sentinel 2 provided by Copernicus free access HubESA. The spatial resolution of this data is 10 m, followed by signature generation, image classification, field check, village wise mango area, which are overlaid on classified map to extract mango acreage. Technical model or the indices used for cropped area estimation are LULC maps and NDVI studies. Projected area of the mango orchards was 47816.0 Ha as estimated by Karnataka State Department of Horticulture. According to analysis ofthe study, using remote sensing methods, estimated area of the mango orchards is 42057.75 Ha. Since the accuracy of the outcome was more than 90%, this methodology will be a model for crop acreage estimation of entire mango growing regions.

Key words: Crop Acerage Estimation, Mango Orchard, Sentinel 2, Ground Truth Points, Remote Sensing, Kolar, Karnataka

◆◆◆◆◆◆

Robotics and machine learning in Horticulture

Vani N.U.[1], P.C. Tripathi[2]
[1]Department of Horticulture with Specialization in Fruit Science, IGKV, Raipur
[2]Division of Fruit crops, ICAR-IIHR, Bengaluru Bengaluru 3
Email- nuvani26@gmail.com

ABSTRACT

The global economy is heavily reliant on the agricultural sector. As the human population keeps growing, pressure on the each component of agricultural system will rise. Big data technologies and high-performance computers have evolved new possibilities for data-intensive science in the multidisciplinary field of horti-technology. Machine learning is a very new field of study and a branch of artificial intelligence that promises to address many issues in the development of knowledge-based farming systems by offering detailed advice and insights about the crops, that helps farmers to minimize crop losses. Modern horticultural operations create data from a range of sensors and crop models that help to better understand the operational environment (an interaction of dynamic crop, soil and weather variables) and the operation itself (machinery data), enabling more accurate and quicker decision-making. The most well-understood approaches of ML still have significant flaws but case-based learning could help it. The logical extension of automation technology into biosystems including horticulture, etc. is known as agricultural robotics. Weed control, cloud seeding, seed planting, harvesting, environmental monitoring and soil analysis are examples of new robotic or drone applications in horticulture. The robotic platform will be able to gather fruit selectively and spray solely on foliage and predetermined targets at precise locations. However, at the present majority of research efforts are focused on developing new learning algorithms rather than accumulating proficiency in using them to solve actual issues. Tremendous research to curb the practical farm problems in automation and robotics have a big potential to help society fulfill its 2050 horticultural production goals.

Keywords: Machine learning, robotics, models, agriculture, decision-making

◆◆◆◆◆◆

Towards molecular breeding in Grape: Identification of genomic regions for berry traits (*Vitis vinifera* L.) and development of allele specific markers for berry trait

Anuradha Upadhyay1, Komal D Thorat, Roshni R. Samarth, D.N. Gawande and R.G. Somkuwar
ICAR- National Research Centre for Grapes, Pune

ABSTRACT

Grapevine (*Vitis vinifera* L.) is a fruit crop with considerable economic value grown for various purposes like fresh consumption, processed to obtain wine and raisins, extraction of seed oil and secondary metabolites. In India, grape is majorly grown for fresh consumption and hence appearance of grape bunch determines its market value. Bunches with bold and uniformly sized berries fetch higher price. Application of growth regulators at various stages of bunch development coupled with manual thinning is required for obtain bunches with desired appearance. Thus, development of varieties with loose bunch and bold berries is the focus of research for grape breeders. In this study, two-pronged approach of genome-wide association mapping and QTL linkage mapping was used to identify the genomic region controlling berry traits in grape. Three year phenotyping data and SNP data obtained by genotyping by sequencing (GBS) of selected grape genotypes and segregating population of Carolina Blackrose x Thompson Seedless was used for the analysis. QTL mapping identified major QTLs for berry length, berry width, berry weight and bunch weight on LG 14, Lg19, LG 8 and LG17. Genome wide

association analysis of genotyping and phenotyping data using Maximum likelihood Model (MLM) identified SNPs closely linked with berry traits with high level of significance. Allele specific primers (ASP) were designed for selected linked markers and validated using grape genotypes with contrasting values for the traits. One ASP showed strong co-segregation with the berry traits. These results gave important insight into genetics of bunch and berry traits in grape which will be useful for the identification of candidate genes for the traits as well as development of functional markers for their use in ongoing varietal development program.

◆◆◆◆◆◆

Application of precision agriculture and geospatial techniques in horticulture

Roopendra Kumar[1], M. Feza Ahmed1, M. Rizwanullah[1], Neelu Kumari1 Ankur Tyagi[2] and Ankur Kumar Rai[1]

[1]Department of Horticulture (Fruit and Fruit Technology), Bihar Agricultural University, Sabour, Bhagalpur-813210, Bihar

[2]Department of Fruit Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002, Uttar Pradesh

ABSTRACT

The demand for sustainable production of fruits and vegetables is being driven by farmers and consumers. Since its inception, field crops have been the focus of precision agriculture, which takes both geographical and temporal variability into account to maximise resource efficiency.In the early twenty-first century, it began to be applied to vegetable and tree crops later and it has been growing as a result of more publications and study requests. Commercially available methods for mechanically harvesting horticultural crops were presented, including the first applications for gathering fruit that will be processed.Data collecting, yield mapping, remote sensing, quality mapping and variable rate application are the precision agriculture disciplines with particular relevance for horticulture crops recorded.The GIS technologies being created to assist the farmer in managing crops systems and disease management techniques that are more sustainable but increasingly sophisticated. To speed up agricultural germplasm improvement, geoinformatics and cloud-based, big data-driven applications are also being used. Crop germplasm that has improved tolerance to pathogens and abiotic stress and is compatible with various cropping systems and environmental circumstances is required. Last but not least, new geo informatic techniques and improvements in computing infrastructure enable a more collaborative framework among scientists, decision-makers and the agricultural community to hasten the development, transmission and acceptance of these sustainable solutions.

Keywords: Remote sensing, geospatial, germplasm, geoinformatics, precision agriculture

◆◆◆◆◆◆

Precision agriculture in fruit crops

Ram Lakhan Meena and H.L. Bairwa

Research Scholar, Department of Horticulture, Rajasthan College of Agriculture, Udaipur Assoc. Professor, Department of Horticulture, Rajasthan College of Agriculture, Udaipur

Meenahort7244@gmail.com

ABSTRACT

Precision agriculture is the management of spatial and temporal variability of the fields using ICT (Information, Computers and Technology). Spatial and temporal variability of the field and crop properties are

analyzed, leading to areas of the field with common characteristics called management zones. The precision crop production technologies developed for field crops could be adapted to tree fruit production and precision tree fruit production is precision farming applied to enhance orchard performance by optimizing fruit yield and quality while minimizing adverse environmental impacts. Precision agriculture, or site-specific crop management, is widely used in field crops.Precision agriculture involves observing, measuring, mapping and managing variability in a farm. It relies heavily on sensors, along with Global Positioning Systems or Geographic Information Systems, in order to map the variability of the terrain, organic matter content, moisture levels and nitrogen levels, for example, as well as areas where plants are stressed.Precision agriculture, the consideration of spatial and temporal variability for increasing the efficiency of resources, has been developed over the last twentyfive years and was initially applied to field crops.Precision agriculture however consists of delivering customized inputs based on georeferenced crop information and the partition of fields into zones with particular treatment requirements. With the advent of miniaturized sensor technologies and the ever-increasing number of precision agriculture applications, a variety of agricultural equipment of increasing complexity is progressively being developed.Any improvement in reducing production costs can greatly increase profit for producers.

Key word: Precision, Agriculture, GPS, GPS

◆◆◆◆◆◆

A new innovation towards agriculture : precision farming

Sumit, Satpal Baloda and Sakshi
Department of Horticulture, ChaudaryCharan Singh Haryana Agriculture University, Hisar, Haryana

ABSTRACT

Precision farming is a farming system based on observing, measuring and responding to inter and intra-field variability in crops. The concept of precision farming was given by Professor Pierre C. Robert in late 1980s. Precision farming based on the principle - right input should be supplied on right time in right amount at right place in right manner. Technologyies for precision farming – Computer system, Geographic Information System(GIS), Global Position System(GPS), Remote sensing, Yield Mapping Technology, Precision Nutrient Management in cludes Site Specific Nutrient Management(SSNM). By use of precision farming in horticultural crops we can increase the productivity, decrease cost of cultivation and reduce negative impact on environment by using resoures in a sustainable way. It is widely practiced in developed countries, is still at nascent stage in most of the developing countries like India which needs integrated and sustainable efforts.

◆◆◆◆◆◆

Crop production and precision farming

Ali Haidar shah[1], Priyanka Thakur[2], Arvinder Singh[2], Nomita Laishram[2], Pradeep Kumar[2] and Yogendra Singh Adhikari[3]
[1,2,3]Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh
[2]Sher-e- Kashmir university of Agricultural Sciences and Technology of Jammu, Chatha(J&K)

ABSTRACT

A complete information-based farm management method called “precision farming” offered management principles based on observation and reactions to intra-field changes.It identifies, analyses and manage variability within fields for optimum profitability, sustainability and protection of land resources. In a nutshell, precision farming entails applying the proper amount of treatment to an area at the appropriate time. New technologies

such as Global Positioning Systems (GPS), sensors, satellites or aerial images and Geographical Information Systems (GIS) are utilized to assess and analyze variations in agricultural and horticultural production. Optimum return and preserving resources are the two primary goals of precision farming. Wireless Sensor Networks has crucial role to management of water resources, to assess the optimum point of harvesting, to estimate fertilizer requirements and to predict crop performance more accurately, disease and pest hazard also. Sensors use to precision farming technology in horticulture, which increasing productivity, decreasing production costs and minimizing the environmental impact of farming. Looking to the pressure arising population and erratic climatic variation, more attention required towards the development of technology driven horticulture precision farming. Due to high cost of technology and need of high speed internet facility it is not so popular though it has a vital role in agriculture and horticulture sector.

◆◆◆◆◆◆

CTC green tea processing - A new value added green tea

Diganta Kumar Bora, Aditi Smith Gogoi, ManuranjanGogoi Assistant Professor, Rana Pratap Bhuyan, Emon Bhardwaj, Pubali Neog and Rashmi Kalitat
Department of Tea Husbandry & Technology, AAU, Jorhat

ABSTRACT

An attempt was made to produce green tea in granular form, which may be termed as CTC Green Tea. The appearance of the tea is same as that of conventional CTC black tea except for the green colour. Processing of orthodox (conventional) and granular green tea which we call it as CTC green tea was undertaken to study the biochemical constituents and their subsequent presence in processed green tea as per different plucking standard where leaves were obtained from two tea clones namely TV 1 and S3A3. Highest amount of polyphenol (245.65 mg g-1) was recorded in case of steaming done for 4 minute and processed by CTC method using one leaf and a bud of TV 1. Lowest free radical scavenging activity was recorded in case of CTC green tea processed by steaming done for 6 minutes using three leaves and a bud of TV 1. Samples of green tea processed by steaming method had higher tannin content than roasting method. Total flavonoid content (22.92 mg/g of QE) was found in case of orthodox green tea using one leaf and a bud of S3A3 where roasting done for 4 minutes. The clone S3A3 was found to be superior as far as total catechins are concerned than TV 1. Caffeine content was more in CTC green tea than orthodox green tea irrespective of deenzyming method. Polyphenol to theanine ratio was recorded lowest in S3A3 using two leaves and a bud for processing of CTC green tea manufactured by roasting method.

◆◆◆◆◆◆

Passive solarladakh greenhouse: addressing the challenge of hidden hunger in Ladakh

Tsering Stobdan
DRDO-Defence Institute of High Altitude Research, Leh, UT Ladakh

ABSTRACT

The average altitude of human habitation in Ladakh is over 3000 meteramsl and the temperature drop up to -30ºC in winter. These long winters reduce the cropping season to barely four or five months in a year. Seasonal shortfall and low dietary diversity among the local populace manifests as micronutrient deficiencies, a phenomenon that has been described as 'hidden hunger'. Due to the short growing season, there is no farm income for the resource poor farmers from October to June.In view of the necessity of growing vegetables in

winter, a large number of traditional passive solar greenhouses have been established in Ladakh since the 1980s. However, the traditional greenhouses have limitations and the temperature often drops to -6 to -10°C during winter months. To address this critical concern of the people of the region, Defence Institute of High Altitude Research (DIHAR) developed Ladakh Greenhouse, an improvised passive solar greenhouse. Ladakh Greenhouse has been designed to overcome the limitations of traditional Ladakhi Greenhouse. It hassignificant edge over the existing passive solar greenhouse being used in the region. Farmers in Ladakh are now able to grow a variety of vegetables such as cauliflower, cabbage, broccoli, tomato, chilli, cucumber etc. in peak winter months and few other vegetable varieties in summers in Ladakh Greenhouse, which otherwise is not possible till date. It is leading to self-sufficiency and food security of Ladakh. The greenhouse technology helps in overcoming hidden hunger in the region which results from non-availability of fresh vegetables during winter months in the region.Besides meeting household requirements of fresh vegetables, the farmers are able to generate Rs 60,000-80,000 income in a year from a single greenhouse (60 feet x 24 feet).

◆◆◆◆◆◆

Evaluation of Twelve Genotypes of Cape gooseberry (*Physalis peruviana* L.) under three different agro climatic zones in Chhattisgarh

G.D. Sahu, Prabhakar Singh, Purnendra Kumar Sahu, Sarita Sahu, Shri Vikas Ramteke, and Vijay Kumar

Department of Fruit Science,
Indira Gandhi Krishi Vishwavidyalaya, Raipur (Chhattisgarh)

ABSTRACT

The present investigation was carried out during 2019 and 2020. Twelve genotypes of cape gooseberry were evaluated for nine qualitative and quantitative characters to study the genetic variability and association of the traits. The analysis of all 12 genotypes under 3 agro climatic conditions revealed considerable genetic variability in the evaluated genotypes. Among the genotypes being evaluated IGCG (Sel.-3) recorded the highest fruit yield potential under all three agro climatic zones of Chhattisgarh. A highest plant height of 125.39 cm. at 200 DAT was recorded and it took a minimum of 63.74 days for initiation of flowering. IGCG (Sel.-3) recorded highest number of 13.84 branches/plant and average number of fruits/plant was 87.59. The average fruit weight/plant was 10.77 gm. and average fruit yield/plant was obtained highest which is 4.17 kg. Considering the marketability of fruits IGCG (Sel.-3) yielded 5.96 t/ha of marketable fruit. In terms of sweetness the genotype recorded TSS of 13.97 (^{0}Brix) and a longer shelf life of 9.51 days.

◆◆◆◆◆◆

POSTER

Genetic engineering strategies and modern approaches for enhancing the quality of ornamental plants

Hemant Singh[1], Prakhar Tripathi [1,2] &Jibankumar S. Khuraijam[1,2]
[1]Botanic Garden Division, CSIR-National Botanical Research Institute, Lucknow - 226001, (U.P.)
[2]Academy of Scientific and Innovative Research (AcSIR), Ghaziabad - 201002, (U.P.)

ABSTRACT

Floriculture is an emerging branch of horticulture science concerning with growing, maintaining and marketing of ornamental plants with aim to meet people's aesthetic needs. India occupies the second largest area under floriculture next to China. Due to raise in socio-economic status and changing lifestyle, demand for new plant varieties with elite traits such as improved floral attributes, long-keeping quality, stress tolerance and disease resistance is increasing rapidly in the global market. In a country like India where floriculture is archaic farming activity based on traditional methods that are not sufficient enough to develop novel plant varieties with desire characters in a short period and meet the international quality standards for ornamental plants therefore country's share in the global floriculture trade is only 0.6%, despite of having second largest area under floriculture in world. So instant need is felt to incorporate modern genetic engineering strategies like molecular breeding, RNA interference (RNAi) technologies, trans grafting, cisgenesis/intragenesis and gene editing (CRISPR-Cas9) that possess immense potential in improving ornamental plant attributes like floral color, shape, size, fragrance, vase life, disease resistance and post-harvest traits more quickly and precisely. Commercializing transgenic blue roses and carnations developed by America, Japan and Australia is a great achievement of genetic engineering. Thus, genetic engineering strategies are the need of the hour and offer tremendous scope and potential to traditional methods for the improvement of floriculture crops. So, the present review attempt to summarize the advance biotechnological strategies and methods for manipulating key floral traits that lead to the improvement and development of desired ornamental plant lines.

◆◆◆◆◆◆

Sensors: smart technology for efficient management of ornamentals under protected conditions

Sheeba Belwal[1], Ranjan Srivastava[2], B.D. Bhuj[3], Ajit Kumar[4] and Satish Chand[5]
[1,2,3,4,5]G.B. Pant University of Agriculture & Technology, Pantnagar-263145

ABSTRACT

Qualitative and quantitative characteristics in ornamental crops show significant variations due to subtle climatic changes. These climatic fluctuations affect various biotic and abiotic factors that can result in the occurrence of various plant disorders and diseases. To avoid such undesirable fluctuations, a precise and accurate monitoring system is essential under a protected cultivation system that can be established with the help of key components known as sensors. Automation in the production of high-value floricultural crops can potentially optimize quality and yield with the help of various wireless sensing technologies that sense sensitive data such as moisture status, humidity, solar radiation, etc.. Sensors provide real-time information about the plant growth status that can help a grower to regulate and optimize greenhouse climatic conditions as desired.

◆◆◆◆◆◆

Protected cultivation technology in vegetables Crops and its role in opliftment of rural economy

Niyati Thakur, Ravinder Sharma, Shilpa, Atul, Anshuman and Akanksha Klate
Dr. YSP University of Horticulture and Forestry, Nauni, Solan (HP) 173230

ABSTRACT

India is fortunate to have a variety of agro climatic zones, which enable the cultivation of a large variety of vegetables. In terms of increasing vegetable production and productivity, significant progress has been accomplished. After China, India is the world's second-largest vegetable grower. Vegetable productivity must be increased throughout the nation due to rising consumer demand, improved health awareness and increased purchasing power. The natural growth, pollination and production of vegetable crops can be adversely affected by climate fluctuations and rapid environmental variations at any stage of crop growth. Open cultivation is less profitable due to high labour and input expenses. Consequently, it is advised to use a protected cultivation approach when growing vegetables. Therefore, the present study is an attempt to assess the role of protected cultivation in vegetable crops and towards upliftment of rural economy. The study was conducted based on the secondary data collected from different sources and studies conducted. Results showed that for marginal and small, it helps in creating agri-entrepreneurship. In India, it has evolved into a form of rural entrepreneurship that creates jobs for the unemployed while requiring little start-up capital and offering higher profits. Protected cultivation can result in a significant boost in the resource-use efficiency of crop production. Thus, if extension services for the transfer of scientific crop production technology in polyhouses are further sped up diligently, crop cultivation in polyhouses can perform miracles for the marginal and small farmers.

Keywords: Protected cultivation, Rural upliftment, Agrientrepreneurship, Resource use efficiency.

◆◆◆◆◆◆

Precision Farming: An Imminent Smart Way of Sustainable Agriculture

Mohini Prabha Singh, ShaikRehana, MadhuBala and R.K. Dubey
Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana, Punjab, India, 141 004.

ABSTRACT

Precision farming is a management system strategy to increase productivity while conserving scarce resources by maximising input use efficiency. By using less water, fertilizers, pesticidesand herbicides in addition to farm equipment, it may be possible to achieve economic and environmental benefits. In order to get precise results, it involves data collection, analysis and implementation. Precision farming is IT-based agriculture that uses a variety of sensors, including yield monitors, GPS, GIS and remote sensing satellites to generate maps for different factors (soil properties, temperature, RH, irrigation, nutritional status, etc.) based on observing, measuring and reacting to field variability in crops. Crops cultivated in open and protected environments are significantly impacted by conditions of water and nutrition stress, necessitating innovative interventions such as precise irrigation and fertilizer management strategies to mitigate these abiotic pressures. To increase the output of high-quality produce, soilless culture techniques like hydroponics and aeroponics can be used. For increased water use efficiency, higher-quality production and greater financial returns in a variety of crops, micro irrigation methods like drip irrigation have been used in several crops. In order to create high-quality produce that allows the grower to have production for a longer length of time and earn more money off-season, control over the growing conditions and elements impacting plant growth is crucial. Precision farming is the need of the hour to

sustain optimum yields with desired quality of produce besides safeguarding the limited natural resources along with their judicious application as per the requirement.

Keywords: Precision farming, hydroponics, aeroponics, input use efficiency, drip irrigation

◆◆◆◆◆◆

Studies on floral biology and pollination behaviour of Giant Himalayan Lily (*Cardiocarinum giganteum Wall.*) in temperate region of Uttarakhand

Surendra Lal[1], Mamta Bohra[2], B. P. Nautiyal[3], A.K. Kapoor[4] and A.S. Bish[5]

[1&4]Dept. of Floriculture and Landscaping, College of Agriculture, G. B. Pant University of Agriculture and Technology Pantnagar- 263123 Uttarakhand

[2,3&5]Dept. of Floriculture and Landscaping, College of Horticulture, VCSG, University of Horticulture and Forestry Bharsar Uttarakhand

ABSTRACT

Cardiocrinum giganteum is a perennial, endangered medicinal herb and ornamentalof family Liliaceae, distributed in temperate areas. Study of reproductive biology is necessary for effective conservation of endangered plants and pollination behaviour is an integral part of reproductive biology. Present study deals with Pollination Behaviour and Floral Biology *C. giganteum*. Autogamy, geitonogamy, natural pollination, open cross pollination and xenogamy experiments were applied in this study. The different parameters for floral biology, fruit set were recorded on the basis of time period. It was revealed from the data that the total span of flower bud development from bud emergence to the anthesis passes through six different stages. Time and duration of flowering recorded between 1st week of June to last week of July. Flowering (peak) takes place during the month of June – July and peak period of anthesis (9.4%) was recorded between 8 am to 10 am. The peak period of anthers dehiscence (24.2%) was observed between 10 am to 12 noon. Best receptivity of stigma (80.00%) had witnessed on the day of anthesis by fruit set method. The maximum pod set (96.66%) has been recorded under hand cross pollination followed by natural pollination (93.33%). The species is self-pollinated but dependent on pollinators for optimum pollination. On the basis of present studies, it can be concluded that mid-June to 1st week of July period found suitable for conducting crop improvement work through sexual method in Giant Himalayan Lily under temperate region of Uttarakhand. This information can be utilized in future breeding programmes that involve extensive crossing works.

◆◆◆◆◆◆

Remote Sensing: an eye in the sky for horticulture

Deepak Sangwan and Manish Kumar

Research Scholar, Dept. of Horticulture, Maharana Pratap Horticultural University, Karnal, 132 001

ABSTRACT

Fruit crops play vital role in improving the land productivity, employment generation, increasing exports, improving socio-economic status of the farmers and entrepreneurs and bestowing food and nutritional security to the people. For systematic and effective management of the prevailing crops and to bring more area of the country under the cultivation of horticultural crops, an upgraded and reliable database must be required for decision making and planning. Remote sensing (RS) is a progressive tool which assists in assembling and updating information to augment scientific management strategies in fruit crops. Now-a-days the discipline of Remote Sensing and Geographical Information System (GIS) has been widely used in horticultural sciences. It is a

process of detecting and monitoring physical characteristics of an area by measuring its reflected and emitted radiation at a distance from the targeted area. It is a multidisciplinary approach which comprises of different sciences such as, optics, spectroscopy, computer, satellite launching, photography and electronics. Remote sensing is rapidly proving their potential for application in horticulture for mapping of orchards and estimation of cultivable land area, land assessment and suitability, production estimation, soil moisture status, precision farming, detection of abiotic stress, soil resource mapping, drought assessment and monitoring, cropping system analysis, crop canopy measurement, yield estimation, detection of disease and pests etc. It has proved to be an influential tool for the environmental monitoring in several instances.

Keyword: Remote Sensing, Horticultural crops, monitoring and productivity

◆◆◆◆◆◆

Studies on post jarvest application of different chemicals on physical parameters of *Sapota* cv. Kalipatti

Shivani and A.M. Bhosale
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra),India
Ph.D. Scholar, CCS Haryana Agricultural University, Hisar, Haryana, Pincode – 125004.

ABSTRACT

The present investigation entitled “Studies on postharvest application of different chemicals on shelf life of sapota cv. Kalipatti” conducted during 2020–21 at PG laboratory, Department of Horticulture, Vasantrao Naik MarathwadaKrishi Vidyapeeth, Parbhani (Maharashtra). The sapota fruits are climacteric; they ripen quickly after harvest and become softened dueto a rapid increase in the activity of various oxidative enzymes, according to the original articlepublished in the International Journal of Agricultural Science and Study (IJASR). As a result,properpost-harvestmanagementisneededtokeepsapotafruitsfresh. Various chemicals, such as calcium chloride, potassium permanganate, salicylic acid, andkinetin, have been used to slow down the metabolic activities of the fruit to delay ripening, minimizelosses and preserve colour and consistency. These chemicals inhibit the growth and spread of microorganisms by decreasing shrivelling, resulting in improvedshelf life and fruit marketability for a longer period of time. Therefore, this investigation was administered to hunt out administered the "Influenceof pre-harvest spraying treatments of chemicals and plant growth regulators on chemical parameters post-harvestlosses and shelf lifeofsapota [Manilkara achras (Mill.) Forsberg] fruitscv.Kalipatti". The study material comprised of nine treatments which were CaCl2 4 % and CaCl2 2 %, CaCl2 1 % for 5 minutes, GA3 200 ppm , GA3 150 ppm GA3 100 ppmfor 5 minutes and BA 150 ppm, BA 75 ppm , BA 50 ppm for 5 minutes. Treated and untreatedfruits were packed in card board cartoons of 30× 30 ×30 cm size with 6 vents each of 3 cmdiameter equally on opposite sides and stored in PG laboratory. The experiment was framed in Completely Randomized Design with nine treatments and a control. The fruits were subjected tovariousquantitative and qualitative analysisonat3rd, 6th, 9th and 12th days of storage period.By end of storage period the physical parameters likelowest PLW (19.18) was recorded in fruit when treated with CaCl2 over control. It can be concluded that, CaCl2 4 % was found best treatmentwhich not only extended the shelf life of sapota fruits but also reduced the post – harvest lossesanddecreased physical parameters like PLW.

Keywords: Sapota, storage period, shelflife, quantitative and qualitative analysis.

◆◆◆◆◆◆

VRT: a precision horticulture technology towards agriculture 5.0

Harish. A, Ramesh Kumar. A and Archana Mahida
Department of Horticulture, School of Life Sciences, Central University of Tamil Nadu, Thiruvarur-6100005, TN, India

ABSTRACT

Precision horticulture is an information-based management strategy that relies on collecting site-specific or plant-specific data. These data can be transformed into helpful information to aid growers in making sensible management choices. It is a precise crop management technology which observed, measured and analysed the specific demand of different crops in particular field. Precision farming is a holistic approach to develop a comprehensive design to optimize the farm production with a precise application of resources and high input use efficiency. It includes various technologies *i.e.* Global positioning system (GPS), Geographical information system (GIS), Grid sampling, Variable-rate technology (VRT), Remote sensors and Proximate sensors. Among these, VRT works by using field variability which measures the application rate of inputs within the field and allows the farmers to apply inputs at the proper time, location, amount and manner. Inputs that can be varied in application specific to the field location include fertilizers, herbicides, tillage practices, insecticides, fungicides and irrigation management. VRT system includes computer controller, GPS receiver and GIS map database. The computer controller adjusts the rate of inputs to be applied into the field. This controller integrated with GIS database which contains the flow rate instructions for the application equipment and GPS receiver is linked with computer which coordinates with location of application and GIS map database indicates the particular rate of inputs.VRT technology makes precision horticulture easy, logical solutions with a straight forward approach. We required a simple and effective approach to our variable rate plans, which is effectively delivered by this technology.

Keywords: Precision farming, Precision horticulture, site-specific management, GPS receiver and VRT Technology.

◆◆◆◆◆◆

Precision horticulture

Homeshvari and Badri Lal Nagar
Department of Horticulture (Vegetable Science), College of Agriculture, RVSKVV, Gwalior (M.P.) - 474002.

ABSTRACT

Precision horticulture or precision farming is generally defined as an information and technology-based horticultural management system for identifying, analyzing and managing spatial and temporal variability within fields to achieve optimal productivity and profitability, sustainability and protection of the earth's resources by minimizing production costs. The use of inputs (*i.e.* chemical fertilizers and pesticides) based on the right amount, at the right time and in the right place. This type of management is commonly known as "Site Specific Management". Increased productivity in the global food supply has increasingly relied on the expansion of irrigation systems in recent decades, with more than a third of the world's food now requiring irrigation for production. Taken together, global market-based competition for agricultural products is challenging the economic viability of traditional agricultural systems and requires the development of new and dynamic production systems.Tools and equipment used in precision farming is Global positioning system (GPS), Sensor technologies,Geographic information system (GIS), Grid soil sampling and variable-rate fertilizer (VRT) application, Crop management, Soil and plant sensors, Global Positioning System (GPS), Rate controllers, Precision irrigation in pressurized systems, Software and Yield monitor.Precision horticulture provides a new solution using a systems approach to current agricultural

problems, such as the need to balance productivity with environmental concerns. It is based on advanced information technology. It includes describing and modeling variation in soils and plant species and integrating horticultural practices to meet site-specific requirements. Its goal is to increase economic returns, as well as reduce energy consumption and the environmental impact of agriculture.

Keywords:- Precision horticulture, Global positioning system (GPS), Geographic information system (GIS), Sensor.

◆◆◆◆◆◆

Effect of fertigation on growth, yield and quality of mango cv. Pant sinduri

Pooja Devi, C.P. SINGH
Ph.D. Scholar, Department of Fruit Science, Punjab Agricultural University, Ludhiana, 141004
Professor, G.B.P.U.A.&T, Pantnagar, Uttarakhand, 263145

ABSTRACT

A field experiment was conducted during 2017-18 to study the effect of drip fertigation on yield and quality attributes of mango cv. Pant Sinduri at Horticulture Research Centre, Patharchatta, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The experiment was organized in a randomized block design involving four replications and incorporated six treatments encompassing drip fertigation at 100, 80, 60, 40 and 20 percent recommended fertilizer dose and a control (wherein no fertilizers were applied). The outcome of experimentation revealed non-significant variation among various flowering parameters like the male flower percentage, hermaphrodite flower percentage and flower sex ratio. However, the percentage fruit set, fruit retention, fruit drop and yield varied significantly with different drip fertigation levels. Treatment T1 (fertigation with 100% recommended dose) recorded maximum fruit set (16.59%), fruit retention (2.87%) and minimal fruit drop (97.26%), subsequently leading to the highest fruit number (418) and yield (89.08 kg/tree) under this treatment. Similarly, fruit physical parameters like fruit weight (g), fruit volume (ml), pulp weight (g) and edible portion (%) as well as biochemical parameters like TSS (0brix), acidity (%), total sugar (%), reducing sugar (%), ascorbic acid (mg/100g) and carotenoids (mg/100 g of pulp) were found highest under this treatment *i.e.* treatment T1. However, these parameters were statistically at par with treatment T2, *i.e.*, fertigation with 80% recommended dose. On the other hand, significantly minimum values for these parameters were observed in the control. Therefore, it was concluded that drip fertigation at 80% recommended dose of fertilizers is economically advantageous for mango cv. Pant Sinduri.

◆◆◆◆◆◆

The future of plant monitoring in horticultural crops through automation

Saurabh Tiwari
Research Scholar, Chandra Shekar Azad University of Agriculture and Technology,
Kanpur-208002

ABSTRACT

Horticultural crops are more pron to various insect-pest and diseases than the arable crops. They require frequent monitoring and attention on plant basis in order to keep the emerging pests and diseases under acceptable threshold level. An innovative approach such as digital scouting application for mobile devices, which can provide a precise indentifying and monitoring plateform, may play a crucial role in enhancing the production of horticultural crops. The camera of the mobile device may be utilized as the scanner and capture the photos of sticky traps through the application interface to identify the insect pest and count the number of insects on it. After the image

analysis it may provide an schematic result like name of the pest, population based on image analysis, potential threat level, etc. The data obtained so could be collated with other measurements and a wider analysis may be provided. Based on this analysis appropriate control measuresand/or biological solutions may be suggested through the application. In this way the management of such problems will be rapid and through the help of such application, effective control could be done precisely with in the time. In larger areas, unmanned aerial vehicles (UAV) or drones are really helpful as drones attached with such scouting device can locate and identify the pest and disease from a remote location. Thus, by the utilization of such technologies, we can reduce the damage to a great extent, ultimately leading to higher levels of production of horticultural crops.

◆◆◆◆◆◆

Precision farming in horticulture: a scenario

Abhishek Pratap Singh, Vipin Kumar, Sujeet Kumar Patel, Divyansh Mishra
Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya 224229 (U.P)

ABSTRACT

The human population continues to grow steadily with the shrinking resources being used for agricultural production situates great challenge against world agricultural system to attain food and environmental security. To counter these challenges there is urgent need of application of modern Hi-tech technologies for enhancing the productivity. Precision farming (PF) improving the capability of agricultural land to produce crops on sustainable basis. The PF is based on the concept of determination of spatial and temporal variability in the crop production which in turn aimed for increasing crop productivity and reducing environmental menaces. It is innovative technology which comprises the application of several Hi-tech tools like Geographical Information System (GIS), Global Positioning System (GPS), Remote Sensing (RS) and Variable Rate Technology (VRT). Thus, precision agriculture is conceptualized by a system approach to re-organize the total system of agriculture towards a low-input, high-efficiency and sustainable agriculture. Looking to the pressure arising population and erratic climatic variation, more attention required towards the development of technology driven horticulture precision farming is being reviewed as a promise in this regard.

Keywords: Precision farming, Horticulture precision farming,World agricultural system.

◆◆◆◆◆◆

Climate smart horticulture

Rakhi Gautam, Pratibha and A K Singh
Department of Horticulture, College of Agriculture,
G. B. Pant University of Agriculture and Technology, 263145 (U.S. Nagar, Uttarakhand)

ABSTRACT

Horticulture is considered to be “climate smart” when it contribute to increasing food and nutritional security, adaptation and mitigation in a sustainable way. Due to periodic modification of earth’s climate brought about due to the changes in the atmosphere and various other geological, chemical, biological and geological factors within the earth’s system. A growing global population and changing diets are driving up the demand for horticultural crops. The challenge is intensified by horticulture’s extreme vulnerability to climate change. Climate Smart Horticulture (CSH) has a great role to play at this defining moment. Some of the CSH production practices and technologies include improved timing and reliability of seasonal forecasts and hydrological monitoring, use of quality seeds and planting materials, soil and water conservation, organic manure use and crop diversification. In

modern commercial horticulture production systems, weather stations often monitor irrigation in accordance with the water requirements of crops, information and communications technologies and some of the innovations regarding CSH include yield monitoring in fruits and nuts, precision irrigation, robotics, small aerial systems for aerial crop surveying, Structure from Motion (SfM) techniques etc. It strengthens resilience, variability and reduces horticulture's contribution to climate change and enhances the achievement of national food security and development goals.

Keywords: Adaptation, mitigation, sustainable, climate smart horticulture.

◆◆◆◆◆◆

Precision farming in horticulture: an approach for improving production

Akansha Verma
Ph.D. scholar Swami Keshwanand Rajasthan Agriculture University, Bikaner
Rajasthan (334006)

ABSTRACT

Precision agriculture is a popular new and innovative concept in production of horticulture crops. Precision agriculture can be defined as a comprehensive system designed to optimize agricultural production through the application of advanced technology, crop information and management practices. A truly comprehensive approach to precision horticulture starts with crop planning and includes tillage, planting, chemical applications, harvesting and post-harvest management of the crop. A more comprehensiveagricultural approach uses information technology to bring data from different sources to bear on decisions associated with horticulture production, logistics, marketing, finance and personnel. Technological interventions in precision horticulture include genetic engineering, genetic conservation, integrated nutrient management, micro irrigation, fertigation, protected cultivation, post-harvest technology, etc. Precision farming is a complete system designed to increase production. This can increase production efficiency, improve quality of the product, improve the crop chemical use efficiency, conserve energy and protect environment with the use of key elements of technology, information and management. Technology and management practices such as field scouting, field mapping, variable rate control, yield mapping and post-harvest processing can be readily adopted in vegetable crop production. However, the technology related to precision farming needs more refinement to realize its benefits.Precision agriculture is also called as precision farming, precision horticulture, site-specific farming (SSF), site-specific management (SSM), site-specific crop management (SSCM) and variable rate application (VRA) etc.

Keywords: Precision farming, post-harvest, Information, technology and management.

◆◆◆◆◆◆

Vibration to ensure better pollination in greenhouse tomato crop

Pooshpendra Singh Dixit and Dr. C. M. Tripathi
DRI, Krishi Vigyan Kendra, Chitrakoot (U.P.)

ABSTRACT

Pollination is the act of transferring pollen grains from the anther to the stigma of a flower. Tomato is self-pollinating crop, as flower are equipped with both male and female parts. Tomato plant is capable of producing fruits on its own, without the need of planting another one. Tomato (Solanum lycopersicum L.) is highly self-pollinated crop but aided pollination of flowers is generally needed in the green house grown tomatoes due to limited air movement and high humidity. In several countries bumble bees are being used as a pollinator for the

green house tomato crop. Bumble bees are the perfect pollinators under environmental stress condition (under low and high temperature humidity conditions). But in several countries an electric or battery powered vibrators are being used to vibrate flowers clusters. The vibration will release sufficient pollens which are necessary for pollination. The practice is done twice a day 10.00 to 11.00 AM and 2.0 to 3.0 PM. Flowers are vibrated or shaken every day. Electric vegetable pollination tool/tomato pollinator is a very useful tool to increase the percentage of inseminated flowers, fruits set and improve the tomato yield with good quality fruits.

Keywords: Tomato, Greenhouse, Pollination, Biotic& Abiotic stress, Bumble bee and Vibrator.

◆◆◆◆◆◆

Impact of Foliar Application of Micronutrients on La Hybrid Lilium cv. Pavia

Nivya K. R, M. K. Singh, Namita1, Ritu Jain, Rakesh Pandey and M. C. Meena
Division of Floriculture and Landscaping, Division of Plant Physiology Division of Soil Science and Agricultural Chemistry
ICAR-IARI, New Delhi.

ABSTRACT

Lilium is one of the most important ornamental bulbous flowering plant possess a conspicuous position among the top ten cut flowers in the world. Optimum dose of micronutrients is very important for better growth, flower and bulb production. So the present study has been carried out to produce quality flowers and bulbs by determining the optimum dose of micronutrients in Northern plains conditions. A field experiment was carried out in the floriculture experiment field at ICAR-IARI, New Delhi to study the effect of foliar application of micronutrients (zinc and manganese) on growth analysis, quality flower and bulb production of LA hybrid lilium cv. Pavia during 2021-22. The experiment was laid out in a factorial randomized block design with two factors ($ZnSO_4$ and $MnSO_4$) comprising five levels (distilled water, 2 g/l, 4 g/l, 6 g/l and 8 g/l) of micronutrients. The combination of these two factors are replicated three times in the experiment. Overall best result was found in the interaction of $ZnSO_4$ and $MnSO_4$, when plants are sprayed with $ZnSO_4$ + $MnSO_4$ @ 6g/l each performed better in terms of plant growth analysis parameters *viz.,* Net Assimilation Rate (4.07 g/m^2 leaf area/day) and crop growth rate (4.46 g/m^2 land area/day); quality flower attributes *viz.,* stalk length (99.23 cm), stalk diameter (1.36 cm), number of flower buds per plant (8.53), bud length (11.86 cm) and bud diameter (4.21 cm) and bulb attributes *viz.,* number of bulblets per plant (4.60) and bulb circumference (14.97 cm) whereas least values were recorded in control.

◆◆◆◆◆◆

Offseason flowering in Spider lily through deleafing and foliar nutrient application

Dipal S. Bhatt, S. L. Chawla, M. A. Patel and Sudha Patil
Dept. of Floriculture and Landscape Architecture
ASPEE College of Horticulture & Forestry
Navsari Agricultural University, Navsari, Gujarat – 396450

ABSTRACT

An investigation was conducted to study the effect of deleafing and foliar nutrient application for offseason flowering in spider lily. The experiment was laid out in Randomized Block Design with factorial concept comprising ten treatments along with absolute control which consisting two factors having various levels of leaf cutting (two levels) and foliar nutrient application (five levels).The treatments were replicated thrice.Based on pooled data of

three years, all vegetative and flowering parameters were significantly influence by various treatments of leaf cutting and nutrient application. In case of leaf cutting, plant height, plant spread in N – S and E – W direction and no. of leaves were recorded maximum from leaf cutting in 1st week of June (L_2) while, highest leaf area, width of leaf, early flower stalk emergence, no. of buds per stalk and highest no. of flower buds in the month of July, August, September and Octoberwere observed by leaf cutting in 1st week of May (L_1).Foliar application of nutrient 19:19:19 @ 1.5 % (S_2) recorded significantly highest plant height, plant spread (E – W) and no. of leaves whereas, maximum plant spread (N – S) was reported in the plants sprayed with 12:61:0 @ 1.5 % (S_3) and foliar spray of 13: 0: 45 @ 1.5% (S_5) recorded maximum leaf area, width of leaf, length of flower stalk and no. of flower buds per stalk with early flower stalk emergence. Furthermore, plants treated with foliar application of 13: 0: 45 @ 1.5% (S_5) produced highest flower bud in the month of July, August, September and October as well as total no. of buds per plant, per plot and per ha. Looking to the economics, maximum net realization and B:C ratio (3.93) were noted in cutting of spider lily in 1st week of May with foliar nutrient application of 13: 0: 45 @ 1.5 % (L_1S_5).

◆◆◆◆◆◆

Impact of graded dose of fertilizer on golden rod under different land configuration

Changela Yash, Dipal S. Bhatt, B. M. Tandel and Alka Singh
Dept. of Floriculture and Landscape Architecture
Dept. of Fruit Science
ASPEE College of Horticulture & Forestry
Navsari Agricultural University, Navsari, Gujarat – 396450

ABSTRACT

The investigation was conducted during June 2021 to May 2022 with the objective to assess the individual and interaction effect of graded dose of fertilizer on growth, yield and quality of golden rod under different land configuration. The experiment was laid out in Randomized Block Design with Factorial concept consisting nine treatment combinations, with three land configuration methods *i.e.* flatbed (L_1), ridge and furrow (L_2) and broad bed (L_3) and three graded doses of fertilizer *i.e.* 112.5:75:75 kg NPK/ha (F_1), 150:100:100 kg NPK/ha (F_2) and 187.5:125:125 kg NPK/ha (F_3) and replicated thrice. In respect to land configuration, golden rod plants grown on broad bed (L_3) significantly increased plant height (101.65 cm), no. of leaves/plant (83.93), plant spread in N - S and E - W (50.20 cm and 48.79 cm, respectively), fresh weight of plant (386.64 g), dry weight of plant (152.09 g), no. of suckers/plant (8.33) with maximum panicle length (82.73 cm), rachis length (53.87 cm), diameter of main stalk of panicle (7.84 mm), no. of panicles/clump (14.38) and no. of panicles/ha (9.48 lakh). Application of NPK @ 150:100:100 kg/ha resulted maximum plant height (101.06 cm), no. of leaves/plant (72.20), plant spread in N-S and E-W directions (45.12 cm and 44.43 cm, respectively), fresh weight of plant (382.47 g), dry weight of plant (152.16 g), no. of suckers/plant (7.64), panicle length (76.41 cm), rachis length (49.42 cm), diameter of main stalk of panicle (7.07 mm), no. of panicles/clump (11.07) and no. of panicles/ha. (8.86 lakh). Broad bed along with the application of NPK @ 112.5:75:75 kg/ha - L_3F_1 was found effective for obtaining maximum no. of leaves (94.53), plant spread in N - S and E - W directions (57.24 cm and 56.40 cm, respectively), no. of suckers/ plant (9.47), panicle length (93.89 cm), rachis length (60.63 cm), diameter of main stalk of panicle (8.85 mm) with highest no. of panicles/clump (16.07), no. of panicles/ha (10.74 lakh) and higher net income with utmost BCR (3.52).

◆◆◆◆◆◆

Session-6

Post Harvest, Value Addition and Waste Management

INVITED LECTURES

I-1 Postharvest Management of Horticultural Crops: Issues, Challenges and Strategies

Ram Asrey
Department of Food Science and Postharvest Technology,
ICAR-Indian Agricultural Research Institute, New Delhi-110 012

The humanity world over has faced unprecedented catastrophic effect of Covid-19 pandemic. Despite the huge pandemic induced recession in all the sectors of industry, Indian horticulture has registered outstanding growth in production as well as in export. With the increase about 1.8% over previous year, the total Indian horticultural production is expected to be about 342.33 million tonnes during 2021-22. India has achieved an impressive growth in the capacity building of cool chain management, logistic and supply chain management along with execution of hygiene and food safety laws. With all these efforts, country is still

having several issues including high postharvest losses (18%), supply chain logistics, high price fluctuation, nutritional security to all citizens, quality and safety standards. Challenges like climate change and its likely impact on production, produce quality and supply chain system, competition from other exporting countries (South east Asia and Africa) and tough residue safety norms of importing countries.Also, the increasing public awareness to environment, health and produce quality, consumers are looking for green postharvest technologies which can enhance the shelf life of produce and retain the nutritive value during handling and storage. This gap shows that our preparedness did not match with the pace of horticultural production and fast changing world scenario.

To further to curve the postharvest losses, we need to upscale the existing infrastructure including mechanization, digitalization, multicommodity cold storage, Kisan rail, E-NAM extension platform, cluster development programme etc. Synthetic pre and post storage treatment agents/molecules are now being replaced with eco-friendly products. Green technologies like VHT, HWT, Irradiation, ozonation, UV- irradiation, cold plasma treatment, ethylene gas-based ripening, salt-based fruit de-sapping, pseudomonas derivatives, salicylic acid, methyl jasmonates (MeJA), ethanol, polyamines, 1-Methylcyclopropene, CIPC, edible waxes, essential oils, bio-control agents are gaining popularity across the globe. The ICAR-institutes has started assessing the impact of climate change on annual crops which needs to extend horticultural crops too. Besides, GoI, should create a Marketing Intelligence wing within APEDA.

◆◆◆◆◆◆

I-2 Advanced Postharvest Technologies for Fruits and Vegetables

OP Chauhan and AD Semwal
Fruits and Vegetables Technology Division, DFRL, Mysore 570011

Fruits and vegetables are highly perishable commodities and undergo postharvest losses due to deterioration during harvest, handling, transport and storage mainly because of senescence of the fruit combined with physical damage, fungal decay and infestation. The use of scientific harvesting and postharvest handling practices can significantly reduce these losses. Various such practices include pre-cooling, surface sanitation, use of surface coatings, modified/controlled atmosphere storage, irradiation, minimal processing, vacuum frying and high-pressure processing etc. In addition to that various conventional fruit and vegetable processing techniques which had been largely restricted to hot air dehydration, canning, aseptic packaging and freezing underwent considerable advancement in the improvement of core technologies as such and also improvisations in the design of process equipments to make the product manufacture more user friendly, cost effective and eco-friendly. Optimal use of these techniques, pre-treatments and handling protocols helps to ensure the quality of the produce as well as increases the shelf life during storage and transportation.

Introduction

The importance of fruits and vegetables in human diet has gained increased importance in the recent past as the modern consumer realized the prophylactic nature of fruit and vegetables and also the ability of fruit and vegetable diets to control human stress which is the hallmark of modern life. India is the second largest producer of fruits and vegetables in the world with production of 99.07 million metric tonnes of fruits and 191.77 million metric tonnes of vegetables. However, these being highly perishable commodities and undergo postharvest losses due to deterioration during harvest, handling, transport and storage mainly because of senescence of the fruit combined with physical damage, fungal decay and infestation. The postharvest losses are huge and to an extent of 20-35%. Countries like India are undergoing unforeseen rise in food inflation more so in the case of fruits and vegetables due to the imbalance in demand-supply equations. Another factor contributing to the same is the lack of agro-processing which is still around 2% in the country despite a lot of emphasis from various Governmental bodies. Scientific harvesting and postharvest handling are the practical way to reduce these losses. Several postharvest techniques are available for maintaining quality of fruits and vegetables. These include pre-cooling, surface sanitation, use of surface coatings, modified/controlled atmosphere storage, irradiation and minimal processing, vacuum frying, high pressure processing etc. Optimal use of these various pre-treatments and handling protocols ensure safety of fruits and vegetables during postharvest handling and maintain their quality during storage. Significant change has also been observed in the fruits and vegetables processing industry in last few decades and a number of newer postharvest handling technologies have emerged in recent years. The important physiological considerations to improve postharvest quality and extend shelf-life of fruits and vegetables are respiration rate, storage temperature and optimal O_2 and CO_2 concentrations of modified and controlled atmosphere (MA/CA) storage and ethylene. Knowledge of the physiological profile of the selected fruits and vegetables can be a powerful tool to assist in optimizing commercial utilization.

Pre-cooling

Pre-cooling is a process of removal of accumulated “field heat” reduces the postharvest life of the product. Moisture loss (or) uptake is one of the most important factors that control the shelf-life of fruits and vegetables. Proper storage is an essential part of the marketing and distribution of horticultural commodities. Pre-cooling, hydro-cooling, contact icing, vacuum cooling, forced air cooling, cooling and refrigeration, room cooling, mechanical refrigeration, evaporative cooling, carbon dioxide cooling, proper relative humidity and optimal atmospheric composition in storage facilities and packages are important in reducing postharvest losses of commodities that are preordain to reach the consumer in fresh condition.

Ripening and ethylene adsorbent

Maturity of fruit and vegetables causes profound changes in the biochemical characteristics of the commodity.Ripening hastens the onset of senescence and the probability of cell injury and death. The rate at which fruits and vegetables ripen (or) senesce can be influenced and controlled by environmental factors such as temperature, humidity and gas composition. Ethylene (C_2H_4) induces ripening in many fruits and can also cause some physiological disorders in vegetables. Most of the C_2H_4 may be removed if N_2 generators (or) gas flushing methods are used. Commercial C_2H_4scrubbers include (a) the heated catalyst scrubber (b) C_2H_4absorbing beads and (c) ozone. Ethylene action can be reversibly blocked with high carbon dioxide atmospheres.

Phyto-sanitary treatments

Sanitation and phyto-sanitation measures (SPS) are important in global trade of fruits and vegetables to ensure that these products are free of certain pests and diseases and meet maximum allowable limits for pesticides. Hydrogen peroxide, ozone, UV light, ultrasound are also used for phyto-sanitation of fruits and vegetables. Ozone in gaseous form bubbled through water at 0.1-1.0 ppm for 360 minutes, or at concentrations up to 200 ppm for 10-15 minutes was found to significantly reduce the microbial loads.Ultraviolet (UV) destroys microorganisms by directly damaging DNA and indirectly inducing resistance mechanisms in vegetables against pathogens. Ultrasound (20-100 kHz) has a potential application to fresh produce decontamination. Electrolyzed water (EW), also known as electrolyzed oxidizing water, is conventionally generated by electrolysis of 0.1% sodium chloride solution to produce an electrolyzed basic aqueous solution at the cathode and an electrolyzed acidic solution at the anode. Acidic electrolyzed water (AEW) at pH 2.1-4.5 has bactericidal activity against food borne pathogens. Moreover, these techniques are relatively inexpensive and easy to use.

Pulsed light

The use of pulse white light to inactivate vegetative cells and spores on the surfaces of foods and packaging materials has a commercial importance. Pulsed light is produced in short (1µs to 0.1 s) pulses, typically 1-20 flashes per second that are approximately 20000 times the intensity of sunlight at sea level. It has peak emissions between 400 and 500 nm, this light is in the 'non-ionizing' part of the electromagnetic spectrum and in contrast to irradiation. The broad spectrum of pulsed light inactivates micro-organisms by a combination of photochemical and photo-thermal effects. Inactivation occurs by a number of simultaneous mechanisms, including chemical modifications of proteins, membranes, other cellular materials and nucleic acids.

Surface coating

Surface coatings are used as protective coating for fruits and vegetables and help in reduction in loss in moisture and rate of respiration and ultimately results in prolonged storage life.An edible coating improves structural integrity and mechanical handling and carry product so that they help to maintain quality and inhibit microbial growth causing deterioration of the product. The surface coatings should have the following properties; a) non-toxic to humans, b) good permeability properties, c) stability in formulation, d) rapid drying, e) strong adherence to fruit throughout the entire storage life, f) high gloss and g) economical.

Controlled/modified atmospheric packaging

Modified atmosphere packaging (MAP) can be defined as "the enclosure of food products in a barrier film in which the gaseous environment has been changed/modified to slow respiratory rates, reduce microbiological growth and retard enzymatic spoilage with the intent of extending shelf-life". In Passive modification, the atmosphere is modified as a result of a commodity's respiration, *i.e.*, O_2 consumption and CO_2 generation. In active modification, the package headspace is flushed with a known concentration of O_2, CO_2 and N_2. The primary objective of packaging of fruits and vegetables is to protect the contents during storage, transportation and

Table: Optimum storage conditions for different fruits and vegetables

Vegetables	Tolerance		Optimum		Recommended storage temperature (°C)
	Maximum CO_2 (%)	Minimum O_2 (%)	CO_2 (%)	O_2 (%)	
Artichoke	2	3	2-3	2-3	0-5
Asparagus	14	5	10-14	air	1-5
Beans, snap	10	2	5-10	2-3	5-10
Bell peppers	2	3	0	3-5	8-12
Broccoli	10	1	5-10	1-2	0-5
Brussels sprouts	5	2	5-7	1-2	0-5
Cabbage	5	2	3-6	2-3	0-5
Carrot	5	5	3-4	5	0-5
Cauliflower	5	2	2-5	2-5	0-5
Chilli peppers	2	3	5	3	8-12
Corn , sweet	15	2	10-20	2-4	0-5
Cucumber	10	3	0	3-5	8-12
Lettuce	2	2	0	1-3	0-5
Mushrooms	15	1	5-15	3-21	0-5
Potato	-	-	0	0	4-12
Onion	-	-	0	1-2	0-5
Spinach	15	-	10-20	air	0-5
Tomatoes (mature)	2	3	0	3-5	12-20
Fruits					
Apple	2-5	1-2	1-3	1-2	0-3
Apricot	2	2	2-3	2-3	0-5
Avocado	5	3	3-10	2-5	5-13
Banana	5	2	2-5	2-5	12-15
Cherry (sweet)	15	2	10-12	3-10	0-5
Grapefruit	10	5	5-10	3-10	10-15
Kiwifruit	5	2	3-5	1-2	0-5
Lemon	-	-	0-10	5-10	10-15
Lime	-	-	0-10	5-10	10-15
Mango	5	-	5-8	3-7	10-15
Orange	-	-	0-5	5-10	5-10
Papaya	5	2	5-8	2-5	10-15
Peach	5	2	3-5	1-2	0-5
Pear	2	2	0-1	2-3	0-5
Pineapple	10	2	5-10	2-5	8-13

Organized by:
G.B. Pant University of Agriculture and Technology, Pantnagar-263145, U.S. Nagar, Uttarakhand
Indian Society of Horticultural Research & Development (ISHRD), Uttarakhand India

distribution against deterioration, which may be physical, chemical, (or) biological. Packaging is hence provided at the point of production (or) processing (or) at distribution centres.

Irradiation

Irradiation is a promising technology for improving hygiene and increasing storage and distribution life of food products. Irradiation preserves foods by the use of ionizing radiation (gamma rays from isotopes or, commercially to a lesser extent, from electrons and x-rays). It is used to destroy pathogenic or spoilage bacteria, or to extend the shelf-life of fresh produce by disinfestation and slowing the rate of germination, ripening or sprouting. The combination of irradiation with other technologies such as refrigeration, ozonation, modified atmospheric packaging and surface coatings can enhance the postharvest shelf-life of fruits and vegetables.

Minimal processing

Fresh-cut fruits and vegetables emerged to fulfil new consumer's demands of healthy, palatable and easy to prepare plant foods. 'Minimal processing' describes non-thermal technologies to process food in a manner to guarantee the food safety and preservation as well as to maintain as much as possible the fresh-like characteristics of fruits and vegetables. The principle underlying the use of combined techniques to inhibit microbial growth is known as the 'hurdle' concept and includes the use of mild heat, reduced water activity, preservatives, redox potential, ozonation, modified atmospheric packaging, surface coatings, low dose irradiation and increased acidity etc.

Vacuum frying

Vacuum frying is a comparatively new deep-fat frying technique having advantages over traditional frying. It could be an option for development of novel snacks with superior product quality attributes from different fruits. In this, frying is done at reduced pressure well below the atmospheric level which prevents nutritional losses, discoloration and reduced oil absorption. It plays an incredible role in reducing the formation of acrylamide (a potent toxic substance) which generally tends to occur during high temperature processing. The overall benefits of vacuum frying are basically associated with application of low temperature and low internal pressure along with minimal exposure to oxygen during process.

High pressure processing

High Pressure Processing (HPP) is a novel food preservation method, wherein, food is exposed to high pressures for short time duration to achieve microbial inactivation. Since, the process can be accomplished at low or ambient temperatures and pressure treatment does not break covalent bonds, the product retain fresh like characteristics in terms of nutritional quality and at the same time extending the microbiological shelf life. Both pasteurization and stabilization effects are possible depending on the intensity of the pressure applied. High pressures can be used to inactivate pathogenic and spoilage bacteria, yeasts and molds. The effects of high pressure on microorganisms include morphological changes, cessation of mobility and inactivation as such. The threshold pressure is specific to organisms. The survival patterns of several organisms i.e.*E. coli*, *Salmonella typhimurium, Listeria monocytogenes, Vibrio paraheamolyticus, Bacillus cereus* etc. were established and most of the organisms including yeasts were inactivated within a threshold pressure of 200-500 MPa. The other high pressure induced biological manifestations include inactivation or change in reactivity of enzymes *i.e.* polyphenol oxidase, proteases and dehydrogenases. The applications of high pressure processing include extension in shelf life, microbial decontamination, development of texturized foods, pressure shift aided freezing and thawing of frozen foods etc.

Conclusion

Control of postharvest operations, especially the combination techniques, plays an important role in

influencing the quality issues during postharvest life of produce. Optimal use of these techniques not only helps to ensure the quality but also increase the shelf life during storage and transportation of fruits and vegetables during various military operations. As such generation of infrastructure and of technologies will add to the cost of production but finally it is going to help in reducing the postharvest losses and in long run will become cost effective, feasible and sustainable.

◆◆◆◆◆◆

I-3 Sustainable Post Harvest Management and Processing Technologies to Minimise Food Losses & Waste

R.B. Tiwari
Division of Social Science & Training, ICAR-Indian Institute of Horticultural Research, Hessarghatta Lake Post, Bangalore-560089

An increasing demand from consumers for safe, natural and chemical preservative-free food products is driving researchers to introduce new alternatives and sustainable approaches for handling, storage and preservation of fruits and vegetables. These new advanced technologies are being developed considering environmental sustainability, besides nutritional, microbial inactivation and decontamination aspects in mind which has potential to replace the conventional thermal technologies used in the food processing industry. The major goals of postharvest research and extension are to maintain quality and safety and minimize losses of horticultural crops between production and consumption. Reduction of postharvest losses increases food availability to the growing human population in turn supporting SDG12 a most important sustainable development goal. Strategies for loss prevention include use of genotypes that have longer postharvest life, improved production technologies that results in good keeping quality and use of appropriate postharvest handling systems that maintain product quality and safety for fresh produce marketing. On the other hand, several non-thermal processing technologies such as high pressure processing (HPP), pulsed electric fields (PEF), ultrasound, cold plasma pulsed electric field, high-pressure processing, cold plasma, can be used as potential disinfectant technologies in for processing of fruits and vegetables without any negative impact on food composition and quality. Similarly, several physical treatments such as cold storage, heat, including hot water and hot air treatments, radio frequency and microwave, hypobaric and hyperbaric pressure and far ultraviolet radiation (UV-C light), ozone and electrolysed water have gained great interest in recent years to control many postharvest diseases in fruits and vegetables. As it results on total absence of pesticide residue in the treated product as well as minimal environmental impact. Achieving the goal of sustainable development of the fruit and vegetables value chain is heavily dependent on processing at both the global and local levels. Hence, it will be a wise decision to select available postharvest as well as processing technologies with minimum impact on environment as well as better retention of nutrient and flavour in the processed products.

◆◆◆◆◆◆

I-4 Recent Advances in Protected Cultivation Technologies Transforming in Horticultural Crops Production

Awani Kumar Singh
IARI, New Delhi

The protected cultivation cum Hi-tech techniques is emerging as the most promising field, particular in term of higher productivity, quality, increased income, entrepreneurship etc. But the progress of area coverage under protected technologies is highly satisfying. Other major reason for higher adoption includes promotion of hi-tech horticulture by public financial institutions. Although, despite indubitable potential of protected cultivation, its spread has not been linked concomitantly and processing units besides overall market linkage. Net result is that despite the technology performing exceedingly well by up-to-date farmer; majority of them keeps facing challenges to cope up with the demands of hi-tech horticulture. (Indian Hort. Sept.Oct.2017. pag.68-74)

Annual requirement of vegetables at the present rate of 180g/day /capita is estimated to be 135MTagainst the obtained 125Mt, which clearly indicates that there is a short-fall of 10MT of vegetables. Whereas, if the per capita consumption of FAO (300g/day/capita) sis to taken into consideration, there would be a large gap in demand and production. The actual problems of low productivity have been attributed to the extreme of temperature ranging from 3-48 C during the year which does not allow year-round vegetable cultivation at large scale. In India, this production gap is an opportunity of growing horticultural crops in protected cultivation and large

the area under high-tech horticulture is growing larger day–by-day and the productivity in off- season, with the induction of an artificial techniques like greenhouse technology, in which temperature and moisture is controlled for specific growth of vegetables (Indian Hort. Jan- feb.2022-pag.36-42)

◆◆◆◆◆◆

Oral Presentation

Edible Flowers: Discovering taste along with nutrition palate

Sachi Gupta, Shweta Singh, Jibankumar S. Khuraijamand S. K. Tewari
CSIR-National Botanical Research Institute, Lucknow - 226001, Uttar Pradesh

ABSTRACT

Edible flower is raising interest as rich source of bioactive compounds. Consumption of the edible flowers forms new trend in human nutrition in some countries. Despite the fact that not all nations use flowers as food, their use has generally expanded, as has the interest of researchers from other fields of study since they are thought of as novel sources of nutrients and bioactive substances. Therefore, the determination of bioactive compounds content in their petals presents important tasks for their evaluation as natural source of antioxidants for human diet. Rose (*Rosa* spp), Lotus (*Nelumbo* spp), Nasturtium (*Tropaeolum* spp), Chrysanthemum, Hibiscus, Lavender (*Lavandula spp*), Chamomile (*Matricaria* spp), Marigold (*Tagetes* spp), Purslane (*Protulaca* spp) etc. have been used in the culinary arts for centuries. Different parts such as flowers, leaves, roots can serve as an essential ingredient in a recipe, provide seasoning to a dish, or simply be used as a garnish, tea, relishes, jam or salads. Flowers are part of many regional cuisines, including Asian, European and Middle Eastern cuisines. A powerful argument for their ingestion is new knowledge on the nutritional content and makeup of edible ornamentals. Compared to regular vegetables and fruits, edible flowers have a very high antioxidant capacity. Compared to other vegetables, the flowers of purslane have the highest nutritional value, specifically omega-3 fat. Chamomile is often consumed to reduce anxiety and also improve quality sleeping. The levels of total phenolic compounds (TPC) and the antioxidant capacity significantly higher in *Tagetes erecta*, followed by *Spilanthes oleracea* and *Tropaeolum majus*. Therefore, the overlap between edible ornamentals nutritional and organoleptic properties can support both appealing flavor and improved health.

◆◆◆◆◆◆

Use of Robotics at breathtaking speed in Food and beverage industry

Archana Mahida
Department of Horticulture, Central University of Tamil Nadu, Thiruvarur-6100005

ABSTRACT

Today's modern food plants have a threatening challenge. They need to produce high-quality products at high volume while containing costs. Further, human contact with food products, the more the risk of contamination. Automated equipment limits the amount of human contact on food and beverages during packaging, as technology advances to become more flexible and configurable, companies can improve logistics and quality. During pandemic, consumer buying habits changed almost overnight and it introduced a new set of demands on food manufacturers. Number of industries is experiencing a shift right now as companies are under demand to digitize their operations. Food and beverage industry digitization can include using smart sensors to track products, cloud-based inventory tracking and advanced order processing. Due to repeatability, speed, accuracy and flexibility of robots and automation technologies, including robots, are becoming a core element for food and beverage processing and packaging companies and are integral to protecting brands, market shares and ultimately profitability. Robotics have made it possible for food and beverage processing and packaging companies to vastly increase the scale of factory automation over the past few decades. One of the components is usually an arm, perhaps a multi-jointed robot arm, or an overhead picking arm called a "delta" or "parallel" robot. Delta robots are commonly found in food and beverage processing operations. Robots must be computer controlled and have an electronic control

system with without artificial intelligence capabilities. With the use of this novel technology we can Increase production output rates, Boost manufacturing flexibility, avoid workplace safety hazards and Reduce product waste. This automation technology also helps in Meat Processing, Dairy Processing, Food Delivery. In the next 20 years many activities that humans perform while processing, packaging and delivering foods will become fully automated and Robots will likely become as omnipresent in the food industry. Thus, the role of robots is rapidly becoming a staple in operations for the food and beverage industry.

Keywords: Delta Robotics, Processing and Packaging companies and Food and Beverage Industry

◆◆◆◆◆◆

Mango Peel and Kernel utilization for waste utilization into "*Nankhatai*"

Dev Raj, Tanveer Ahmad and AK Pandey
Department of Post-harvest Technology and Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari (GJ) - 396 450, INDIA

ABSTRACT

The present investigation was undertaken for utilization of mango peel and kernel for preparation of fibre rich biscuits "Nankhatai". India is the largest producer of mango in world with the share of 45.1 per cent. Beside this, India is also largest processor of mangoes with the share of 20 per cent. Processing of mango generated approximately 40-45 per cent of waste. Mango peel and kernel possessing very good nutritive value especially in term of dietary fibre can be utilized for preparation of the mango peel and kernel based biscuits. Biscuits are one of the most popular bakery product in the world used as snack food due to its ready to eat nature, affordable cost and availability in different taste. Mango peel and kernel based biscuits were prepared with different combination of mango peel powder 0%, 5%, 10% & 15% and mango kernel powder 0%, 5%, 7.5% & 10% along with other ingredients. Prepared biscuits were examine on sensory basis and results revealed that mango peel and kernel based biscuit 'Nankhatai" prepared by using 5% mango peel powder, 7.5% mango kernel powder and *maida* 87.5% (treatment T_7) and 5% mango peel powder, 10% mango kernel powder and *maida* 85% along with other ingredient (treatment T_8) possess higher sensory score on 9 point Hedonic scale as compare to other treatment combinations.

◆◆◆◆◆◆

Grape drying in India: Practices and innovations

Ajay Kumar Sharma[1], D A Pawar[2], Sharmistha Naik[1]
[1] ICAR-National Research Centre for Grapes, Pune-412307
[2]ICAR-Central Institute of Agricultural Engineering, Bhopal-

ABSTRACT

Drying is very old practice of grape preservation. India is drying almost 30% of total grape production and raisin making practice is being followed in Maharashtra (Sangli, Solapur and Nashik) and Karnataka (Vijayapura and Bagalkot) states. Different drying practices for grape are natural open sun drying, shade drying, solar drying, hot air drying, microwave drying, pulsed vacuumdrying etc. Australian method of raisin making is well adopted,in India where grape bunches are treated with solution of ethyl oleate and potassium carbonate before drying in racks inside sheds. Various concentrations of ethyl oleate and potassium carbonate solution are alsoapplied on grape bunches during drying process to accelerate moisture loss while SO2 is applied for obtaining even yellow coloured raisins. Faster drying has been achieved by optimizing drying conditions under chamber

whilespraying of ascorbic acid solution on second day of grape drying helped in improved raisin colour. To reduce utilization of chemicals and save the water in the grape drying process (as raisin making areas face water scarcity) innovative mechanism have been developed. For this purpose two machines (130-150 kg/he capacity) have been developed, one for separating berries from bunches (debuncher) and another to remove waxy layer from berry skin and creation of micro cracks by abrasion (abrasive pretreatment machine). Berry abrasion helps in faster grape drying and able to produce raisins without use of any chemical in the raisin making process. The developed technology is demonstrated and able to produce raisins without involvement of chemicals like ethyl oleate and potassium carbonates which are integral part of grape drying industry. There is high market demand for chemicalfree/organic foods due to awareness on health and food safety issues. Therefor such type innovations will open opportunities to produce quality raisins for better reruns andacceptable to wide base of consumers.

◆◆◆◆◆◆

Horticultural waste as potential source of bioactive compounds

A. D. Chaudhary[1] T. R. Ahlawat[2], M. S. Sankanur[3],Vrutii K. Patel[4] and Pooja R. Naik[5]
[1,4,5]Senior Research Fellow, CAAST Secretariat, Directorate of Research
[2]Director of Research& PI, NAHEP-CAAST, NAU, Navsari
[3]Assistant Professor, Dept. FBTI, Co-PI, CAAST-NAU, Navsari
Navsari Agriculture University (NAU), Navsari- Gujarat -396450

ABSTRACT

Horticultural produce are most consumed commodities in the world. On their consumption, huge amount of waste is generated because they do not achieve the standards of commercialization and processing. Likewise, food processing industries generate considerable quantity of waste and the reuse of such waste can protect the environment and contribute towards economic development. Wastes are a good source for animal feedstuff and nutraceuticals and can be recovered to produce functional ingredients for food supplement and cosmetic industries. In processing industries the amount of waste generated depends on horticultural commodity, reutilization of such waste also reduces the need for raw material due to high amounts of bioactive compounds. Bioactive compounds obtained from horticultural waste have ability to scavenge free radicals and prevent oxidation in food and they have anti-oxidant,anti-carcinogenic, anti-inflammatory and anti-microbial properties. In that many compounds such as carotenoids, phenolic acids, flavonoids, anthocyanin's, proanthocyanidines, cinnamic acids and several others have been identified as bioactive compounds. These natural ingredientscan be reutilized for the formulation of fortified, enriched or enhanced foods, which provide health benefits way beyond fulfilling the basic nutrition needs.Thus, there is ample scope for production of bioactive compounds from horticultural waste. However, for commercial extraction of bioactive compounds the public and private sector needs to intensity their research efforts.

◆◆◆◆◆◆

Effect of storage period on quality parameters of woodapple -aonla ready to serve beverage

Priya Awasthi , Subhash Chandra Singh, Vigya Mishra, Setu Kumar and Rohit Kumar
College of Horticulture
Banda University of Agriculture and Technology,Banda (U.P.)- 210001

ABSTRACT

The wood apple is a nutrient rich fruit which contain a surprisingly high amount of protein and low level of sugar and carbohydrate compared than other fruits. Wood apple is rich in Vitamin-A and C and it could be

used in scurvy and liver problem, Pulp has anti- inflammatory anti-pyretic and analgesic activity. It also has anti-diabetic and antioxidant potential thus reduces the level of blood glucose. Aonla fruit is highly nutritious and is a rich source of pectin, poly-phenols apart from ascorbic acid. The fruits are well known for their medicinal properties in curing chronic dysentery, bronchitis and diabetes in the traditional Indian system of medicine. These fruits are not preserved for a long time. Due to lack of knowledge for processing and preservation, a large quantity of both fruits are being spoiled and damaged during harvesting season. The present investigation was carried out to develop the wood apple- aonla ready to serve and also study quality changes in developed RTS during storages period up to three months. Different biochemical attributes of the both fruits juice were analyzed. After that he juices of both fruits were blended in different proportion to prepared RTS in different combinations. There were seven combinations of blend juices which were used to develop Ready to serve, the all treatments standardized as 10% blend pulp 10^0 Brix TSS and 0.3% acidity at initial stage. The seven treatments were stored at room temperature (28±4 ^{0}C).All treatments were consumable up to 3 months on the basis of sensory evaluation by the panel of 5 semi-trained judges. It was observed that all the sensory based characteristics values were continuously decreases with storage period. The storage period affected overall acceptability and the at 0 day the mean value was recorded 7.2 and at 90 days the value of overall acceptability was recorded lowest 4.9. In terms of sensory attributes T_4 (70% W + 30% A) was recorded best among all the treatments. Therefore, Blending of wood apple juice with aonla juice can give a slightly tasty taste in comparison to wood apple or aonla juice alone and it is also good for health point of view.

◆◆◆◆◆◆

Optimization of microencapsulated pomegranate (*Punica granatum*) juice powder with higher retention of nutraceutically enriched bio-molecules

Soma Srivastava, Mukhtar Mansuri, Dilip Jain, Ashutosh Kumar Patel, Pradeep Kumar

ICAR-Central Arid Zone Research institute, Jodhpur-342003

ABSTRACT

Pomegranate juice spray drying is a challenge due to presence of sugars and acids pertaining to lower glass transition temperature (T_g). The present study aimed to elevate glass transition temperature of pomegranate juice utilizing encapsulant (maltodextrin) to obtain nutraceutically enriched powder. Varying levels of inlet air temperature (120-180°C) and encapsulant concentration (25, 30, 35%) were tested for targeted parameters such as powder yield, water activity, color, anthocyanin, flavonoids, phenolic content and antioxidant activity. Resultant parameters such as powder yield, color properties, anthocyanin, antioxidant activity, phenolic and flavonoid contents found in an inverse relation with both inlet air temperatures and encapsulant concentrations. SEM analysis revealed that encapsulated particles were homogenous in shape and size, elliptical to spherical along with smooth crack/dent free surface. Encapsulated anthocyanin molecules were apparent in the SEM images. Higher encapsulant concentration increased fineness of powder while decreasing anthocyanin content. HPLC screening for identification of phenolic compounds shown Gallic acid, Chlorogenic acid, Caffeic acid and Quercetin were identified as major phenolic compounds. HPLC analysis showed higher retention of B-group vitamins such as (D-pantothenic acid, pyridoxine hydrochloride and cyanocobalamin). Proximate analysis revealed 92.14 % carbohydrate, 1.2 % fat, 0.79 % ash and 379.72 Kcal energy value. The process was optimized at 130°C temperature, 30% MD and feed flow rate of 120ml/h which capitulated 32.95% powder recovery with lowest water activity (a_w), maximal color retention, phenols, flavonoids, athocyanin, appreciable free radical scavenging activity and health ameliorating functional components.

◆◆◆◆◆◆

Development of a High Sensorial Functional Food Product as a Carrier for Bitter-tasting but Heart-healthy Arjuna Bark (*Terminalia arjuna*) Powder

Simran Kaur Arora and Astha Balodhi
Deptt. Food Science & Technology, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India-263145

ABSTRACT

Cardio vascular problems are commonly affecting young people worldwideaccounting for 17.7 million deaths. India has the highest burden of acute coronary syndrome and myocardial infarctionandaccounts for 3.54 million deaths especially in younger population. To address this problem, present research work was undertaken to develop a high sensory functionalfood product with incorporation of bitter-tasting but heart-healthyArjunaBark(*Terminalia arjuna*) powder (2.2 to 10.7%). In Ayurveda,'Arjuna'has been used as a cardiotonic in heart failure, ischemic, cardiomyopathy, atherosclerosis and myocardium necrosis.The process was optimized using Completely Randomized Design (CRD) and Randomly Block Design (RBD). Developed standardized food product has high sensory acceptability with brown colour, shiny and glossy appearance, good caramel taste and buttery aroma and desirable texture withhardnessrangingbetween 3424 g to 48000 g andadhesiveness ranging between -2400 g-sec to -1400 g-sec.Developed food product is affordable, ready-to eat (RTE), nutritious with the goodness of milk, milk powder and butter, easy and convenient to carry and shelf-stable.

◆◆◆◆◆◆

Effect of different levels of N, P and K fertigation on the vase life attributes of gladiolus cv. White Prosperity.

Yograj Kushwaha, B. D. Bhuj, Ranjan K. Srivastava, V.P. Singh, Satish Chand
Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

ABSTRACT

The experimentwas laid out in randomized block design (RBD) with five treatments and four replications from November 2019 to May 2020 to study the effect of different levels N, P and K fertigation on the vase life attributes of gladiolus cv. White Prosperity. The corms of uniform size were taken. The treatments are T_1&T_2 at same RDFi.e. 300:200:200 kg NPK/ha in different combinations 33.3:33.3:33.3% and 40:20:20% respectively at vegetative, heading and flowering stage and T_3 &T_4 at same RDFi.e. 225:150:150 kg NPK/ha in different combinations 33.3:33.3:33.3% and 40:20:20% respectively at vegetative, heading and flowering stage. In T_5 (control) RDF were applied @300:200:200 kg NPK/ha in which full dose of P&K and two split dose of nitrogen were applied. The crop was raised under uniform cultural conditions. The days taken for first floret opening was found minimum in T_1 (1.84 days) whereas, the maximum was recorded (2.50 days) in T_5 (control). The diameter of second floret and number of florets/spike were recorded maximum (11.56 cm & 12.58) in T_3&T_2 while, minimum (10.17 cm & 10.17) was found in T_5 (control). With regard to the number of florets remaining open at a time, the T_3 showed the highest value (5.62) whereas, it was lowest (4.67) in T_5 (control). The longest vase life (6.58 days) was recorded in T_1 while the shortest was (5.76 days) observed in T_5 (control). On the basis of present findings, it may be concluded that fertigation is a promising way of fertilizer application for enhanced quality at low input.

Keywords: RDF, NPK, vase life, floret

◆◆◆◆◆◆

Banana peel utilization for value addition into "SEV"

Dev Raj,AK Pandey, AK Senapatiand MM Gohil
Department of Post-harvest Technology and Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari (GJ) - 396 450, INDIA

ABSTRACT

The experiment has been carried out to utilize banana peel intobanana based 'sev'. The results of the study revealed that dipping of banana peel in solution of 2% Salt (NaCl) along with 100 ppm ascorbic acid prevented enzymatic browning significantly and observed lowest enzymatic browning with OD (490 ppm) of 0.017. Further, the experiment for the preparation of 'sev' from banana peel has been carried to the effect of different formulations on the quality of the 'sev'. The formulation of banana peel based dough possesses significant differences on the yield of the banana peel based 'sev. The yield of the Sevvaried significantly varied, with maximum yield in 'sev prepared directly from the gram flour and minimum prepared from the formulation containing 50% banana peel. The fibre content among different formulations varies from 7.51 to 11.14%, with minimum fibre in 'sev' prepared directly from the gram flour and maximum prepared from the formulation containing 50% banana peel. Maximum sensory score was obtained by treatment F_1 ('sev'prepared directly from the gram flour) statistically at par with the 'sev'prepared using formulation F_4 (formulation containing 30% peel of banana). The results of the study revealed that immediate dipping of the banana peel after peeling in the solution of 100ppm ascorbic acid along with 2% salt solution followed by blanching at 85-90 ^{o}C for 3 minutes prevent enzymatic browning of the peel. After pretreatment, 30% of the banana peel can be utilized along with gram flour for preparation of fibre rich sevian. Banana peel based 'sev' with better nutritional and sensory attributes can be prepared by frying 'sev' in sunflower oil containing 150 ppm TBHQ followed by packing in aluminium laminated bag.

◆◆◆◆◆◆

Fruit wastes as potential component of biodegradable plastic

Nithya, G. R., B. M. Tandel, S. T. Bhatt, Shrilatha, K. A.and V. K. Patel
NAHEP-CAAST, ACHF, NAU, Navsari

ABSTRACT

Plastics due to their excellent properties became integral part of our lives. These conventional plastics are produced from non-renewable fossil fuel sources like petroleum. The conventional plastics take decades to degrade within the nature means they persist in the environment for longer period, leading to an accumulation in water and land resources. Because of improper management of disposed plastic it is creating pollution and has become a massive threat to flora and fauna and recently government has banned the use of many single use plastics. So it is the need of the hour to seek for the next best alternative for these conventional plastics. The best solution is managing synthetic polymer *i.e.* by reduce, recycle and reuse principle and promoting new version of plastics *i.e.* biodegradable plastics or biopolymers. Use of fruit wastes for producing biodegradable plastics, will not only limit our dependency on synthetic plastics, but may also assist in fruit waste management in an effective manner. The remains of fruits such as jackfruit perianth, orange peel, banana peel, avocado seed, mango kernel and dragon fruit peel *etc*., being rich in starch, cellulose, protein and lipid *etc*., are used in biodegradable plastic production. This environmental friendly approach can remove our dependency from fossil based conventional polymers and will lead us to a much more sustainable future.

◆◆◆◆◆◆

Dehydrated floral crafts

Shweta Singh, Shachi Gupta, K.J. Singh and S.K. Tewari
CSIR-National Botanical Research Institute, Lucknow-226 001

ABSTRACT

CSIR-National Botanical Research Institute (CSIR-NBRI), Lucknow is the pioneer institution for development of dehydration technique of flowers and foliages and making various distinctive and artistic decorative products from these. Dehydrated flowers and foliage are excellent due to their special beauty by retaining natural colour and shape after drying, long lasting value and can be enjoyed in any season.

Dehydration of flowers and foliage is done by different methods. CSIR-NBRI has standardised methods *viz*. pressing method (for 2D products) and embedding drying (for 3D structure) through various technique. Air drying is the simplest method under, natural conditions whereas embedding drying is to avoid shrinkage and other morphological change in dehydrated materials. Press drying is one of the most common methods for drying flowers and foliages, however, the original shape of the plant material cannot be changed. This method is basically used for preparing greeting cards, landscapes, wall hangings, herbarium, scenery, table mats, coasters and greeting envelopes etc. This technique is very ideal for making high quality herbarium specimens and different types of value-addedhigh-qualityspecimens can be prepared. This technology can be revolutionary in the resin-based jewellery market for trendy women, as several kinds of floral jewellery *viz*. ear rings, finger rings, pendants and bracelets are being prepared by this technology. Adopting this technology of value addition, the beneficiaries can earn money and it is a good source of employment generation in rural sector for farmers, rural women and unemployed youth.Dehydrated floral crafts of CSIR-NBRI has identified for promoting as income generating activity and women empowerment tool.CSIR-NBRI has been propagating this technique through NGOs and SHGs in many states of our country.

Keywords: dry flower, artifacts, floral jewellery, women empowerment

◆◆◆◆◆◆

Physico-chemical changes of carrot during storage at high altitude trans-Himalayan region of Leh-Ladakh

[1,3]Vivek Kumar Tiwari, [1]Narendra Singh and [2]Somen Acharya
[1]Defence Institute of High Altitude Research-DRDO, C/O 56/APO, Leh-Ladakh
[2]Defence Research Laboratory-DRDO, Tejpur, Assam
[3]Department of Horticulture, Lovely Professional University, Jalandhar, Punjab

ABSTRACT

The increasing global demand for fresh fruits and vegetables continues tochallenge researchers and industry to develop advanced methods for maintaining food quality and extending shelf life. In developing countries, near about 20-40% of fruit and vegetable are spoiled due to a lack ofproper post-harvest management. These experiments were conducted during the winter season of the year 2019-2020 in the trans-Himalayan region of Ladakh, India, to study theeffect of *Aloe vera* and CIPC on the physiochemical properties of carrots during storage. Therefore, it is important to investigate the changes in the quality and physiological values of carrots during long-term storage. Sugar profiling (glucose, fructose and sucrose) was observed in a control sample, *Aloe vera,* and CIPC-treated root during the 90 days storage period.However, *Aloe vera* coated root showed reduced weight loss (%) and retained the highest moisture (%) content as compared to other treatments. Whereas, the lowest sprouting (%) was observed in CIPC-treated carrots. During the storage period, the control exhibited

maximum total soluble solids and total sugar as compared to other treated roots. The lowest value of glucose, fructose and sucrose was observed in *Aloe vera*, which is statistically at par with CIPC-treated carrots. While the maximum degradation of carotene content was recorded without treated carrots (control).

◆◆◆◆◆◆

Flash vacuum expansion in food processing

Vasantha S. V., Nilam V. Pateland Suvarna
ACHF, Navsari Agricultural University (NAU),
Navsari- Gujarat- 396 450

ABSTRACT

Nowadays consumer's increasing interest in microbial safety products with premium appearance, flavour, great nutritional value and extended shelf-life has promoted the development of emerging non-thermal food processing technologies as alternative or substitution to traditional thermal methods because thermal method is the traditional method for food processing, which can kill the microorganisms but also lead to physico-chemical and sensory quality damage, especially to temperature sensitive foods. Among different methods of non-thermal processing, Flash Vacuum Expansion (FVE) is one such, technology to improve the quality of the product. FVE is a process in which plant materials are steam-heated to 60-90! then instantly introduced in a vacuum chamber (2-5 kPa) where they expand or disaggregate due to formation of micro-channels inside the tissues and instantaneous evaporation of constituent water takes place. Steam heating induces a thermal denaturation of endogenous oxidases. Whole process performed with the absence of oxygen, prevents oxidation and subsequent browning of the products. This process has a potential to aid juice expression and it also improves extraction of valuable healthy components from any plant material. FVE enhances complete extraction of bioactive compounds present in plant tissues which is not possible in case of traditional process. This process can be implemented for extraction of pigments, to disintegrate plant tissues and as pretreatment for extraction of juice for wine making and also it reduces the activity of enzymes in plant products which could improve the stability of the finished products like juice and puree.

◆◆◆◆◆◆

Vase life enhancement studies on Gladiolus grandiflorus

Sheeba Belwal[1], B.D. Bhuj[2], Ranjan Srivastava[3], N.C Shahi[4] and Satish Chand[5]
G.B. Pant University of Agriculture & Technology, Pantnagar-263145Uttarakhand

ABSTRACT

An experiment was conducted to obtain a higher vase life in Gladiolus crop. The variety selected for the experiment was *Nova lux.* The experiment consisted of thirteen treatment combinations of sucrose, 8 Hydroxy quinoline citrate (8-HQC) and $AgNO_3$. The results show that the treatments have a significant effect on the total blooming period, floral diameter and spike length post harvest. Vase life was recorded of each spike from day of transfer of spikes from 2nd floret blooming *i.e.* end of storage life to withering of the 6th floret kept in distilled water. For vase life, the optimum treatment combination recorded as per the data analyzed is found to be of T_8 (8-HQC 300 ppm, sucrose 6%) of 11.11 days over the control T_1 showing vase life duration of 8.46 days.

◆◆◆◆◆◆◆

Transforming livelihood of tribal's through processing and value of minor fruits

R.A. Kaushik
Prof. Horticulture and Director Extension Education
MPUAT, Udaipur 313001, Rajasthan

ABSTRACT

Fruit trees like ber, aonla, jamun , tamarind , custard apple, bael, lasora, phalsa, ker, pilu, *etc* well suited for arid environment, remained under exploited owing particularly to lack of appreciation of their quality as fruits, their economic potential and above all due to non-availability of the needed technology for their profitable cultivation. Because of their curative properties, these fruits have been used in Indian system of medicine such as Ayurvedic and Unani since time immemorial. Apart from their nutritive and medicinal values quite a few of these underutilized fruits have excellent flavour and very attractive colour. In spite of these quality attributes most have not undergone any conscious phase of domestication and human selection. Their cultivation is very restricted and they grow mainly wild. Being tolerant to biotic and abiotic stresses, these fruit species are suitable for growing in the disaster- and drought-prone areas. India has a rich heritage of indigenous fruit types. Significant advances have been made in recent times towards providing technology support for their cultivation. Processing and value addition in these minor fruits would provide employment, nutritional and economical security and these activities can easily be undertaken by tribal women. Several government agencies and NGOs have chosen fruits and their processing and value addition as an intervention for empowerment of tribal women and there are several success stories, which need to be replicated in similar situations/ locations. We at MPUAT Udaipur, Rajasthan along with an NGO and private partners have demonstrated that how custard apple and jamun processing has transformed the life of tribals and provided lots of entrepreneurship/ employment opportunities at doorstep. This model has been replicated at several locations in the country and university is having fifteen commercial licenses of this technology with private/ public parties.

◆◆◆◆◆◆

Role of Defence Institute of Bio-energy Research (DIBER) Drdo in conservation and value addition of medicinal plants of Uttarakhand Himalayas

Dr Hemant Kumar Pandey, Vinod Kumar and Gaddam Balakrishna
Defence Institute of Bio-energy Research
Defence Research & Development Organization
Pithoragarh – 262501 (Uttarakhand)

ABSTRACT

Since time immemorial western Uttarakhand Himalayas are famous for its rich medicinal and aromatic plant biodiversity. Due to diverseagro-climatic conditions and topography, this region is reputed as treasure house of medicinal and aromatic plants. Nowadays, due to increasing demand and awareness towards of herbal products *i.e.* in medicines as well as in cosmetics, the medicinal plants of Uttarakhand Himalayas are getting unprecedented attention through the world. The unscientific, irregular and over exploitation of medicinal plants from its natural habitat has resulted in very fast depletion as well as extinction of some important medicinal plant species. About 2500 plant species are being utilized in different Indian system of medicines; more than 1750 herbal species are native of Indian Himalayan region, in which Uttarakhand Himalayas have a share of more than 700 species, which are still in use. According to Red Data Book of IUCN about 121 plant species of Himalayan region are under severe threat. The Red data book published by BSI identified that about 214 species of flowering plants are endangered in Himalayan region, out of which 29 species have been listed under rare

category and some of them are at the verge of extinction. This precious natural wealth can be saved from extinction by developing their agro-technology, adopting scientific methods of collection. Hence, *in-situ* and *ex-situ* conservation of highly demanded medicinal plants is the need of hour.

Defence Institute of Bio-energy Research (DIBER) Haldwani is working on different R&D aspects medicinal and aromatic plants of Uttarakhand Himalayas, especially on their conservation and value addition. By extensive survey of this region medicinal plants have been collected, identified through authentic sources and live herbal gardens have been developed at Pithoragarh having 120 species, Haldwani 50 species and at Auli (Joshimath) 55 species of economically and therapeutically important medicinal plants. Agro-technology of thirteen economically important plants has been developed and provided time to time to the progressive farmers. The essential oil of thirty aromatic plants has been extracted at different plant stages to know the plant stage having maximum essential oil yield. Under value addition of Himalayan herbs institute has developed some herbal products *viz.* Anti-leucoderma herbal product (ointment & oral dose), Anti-eczema herbal ointment, Anti-toothache herbal solution, Anti UV radiation cream, Herbal health supplement. After completion of different pharmacological, bio-chemical and toxicological evaluation, seven patents on these products have been filed and transfer of technology of first three products has been done with four herbal pharmaceuticals like M/S AIMIL Pharmaceuticals India Pvt. (Ltd), New Delhi, M/S International Herbal Corporation, Hardwar, M/S Biological Pharmaceuticals, Kottayam, Kerala and M/S SRB Health Care, Anand, Gujarat. The AIMIL Pharmaceuticals, New Delhi has launched Anti-leucoderma herbal product into the market by trade name of LUKOSKIN. In last four years company has sold Lukoskin worth Rs. 76.66 crores, this has generated two crore and thirty Lakhs royalty to the DRDO. Since, leucoderma skin disorder is almost incurable, this herbal product is proving as a boon for leucoderma affected patients. According to company sources they have cured more the one lakh leucoderma patients and about one lakh fifty thousand leucoderma patients are still registered with the company and getting benefited. The Phyto-medicine Group of the institute has further researched on this product and developed advance version of Lukoskin, the Anti-leucoderma Herbal Product (Mark-II), having clinical efficacy more than 90% and recovery time of the disease is also reduced. After filing patent on this product its ToT has been undertaken with above firms. The AIMIL Pharmaceutical is also planning to launch Anti-eczema herbal ointment by trade name of EXOSKIN soon into the market. At present group is engaged in the development of four herbal products *viz.* Anti-oxidant and immuno-stimulant herbal capsules, Herbal Health Supplement, Cordivit performance enhancing product and Anti-hypertensive Syrup, which are in different stages of development. Hence, Phyto-medicine Group of DIBER its best efforts for conservation and value addition of medicinal and aromatic plants of Uttarakhand Himalayas.

◆◆◆◆◆◆

Screening of packaging materials to enhance the shelf life of marigold flowers

Ritu Jain, Viresh M B, M C Singh, Babita Singh, A K Tiwari and Shruti Sethi
Division of Floriculture and Landscaping, ICAR- Indian Agricultural Research Institute,
New Delhi 110012

ABSTRACT

Marigold is one of the most important commercial loose flower crops in India. Storage and packaging systems plays a pivotal role in regulation of good quality flowers in market for better remunerative prices. Proper storage and packaging material help to ensure the fresh quality of the flowers and offers advantage of expanding the shelf life of flowers. Keeping in view, the year around availability and versatile utility of marigold flowers, dearth of facilities to stock up produce in cold stores or cold chain transportation at economical prices and paucity of research on improvement in quality of loose flowers with economical storage and packaging, the study was conducted to increase the shelf life of marigold by using different packaging materials under ambient and

cold storage conditions. The experiment was carried out in the laboratory of the Division of Plant Physiology and Division of Food Science & Postharvest Technology, ICAR-Indian Agricultural Research Institute, New Delhi, during 2020-21. Fully developed mature flowers were hand-plucked from plants early in the morning collected in polyethylene bags and brought to the laboratory and sprayed with 4% boric acid. The flowers were packed in Muslin cloth, Woven Bag, LDPE (25µ), HDPE (51µ) Shrink wrap under both ambient and cold storage conditions and were compared with Control (unpacked flowers) . In control treatment loose flowers were kept in bamboo basket. The experiments were carried out in completely randomized design with two replications. The experiments were conducted under ambient and cold storage conditions. The observations recorded were shelf life (days), days for floret wilting, flower colour, flower diameter, physiological loss in weight, moisture content, respiration rate, membrane stability index, total carotenoids and antioxidant enzymes namely SOD, POX, Catalase etc.It was observed that maximum shelf life, moisture content, carotenoids content, flower diameter, minimum shrinkage, respiration rate and catalase activity was recorded for the flowers packed in shrink wrap and stored at low temperature.

◆◆◆◆◆◆

Natural dye stability studies under different temperature, light and Ph regimes

Babita Singh, Ritu Jain, Prativa Anand and S. S. Sindhu
ICAR-Indian Agricultural Research Institute
Division of Floriculture and Landscaping, Pusa, New Delhi -110012

ABSTRACT

The natural dyes from plants were traced long time ago. In India 450 plants are found to be good source of natural dye. For the extraction of natural dye different plant parts are used such as seeds, flowers, leaves and barks. In the present study, an alternative dye yielding plant red rose flower were studied for its potentiality for obtaining natural dye. Red rose is a one of the most attractive and cut flower, which is mainly used as an ornamental flower. The natural dyes from plants were traced long time ago. In India 450 plants are found to be good source of natural dye. For the extraction of natural dye different plant parts are used such as seeds, flowers, leaves and barks. In the present study, an alternative dye yielding plant red rose flower were studied for its potentiality for obtaining natural dye. Red rose is a one of the most attractive and cut flower, which is mainly used as an ornamental flower. The natural dyes from plants were traced long time ago. In India 450 plants are found to be good source of natural dye. For the extraction of natural dye different plant parts are used such as seeds, flowers, leaves and barks. In the present study, an alternative dye yielding plant red rose (var. Rose Sherbat) flower were studied for its potentiality for obtaining natural dye and pH, thermo and photo stability. Rose is a one of the most attractive flower used as cut as well loose flower purposes.

India has a rich biodiversity and harbours a wealth of useful germplasm resources and there is no doubt that the plant kingdom is a treasure-house of diverse natural products. One such product from nature is the dye. Dyes are one of the most important uses of the plants. Recently, interest in the use of natural dyes has been growing rapidly due to the result of stringent environmental standards imposed by many countries in response to toxic and allergic reactions associated with synthetic dyes. In the present study dye was extracted from petals of rose cv. Rose Sherbet by acidic and aqueous method. The colour intensity was found to be more in acidic medium as compared to water. The extracted natural colour (dye) was stored in glass bottles for studying, thermo, pH and photo stability of the same. The pH stability was estimated using solutions of different pH ranging from pH 1.0 to pH 7.0. It was observed that the dye was stable in acidic pH solution up to pH 5.0 and on further increase in pH resulted in deterioration of dye hue. In case of photo-stability studies, it was observed that the dye solution kept under natural light deteriorated earliest whereas, in dark storage the dye colour was most

stable. The thermal stability of dye was estimated at 5°C, 25 °C, 40°C, 70°C and 100°C temperatures. It was observed that the dye colour was stable at 5 °C, 25 °C and 40°C up to 4 hours while it was highly unstable at 70 and 100°C.

◆◆◆◆◆◆

Vase life studies on Gerbera var. ArkaNesara

Sangeetha Priya S, Preethi P, Vijay Rakesh Reddy S, VittalKamble and Divya Vani
ICAR - Indian Institute of Horticultural Research,
Hesaraghatta Lake Post, Bengaluru, Karnataka, India - 560089

ABSTRACT

Gerbera, popularly called as 'African daisy', is known for its longer vase life and faster rehydration in the global flower market. A vase life study was conducted to standardize the pulsing and holding solution for the gerbera flowers var. ArkaNesara which were grown under vertical soil-less conditions. The experiment on pulsing solution included two factors, *viz.,* pulsing solution (water, 2 and 4 % sucrose + 100 ppm citric acid, 2 and 4 % crystal sugar + 100 ppm citric acid) and pulsing time (2 and 3 h). Results revealed that flowers pulsed with 4 % crystal sugar along with 100 ppm citric acid for 2 h exhibited greater physiological weight retention after 1 day and lesser physiological loss in weight on subsequent days. Hence, for the subsequent study on holding solution, the flowers were pulsed in 4 % crystal sugar + 100 ppm citric acid for 2 h and kept in different vase solutions. It was found that 4 % crystal sugar along with 100 ppm spermine, 100 ppm citric acid and 1000 ppm $CaCl_2$ exhibited longer vase life of 7.78 days against 6.11 days in water. The extended vase life might be due to higher water uptake (26 ml/ 7 day), slower petal discolouration and firmer stalk owing to the undisrupted carbohydrate supply. Thus, it can be concluded that gerbera flowers var. ArkaNesara pulsed with 4 % crystal sugar for 2 h and placed in holding solution of 4 % crystal sugar with 100 ppm spermine could extend the aesthetic vase life of flowers longer than usual water.

Keywords: Gerbera, pulsing and holding solution, sugar, citric acid, polyamine

◆◆◆◆◆◆

Effect of pre-treatments on optical Properties and volatile composition of wood-apple (*Limonia acidissima* L.) powder

Vigya Mishra[1], Ritul[2], Ashutosh Rai[3] and Vishal Chugh[4]
[1,2]Department of Post Harvest Technology, College of Horticulture, Banda University of Agriculture and Technology, Banda, 210001 (U.P.)

ABSTRACT

The wood apple fruit is an underexplored fruit with rich nutritional profile. Being a rich source of organic acids the fruit pulp can be used as a natural acidulant with health benefits. The pulp of the fruit can be preserved in the dried or powdered form. The present study was conducted during year 2021-22 at the Department of Post Harvest Technology, College of Horticulture, Banda University of Agriculture & Technology, Banda to study the effect of different pre-treatments on the optical properties and volatile composition of wood-apple powder. Wood-apple powder (WAP_4) prepared after blanching of wood-apple pulp for 3 minute and drying @ 70°C (± 3°C) temperature was found as the best in terms of total soluble protein and total pectin content. The optical properties of wood apple powder were measured in terms of L, a and b values. The values varied from 55.38 to 67.37, 7.97 to 13.09 and 26.118 to 28.12 for L, a and b, respectively. The volatiles composition of fresh and pre-

treated wood apple powder was analyzed by GC-MS. A significant change in the volatile composition of the powder was recorded as affected by different pre-treatments.

Keywords: - *wood apple powder, optical properties, volatile composition, pre-treatments*

◆◆◆◆◆◆

POSTER

A nobel approaches towards the horticulture specific waste minimization and their utilization

Anita Panwar[1], Ankita Dobhal[2], Bharti[3] and Etalesh Goutam[4]
[1&2]V.C.S.G Uttarakhand University of Horticulture and Forestry, Ranichauri, Tehri Garhwal
[3&4]Lovely Professional University, Phagwara, Punjab-144411, India

ABSTRACT

Fruits and vegetables are essential for human nutrition, delivering a substantial proportion of vitamins, minerals and fibers in our daily diet. Unfortunately, half the fruits and vegetables produced worldwide end up as wastes, generating environmental issues caused mainly by microbial degradation. These by-products still contain many bioactive compounds post-processing, such as macronutrients (proteins and carbohydrates) and phytochemicals (polyphenols and carotenoids). However these plant by-products are rich in valuable compounds which can be utilized in various industries as novel, low-cost, economical and natural sources of dietary fiber, antioxidants, pectin, enzymes, organic acids, food additives, essential oils, bioactive compounds, carotenoids, polyphenols, vitamins, enzymes. Recently, the recovery of the bioactive compounds from industry by-products has received significant attention, mainly due to their possible health benefits for humans. The increase awareness of nowadays consumers regarding the food they purchase and consume and the health has led to an increase demand of foods containing biologically active compounds, namely antioxidants, which can help the body to fight against oxidative stress. Both synthetic as well as natural antioxidants are using in food industry but the application of synthetics has been reassessed due to its potential carcinogenic effects. As a consequence finding, new or nonconventional sources of antioxidants are a priority for food and also pharmaceutical industries. Wastes from fruits and vegetable processing are shown to contained valuable molecules (antioxidants, dietary fibers, proteins, natural colorants, aroma compounds, etc.) which can be extracted, purified and valorised in value-added products.

◆◆◆◆◆◆

Advancement in shelf life extension of fresh-cut fruits and vegetables

Neha Rawat and S. K. Sharma
Department of Food Science and Technology, GBPUAT, Pantnagar

ABSTRACT

Fresh cut fruits and vegetables are minimally processed products which can be consumed as it is without undergoing major processing operations. The concept of fresh cut fruits and vegetables provides an approach where minimal damage to nutritional components occurs. With the hectic life style of people this concept is gaining more popularity at commercial scale as well because of convenience in the utilization of such products while retaining maximum nutrients. Besides their nutritional benefits the problem of shelf life of such products becomes a major issue among researchers as fresh cut fruits and vegetables are more prone to microbial contamination because of exposed surface when they are cut. So, various methods have been developed and improvised in-order to enhance the shelf life of fresh cut produce. The methods are acidification, application of reducing agents, application of edible coatings, application of natural antimicrobials, firming agents, modified atmosphere packaging, UV-C Radiation, high hydrostatic pressure, Ozone treatments etc. These methods have their own advantages and limitations. This paper deals with advancement in the shelf life of fresh cut produce with exiting technologies or novel technologies and highlight the potential scope for the future researches to reduce the limitations or improvise the current technology.

◆◆◆◆◆◆

Banana byproducts as bio-products and its agri-preneurial potential

Patel, Jolly J., Singh, Susheel, Ahlawat, T.R. and Italiya, A. P.
NAHEP-CAAST and Agricultural University, NMCA, Navsari Agriculture University (NAU), Navsari- Gujarat

ABSTRACT

Banana (*Musa paradisiaca*) is an important fruit crop and India is one of leading producer and consumer among other countries in the world. Primarily banana crop is grown for their fruit but it is also subjected to several post-harvest process which generates quantum of byproducts and wastes. Consequently, many untapped resources are lost without appropriate agricultural waste management practices, causing severe ecological problems. Banana post-harvest waste, *viz.*, pseudostem, leaves and suckers, are dumped in rivers, lakes, or low-lying areas where it generates greenhouse gases and thus poses a serious threat to the ecosystem. Recently, due to environmental awareness, as ecological and renewable characteristics, banana post-harvest waste was gaining interest and used to extract fibers, biofuel, biogas as well as rich source of major, macro- and micro-nutrients. Looking at this perspective, entrepreneurs should take this golden opportunity and do the needful for such kind of business. Thus, farmers or entrepreneurs should cultivate more banana trees in unproductive lands of coastal and hilly areas for extra income from the useless wastes and ensure an eco-friendly environment. Women can also be employed in the production of different bio-products from banana wastes and thus, they can contribute to their livelihood improvement. Hence by-product could be potential bio-products and also have immense potential to be an agri-enterpreneur.

◆◆◆◆◆◆

Potential of marigold in oil industry

Ashmita Sahu, VK Rao, and Anamika Sajwan
Department of Horticulture, G.B Pant University of Agriculture & Technology, Pantnagar-263145, U.S. Nagar, Uttarakhand

ABSTRACT

Wild marigold *(Tagetes minuta)* is valued for its essential oil. It is an erect and grows 1-2 m tall, profusely flowering, annual aromatic plant originated from South Africa. It is found in between altitudes of 1000 – 2500 m and grown in the areas of Himachal Pradesh, Jammu and Kashmir and Uttarakhand where it occurs in natural habitat as a weed in crop fields. It is suitable for cultivation in wide range of soils from sandy loam – clay loam with pH 4.5 – 8.0. Better quality of essential oil is produced in moist temperate regions where nights are cool during growth and flowering season of the plant.For high-quality essential oil, the crop during the reproductive phase should have an average temperature of 12–30°C. It yields 0.25- 0.5% essential oil.The essential oil is used in the perfumery pharmaceutical, food flavouring and agricultural industries. The oil and absolute are employed in compounding high grade perfumes and for flavouring alcoholic beverages, frozen dairy desserts, candy, baked goods, gelatins, puddings and condiments. Dried leaves are used as medicinal tea and for culinary purpose imparting aroma to soups, food and vegetable preparations. The plant as a companion crop controls nematodes, slugs and at times suppresses weeds. Dried powder can be used to control weeds in rice. Oil and its constituents have insecticidal, antibacterial, antifungal, antiviral and mosquito larvicidal activities. India can increase the area under cultivation and can become an important exporting country of wild marigold products.

◆◆◆◆◆◆

Anti-nutritional factors in vegetable crops

Shani Kumar[1], Dr. G. C. Yadav, Subhash Verma[2] ,Lav Kumar[1], Mritunjay Rai[1],
[1,]Ph.D research schoolers, Professor, Department of vegetable science
ANDU&T KumarganjAyodha, 224229
[2]Ph.D research schoolers, Department of vegetable science
BAU Sabour, Bhagalpur

ABSTRACT

Vegetables are an important source of protective food and a part of healthy diet. In fact, they make up forabout 20% of an average Indian meal. However, plants generally contain toxic andanti-nutrients acquired from fertilizers pesticides and several naturally occurring chemicals. Some of thesechemicals are known as anti-nutritional factors (ANFs) having high biological activity. There are many classes of ANFs prevalent in many vegetable crops. Tomato synthesizes aglycoalkaloidtomatine and pumpkin has choline-esterase inhibitor which is a neurotoxin. A chemical composedsolanine is predominantly found in the tubers of potato. Amount of trypsin inhibitor was also detected in *Phaseolus vulgaris*. Other AN Fsincludes alkaloids, protease inhibitors, oxalates, haemagglutinins (lectins), nitrate etc. There is need tocontrol the anti-nutritional factors to improve the quality of vegetables because intake of huge quantities ofnatural toxins over a long period of time might produce some health detrimental effects Domestic methods ofprocessing such as cooking pressure cooking, microwave cooking, autoclaving, dehulling, soaking andgermination can easily eliminate/reduce the activity of antinutritional factors in vegetables. For example,Boiling was able to reduce the ANFs in colocasia and Long germination period reducestrypsin inhibitors, phytic acid, protease inhibitors etc. Soaking also reduces trypsininhibitors, tannin, oxalates, phytic acid and cyanide contents. Hence, the need forexploration of ant nutritional information in vegetables is significant in overcoming nutritive disorders inorder to contribute to and nutritional security inIndia.

Key words: Vegetable, Anti-nutritional, Dehulling, Lectins, Tannin, Cynide.

◆◆◆◆◆◆

Strategies for waste management in horticulture processing industry

Manish Kumar[1], Mukesh Kumar[2] and Deepak Sangwan[3]
[1&3]Research Scholar, Dept. of Horticulture, Maharana Pratap Horticultural University, Karnal, 132 001
[2]Assistant Professor, Dept. of Horticulture, CCS Haryana Agricultural University, Hisar, 125 004

ABSTRACT

Food processing is an important sector in horticulture industry. Its scope has increased manifold to prevent wastage of perishable commodities to a great extent. The food processing industries generate a large quantity and variety of food products, providing employment to a large number of people and uplift their economic status. The production, processing and preparation of food, all results in generation of huge quantity of waste material causing health hazards due to environmental pollution. The waste material may be in the form of leaf/ straw, waste during harvesting, food preparation waste, after processing waste, unused material as waste, food processing operation waste, etc. So, the disposal of waste material has become a challenge to the processors, as different agencies are pressurizing for an environment friendly treatment of waste material. The proper waste management can be done by either application of suitable waste treatment or waste utilization technology. Therefore, the adoption of right approach/strategy would be of utmost importance for waste management. Some of strategies which could be adopted are selection of less or no waste generated techniques e.g. enzyme technology for juice extraction, recovery of maximum useful materials (oil from apricot stones, pectin / fibre from apple

pomace), using the waste as substrate for production of valuable substances e.g. use of spent mushroom substrate for crop production, conversion of waste material into useful products (ethanol from fruit waste, citric acid from pomace) and the waste material of fruit & vegetable origin should get first preference for production of food/ feed related substances, followed by biogas. So, by adopting above strategies we can manage processing industries waste.

◆◆◆◆◆◆

Standardization of different drying methods for dry flower making in Telangana State

Zehra Salma, S.Praneeth Kumar and P.Prasanth
Floricultural Research Station,SKLTSHU,Hyderabad-500 030.

ABSTRACT

Flowers are closely connected to mankind representing every occasion in their day to day life. In order to replace the beauty of fresh flowers which have a very short post harvest longevity, dry flowers can be a better alternative without disturbing the aesthetic value and made available irrespective of the season. This can also be a lucrative business for young rural entrepreneurs. With an objective to standardize suitable drying methods for different ornamental and commercial flowers of Telangana state an experiment was conducted at Floricultural Research Station, SKLTSHU, Hyderabad. The Experiment consists of twelve treatments and replicated thrice in CRD design with different drying techniques as treatments *viz.,* Press drying, Air drying, Water drying, Embedded drying at ambient conditions(in sand,borax,silica gel), Hot air oven drying (50-60^{0}c) and Micro wave oven drying (180^{0}c) with embedding in sand, borax and silica gel.The observations recorded were time taken for drying, texture, moisture percentage, colour retention, shape retention and overall acceptability. The results of the experiment revealed that press drying was suitable for flowers with thin petals and without thick disc like bougainvillea (6 days) and clitoris (7 days) for drying, whereas air drying was suitable for celosia (10 days), gypsophilla(12 days) and gomphrena (15 days) as it took minimum time for drying and retained the colour. Among the embedding material silica gel recorded maximum scores(5) in all the parameters when kept at ambient conditions, hot air oven and microwave oven. It can be concluded that silica gel as embedding material in hot air oven and micro wave oven was found to be most suitable methods for drying flowers with a maximum overall acceptability score (5).

◆◆◆◆◆◆

Biotechnology: an eco-friendly approach for waste water management in pulp and paper industry

Raveena Thakur, Bhupender Dutt and Rajneesh Kumar
Department of Forest Products, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-Solan (HP) -175001

ABSTRACT

In a world of increasing population, the demand for paper and its products is tremendously increasing and the meeting up of the demand comes up with a price of large amount of wastewater generation, containing dissolved wood-derived substances and residual process chemicals which adversely affect the environment. Owing to the increased environmental awareness, these potentially highly polluting raw wastewaters from the mills cannot be directly released in nature. Instead, recycling of the wastewater with the help of microbes is

becoming an attractive alternative for many pulp and paper mills as it also offers potential savings in the cost of fresh water. Recycling of the wastewaters can be done either by closing up the systems in the mill or by treating the wastewaters such that they can be reused. Wastewater purification is usual carried out by a sequential approach.-sedimentation and an aerobic microbial process called the activated sludge operation, or an anaerobic digestion. The activated sludge process, operates through successive action of many different microbes active in the sludge and carried on site in large aerated tanks. The success of the process is dependent on successful maintenance of the dissolved oxygen as well as good settling of the sludge. The settlement, in turn, depends on the type of microbial flora involved; the presence of excessive amounts of filamentous bacteria forming a matrix for flock forming bacteria can cause significant settlement problems. Several enzymes isolated from microbes such as lignin peroxidise, manganese peroxidise and laccase can be potentially used in wastewater management in pulp and paper industry.

Keywords: Activated sludge, Environmental awareness, Microbes, Wastewater

◆◆◆◆◆◆

Influence of enriched organic manures and bio-enhancer on quality and nutrient uptake of cauliflower (*Brassica oleracea* var. botrytis)

Pavan K. Patel[1], Piyush Verma[2] and Patel Avinash J.[3]
[1&3] Dept. of Horticulture, B.A.C.A., A.A.U., Anand - 388110
[2]College of Horticulture, S.D.A.U., Jagudan - 384460

ABSTRACT

A field experiment was conducted at College Farm, College of Horticulture, S.D.A.U., Jagudan, Dist. Mehsana, Gujarat during*rabi* season 2020, to observed the influence of enriched organic manures and bio-enhancer on quality and nutrient uptake of cauliflower (*Brassica oleracea* var. *botrytis*). Experiment was carried out in randomized block design with factorial concept with three replications. Different organic manures with six level *viz.* O_1: 80% RDN through FYM, O_2: 80% RDN through Poultry manure, O_3: 80% RDN through Vermicompost, O_4: 60% RDN through FYM, O_5: 60% RDN through Poultry manure and O_6: 60% RDN through Vermicompost and bio-enhancer with two levels *viz.,* F_1: NPK consortium @ 5 lit/ha and F_2: Ghan-Jeevamrut @ 250 kg/ha. Among six level of organic manures, 80% RDN through Vermicompost performed significantly superior over other treatment with respect to diameter of curd (10.82 cm), TSS (7.07 ^{o}Brix), chlorophyll a (62.31 mg/100g),chlorophyll b (24.78 mg/100g) and total chlorophyll content (87.09 mg/100g). Nutrient uptake by plant *viz.*, nitrogen uptake (67.9 kg/ha), phosphorus uptake (8.46 kg/ha) and potassium uptake (61.74 kg/ha) were also recorded statistically higher value with the same treatment *i.e.* 80% RDN through Vermicompost. Among different treatments of bio-enhancer, NPK consortium @ 5 lit/ha treatment significantly increased chlorophyll b (24.00 mg/100g) and total chlorophyll content (83.10 mg/100g) at 45 DATP. Nitrogen uptake (63.61 kg/ha), phosphorus uptake (7.79 kg/ha) and potassium uptake (59.60 kg/ha) were also significantly higher with the application of NPK consortium. The interaction between 80% RDN through Vermicompost and NPK consortium @ 5 lit/ha was found superior for diameter of curd (12.10 cm).

Keywords: Organic manure, NPK consortium, ghan-jeevamrut, cauliflower

◆◆◆◆◆◆

Biofortified vegetables: a way forward to combat mall nutrition and ensure food security

Himanshu Singh, Neha, Sweta Soni, Neetu, Sunil Kumar and Ajeet Singh
Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda (U.P.)- 210001

ABSTRACT

Increasing the amount of vitamins and minerals in a crop through plant breeding, transgenic methods, or agronomic practises is a process known as biofortification. Due to an unbalanced and inappropriate diet, malnutrition affects more than half of the world's population, particularly women and young children. Malnutrition and hunger are currently developing nations' two main challenges. Under five-year-old children in India make up about 43.5% of the chronically undernourished population. An emerging, promising, affordable and sustainable method of providing micronutrients to a population with limited access to varied meals and other micronutrient therapies is biofortification. The low-cost strategy is to develop plants to increase the bioavailability of specific micronutrients in consumable foodfor poor countries and their people who cannot afford high-quality food. The daily diet should include a variety of vegetables. Vegetables that have been biofortified can therefore help to reduce the lack of micronutrients. Three methods—agronomic biofortification, traditional plant breeding and genetic engineering—can be used to achieve biofortification. The concentration and bioavailability of micronutrients in the edible crop tissues can be improved through genetic engineering. Most vegetable crops, including cassava, beans, potatoes, orange sweet potatoes (OSP), cowpeas, pumpkin, etc., have used its techniques. There have been released both conventional and transgenic variants. Promoting the creation, cultivation and consumption of biofortified vegetables is necessary to prevent a number of health problems. Thus, increasing the consumption of a variety of non-staple foods in society is the most effective solution to end undernutrition as a public health issue in developing countries.

◆◆◆◆◆◆

Studies on postharvest handling of *Clarkia amoena* (Lehm.) A. Nelson and J.F. Macbr

Vivek Bhanwala
Dr Suman Bhatia Major Discipline : Floriculture and Landscape Architecture

ABSTRACT

The current study, entitled "Studies on Postharvest Handling of Clarkia amoena (Lehm.) A. Nelson & J.F. Macbr," was carried out during 2020-21 in the Department of Floriculture and Landscape Architecture of Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.). The study comprised of two postharvest experiments to standardized different pulsing and holding solution(s) to increase the vase life of godetia (Clarkia amoena). The pulsing experiment was laid out in completely randomized design with 13 treatments and replicated thrice. Under this experiment sucrose (4 %), 8-HQC (200 and 300 ppm) and BA (15 ppm) were used in different combinations for 2, 4 and 6 hours. It may be concluded that pulsing treatment of sucrose (4%) + 8-HQC (300 ppm) + BA (15 ppm) for 6 hours was found best in relation to vase life, amount of solution consumed, percent weight loss, early floret opening and with better overall presentability of godetia cut flowers. Second experiment of holding solutions was laid out under completely randomized design (factorial) with 13 treatments in which sucrose (2%), 8-HQC (100 and 200 ppm) and BA (5, 10, 15 ppm) were used in different combinations with 3 de-leafing treatments. It was observed that holding solution of sucrose (2%) + 8-HQC (100 ppm) + BA (10 ppm) was concluded best regarding vase life, flower diameter, percent weight loss, early floret

opening and good overall presentability of godetia cut flowers. In the present investigation, it is observed that de-leafing of cut stems after 6 inches from top was found best with longest vase life and better presentability of godetia cut flowers.

◆◆◆◆◆◆

Study on microwave and conventional heating effect on the physico-chemical properties of Mahua oil

Muhammed Firoz[1], Yashi Srivastava[1], Soma Srivastava[2], Pradeep Kumar[2], Shailendra Kumar[1]
[1]Department of Applied Agriculture, Central University of Punjab, Bathinda (Punjab)
[2]Central Arid Zone Research Institute (CAZRI)-ICAR, Jodhpur (Rajasthan)

ABSTRACT

Introduction:Mahua or 'Butter nut tree' is known for its sweet flowers which possess a lot of ethnic values among the tribal people for the development of various fermented and non-fermented food products.

Methodology: The objective of study was based on comparative of conventional and microwave treatment at different power level (P-60, P-80 and P-100) and different temperature (150ÚC, 180ÚC and 200ÚC) with time interval (5min, 10min, 15min and 20min) used to analyze the chemical and Physical changes in Mahua Oil. Experimental Result:It has been found that Free Fatty Acid, Peroxide Value, Conjugated Diene and Conjugated triene, viscosity and density has been increased 15.38% and 15.72%, 48.63% and 40.86%, 51.27%, 50.21% and 1.94%, 2.96%,31.61% and 31.04% and 2.89% and 3% while Iodine Value, Polyphenol and Refractive index has been decreased 1.81% and1.85%, 0.09% and 0.11% and 0.04% and 0.07% for 20min at P-100 and 200C respectively in microwave and conventional mode of treatment.

Conclusion: The study concluded that the direction of changes was positive, that is, similar to the conventional heating effects on lipid-containing food.

◆◆◆◆◆◆

Adoption Status of Post-harvest Technologies Amongst the Vegetable Growers in Punjab

Jashleen Kaur Sidhu and Lopamudra Mohapatra
Department of Extension Education,Punjab Agricultural University,
Ludhiana (Punjab) 141004

ABSTRACT

In Punjab state total production of vegetables is about 61.09 lac tonnes and almost 20-40 per cent of the produce goes waste annually during post-harvest operations, this may be accrued to lack of knowledge, post-harvest management skills and technology which have caused several economic and food security setbacks. The existing level of knowledge of vegetable growers regarding post-harvest management practices of vegetables, adoption of post-harvest management practices and factors affecting the adoption of the same has been studiedinvegetable growing clusters of Punjab state namely; Baba Bakala Sahib, Malerkotla and Nakodar. A total of 240 vegetable growers were selected as respondents of the study. Knowledge test was prepared for five crops selected for the study viz; potato, tomato, cauliflower, okra and pea. Majority of the tomato (49.2 %),

cauliflower (37.5 %), okra (41.5 %) and pea (50.2 %) growers possessed low level of knowledge regarding various post-harvest practices whereas potato (56.9 %) growers possessed medium level of knowledge. About 58.62 per cent of the vegetable growers growing potato have adopted recommended harvesting practices. Recommended grading practice was adopted by majority of cauliflower (94.32 %), tomato (89.55 %) and okra (80.9 %) growers. Cleaning of vegetables was not adopted by any of the vegetable grower. Major constraints faced by vegetable growers were inadequate storage and infrastructural facilities and high cost involved in following recommended practices. It is suggested that there is a need to popularize field level trainings and low cost storage technologies, so that post-harvest losses could be minimized.

◆◆◆◆◆◆

Enhancement of shelf life of Ber fruits using olive oil based composite edible coatings

Kusum and Omveer Singh
Department of Horticulture, College of Agiculture
G.B. Pant University of Agriculture and Technology, Pantnagar-263145, Uttrakhand

ABSTRACT

Ber (*Ziziphus mauritiana* Lamk.) is an indigenous and economically important tropical fruit which is also known as Indian jujube, belongs to the family Rhamnaceae. Shelf life of ber is only 4 to 5 days and is the major constraint for market glut. Methods to increase its shelf life by applying different surface coating treatments were developed to regulate the market for fresh fruit. Work was planned to evaluate olive oil based composite edible coatings along with modified atmospheric packaging to enhance shelf life and maintaining quality of ber fruits cv.Umran. Physical characteristics of fruits were analyzed and recorded at seven days interval when kept at refrigerated condition of 8ºC. The study revealed that olive oil coatings were effective in maintaining quality of Ber fruit during modified storage packaging in polyethylene bags for a period of 35 days. Minimum physiological loss in weight, percent decay and shrinkage percentage while maximum retention in firmness and colour of fruits were found in olive oil (100%) treated fruits incorporated with 1% ascorbic acid as an antioxidant. Based on results it is concluded that olive oil based edible coatings when incorporated with 1% ascorbic acid as an antioxidant, duly packed in polyethylene bags and kept at 8ºC were proved best combinations and could be applied to enhance shelf life and quality of ber fruits until 35 days.

◆◆◆◆◆◆

Watermelon processing and value addition

Dev Raj, Chetan Prasad HP, AK Senapati and JM Mayani
Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari (GJ) - 396 450, INDIA

ABSTRACT

Watermelon (*Citrullus lanatus*) is well known and widely cultivated cucurbitaceous crop especially on the garden land and River bed in India. The sweet and juicy flesh of ripe fruit is being eaten fresh throughout the Tropical and Sub tropical regions of India and known for refreshing as well as cooling effect in the summer season. This delicious and nourishing fruit contains 95% water, 3.3% carbohydrates and 0.3% minerals besides being rich in vitamins and proteins. The fruit is known to be rich in iron which can even help in eradication of anemia among anemic persons. Although it is important crop of India but still no processed products are available in the market. So the experiment was conducted for preparation of watermelon nectar and utilization of rind left

after juice extraction for candy preparation which otherwise causes disposal problems. The results of the studies shows that water melon nectar containing 25% pulp portion, 16°Brix TSS and 0.30% acidity possess higher sensory score. Results of the experiments for preparation of candy from watermelon rind shows that best quality watermelon candy can be prepared by blanching water melon pieces (1.0-1.5 cm) for 5 minutes followed by immediate mixing watermelon rind pieces and sugar in the ratio of 1:1 containing 0.20% citric acid and 1000 ppm KMS. Thus watermelon drink as well as candy can be made available throughout the year if processed during the season.

◆◆◆◆◆◆

Fermented Oyster Mushroom: An Under-Explored Potential Functional Food 7

Swati Singh[1], H.G. Suthar[2] and A.D. Chaudhary[3], Susheel Singh[4]
Department of Agricultural Microbiology, NMCA, NAU, Navsari
Department of Post Harvest Technology, ACHF, NAU, Navsari
Directorate of Research, NAU, Navsari

ABSTRACT

Oyster mushrooms are one of the most widely cultivated species across the globe. Major chunk these mushrooms are consumed after passing through certain processing steps such as drying, marinating, sterilizing and freezing and this may also improved the shelf-life. But certain reports indicate loss of nutrient quality during storage conditions. However, Lactic acid fermentation as one of the cheapest, easiest and oldest traditional technique to preserve the foods but its utilization in oyster mushrooms is very scanty. Scientific studies pertaining to standardization and optimization of LAB in oyster mushroom considering the microbiological, biochemical and sensory properties of fermented products, it was found that there was an increase in antioxidant capacity limitation or inhibition of nutrient oxidation which makes the food beneficial for consumption, percent inhibition of α-glucosidase activity and anti-glycation activity reflects its anti-ageing benefits. Thus, oyster mushrooms fermented through LAB strains has huge potential in monetary terms which needs to be tapped in near future.

Keywords: Antioxidant capacity, Fermentation, LAB, Oyster, Preservation

◆◆◆◆◆◆

Potential of 'Noni' Fruit for Value Addition

Dev Raj, A K Senapati, AK Pandey and KK Jindal
ASPEE College of Horticulture, Navsari Agricultural University, Navsari (GJ) - 396 450, INDIA
#UGC National Fellow Life Sciences &Former ADG (Hort.),
Life Member International Society for Noni Science

ABSTRACT

The experiment was conducted to study the effect of enzymatic treatments on the recovery of noni (*Morinda citrifoli*a L.) juice using sixteen different enzyme treatments (Pectinase, cellulose and their combinations) were used for extraction of the 'Noni' fruit juice. The juice after extraction filtered, heat pasteurized and packed in glass bottles followed by processing (96±1°C) for 30 min. The juice was stored for 12 months to study the storage stability. The juice obtained form best treatment was also used for blending with mango pulp with 12 treatments for preparation of blended Noni mango nectar. Different treatments used for extraction of the 'Noni' fruit juice revealed that treatment of the crushed fruits with 0.1% Pectinase (T_3) for 3 hours gave

maximum 50.52% juice recovery by pressing with better quality attributes and storage stability against manual pressing without enzyme (31.71%). The colour, body and overall acceptability of noni juice was observed to be significantly better when juice was extracted using 0.15% Pectinase at par with 0.10% Pectinase treatment (T_3) for 3 hours. The extracted juice remained shelf stable for 12 months at ambient temperature without any spoilage and contamination. Further, value addition of noni juice shows that blended Noni mango nectar can be prepared using 5% Noni fruit juice and 15% mango pulp followed by maintaining 16°Brix TSS and 0.3% acidity of the nectar remained shelf stable for the period of 6 months and found more acceptable on the basis of sensory scores and nutritional composition. The blending of noni juice (5%) with mango fruit pulp (15%) found to mask the effect of the pungent odour to great extent and so possess potential for preparation of 'Noni Mango Nectar'. This formulation of the nectar is liked extremely by the children which otherwise dislike the pure Noni juice. The blended nectar were found shelf stable during 6 months storage.

◆◆◆◆◆◆

Studies on post harvest application of different chemicals on physical parameters of *Sapota* cv. Kalipatti

Shivani and A.M. Bhosale
Department of Horticulture
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani(Maharashtra), India
CCS Haryana Agricultural University, Hisar, Haryana, Pincode – 125004.

ABSTRACT

The presentinvestigation entitled "Studiesonpostharvestapplicationofdifferentchemicals on shelf life of sapota cv. Kalipatti" conducted during 2020–21 at PG laboratory, Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (Maharashtra). The sapota fruits are climacteric, they ripen quickly after harvest and become softened dueto a rapid increase in the activity of various oxidative enzymes, according to the original articlepublished in the International Journal of Agricultural Science and Study (IJASR). As a result, properpost-harvestmanagementisneededtokeepsapota fruitsfresh. Various chemicals, such as calcium chloride, potassium permanganate, salicylic acid, andkinetin, have been used to slow down the metabolic activities of the fruit to delay ripening,minimizelosses and preserve colour and consistency (Tsomu and Patel, 2014). These chemicals inhibit the growth and spread of microorganisms by decreasing shrivelling, resulting in improvedshelf life and fruit marketability for a longer period of time. Therefore, this investigation was administered to hunt out administere the "Influence of pre-harvest spraying treatments of chemicals and plant growth regulators on chemical parameters post-harvestlosses and shelf lifeofsapota [Manilkaraachras (Mill.) Forsberg]fruitscv. Kalipatti". The study material comprised of nine treatments which were CaCl2 4 % and CaCl2 2 %, CaCl2 1 % for 5 minutes, GA3 200 ppm , GA3 150 ppm GA3 100 ppmfor 5 minutes and BA 150 ppm, BA 75 ppm , BA 50 ppm for 5 minutes. Treated and untreatedfruits were packed in card board cartoons of 30× 30 ×30 cm size with 6 vents each of 3 cmdiameter equally on opposite sides and stored in PG laboratory. The experiment was framed inCompletely Randomized Design with nine treatments and a control. The fruits were subjected tovariousquantitative and qualitative analysisonat3rd,6th,9thand12thdaysofstorage period.By end of storage period the physical parameters likelowest PLW (19.18) was recorded in fruit when treated withCaCl2overcontrol. It can be concluded that, CaCl2 4 % was found best treatmentwhich not only extended the shelf life of sapota fruits but also reduced the post – harvest lossesand decreased physical parameters like PLW.

Keywords: Sapota,storageperiod,shelflife,quantitativeandqualitativeanalysis.

◆◆◆◆◆◆

Diversified tea products around the world

Pubali Neog, Eimon Bharadwaj, Rashmi Kalita, Diganta Kumar Borah, Mridul Deka and Rana Pratap Bhuyan
Dept. of Tea Husbandry & Technology, AAU, Jorhat

ABSTRACT

Tea, one of the most popular beverages in the world, has several beneficial effects including effects on immune function and inflammation. Presently, the world market price of tea has stagnated with supplies being stable and this situation emphasizes the need for exploring alternative means of increasing profits from tea cultivation. Product diversification of tea through value addition seems to be an important approach to mitigate the impacts of low market price and high production costs. Tea is a rich source of polyphenols and now-a-days interest in the possible health benefits of polyphenols, particularly flavonoids, has increased owing to their antioxidant and free-radical scavenging abilities. However, to achieve health benefits only drinking tea may not provide a sufficient level of catechins. Therefore, the use of catechins in foods is an alternative way to supplement catechin consumption. Different value added tea products are traditional tea, hand crafted tea, Specialty tea, Instant tea, flavoured tea, special health tea, etc. Several tea products with high amount of tea catechins are produced in Japan like green tea tablets, catechin capsules, catechin candy, green tea chewing gum etc. Various products of China are tea seed oil, tea saponin, micro tea powder, tea polyphenol etc. In Korea different beauty products with green tea such as nokcha (green tea) soap, tea oil, tea latte, sun cream and supplements among other things are available. Tea Cola, Tea toffee, Tea ice cream, apple tea, tea wine, tulsi green tea, ice tea etc. are available in India.

◆◆◆◆◆◆

Evaluation of onion genotypes for dehydration suitability and functional quality

Sajeel Ahamad, Vivek Saurabh, Nirmal Kumar Meena
Division of Food Science and Postharvest Technology,
ICAR-Indian Agricultural Research Institute, New Delhi 110012

ABSTRACT

Onion is a widely consumed commodity worldwide but the availability of suitable genotypes for dehydration purpose is very less. In this study the eight genotypes of onion namely, Pusa Shobha, Pusa Sona, Pusa Riddhi, ORVA 19-03, ORVA 19-05, ORVA 19-07, ORVA 19-14, ORVA 19-16 were evaluated for their physico-chemical constituents variation and their dehydration suitability. On the basis of physico-chemical constituent variations and dehydration characteristics of the genotype Pusa Shobha was found more suitable for dehydration as it retains more pungency, total phenols, antioxidant activity and high dry matter content and dehydration ratio and less browning. With regards the treatments and drying temperature the maximum retention of ascorbic acid, antioxidant activity, total phenols, pungency, better rehydration ratio and low non enzymatic browning was found in NaCl 5% and 60! respectively.Packaging and storage temperature, the onion slices packed in 200 g HDPE pouches and stored at low temperature retain better nutritional qualities in respect of ascorbic acid, pungency, total phenol, antioxidant activity, rehydration ratio and sensory score and less moisture content and NEB during storage as compare to slices packed in 200 g LDPE stored at ambient conditions upto 4 months. Dehydration of onion reduces its weight and volumeto a safe level without destroying its colour, flavour and nutritive value and therefore decreases its transportation and storage costs and could be one of the feasible methods for preservation of surplus produce for us and minimizing the fluctuation in the market price.

◆◆◆◆◆◆

Fruit and vegetable waste management: Conventional and emerging approaches

Swagat Ranjan , Behera and D. S. Duhan
Department of Vegetable Science, Chaudhary Charan Singh Haryana Agricultural University,
Hisar – 125 004 E-mail: swgtbehera@gmail.com

ABSTRACT

World agricultural and food sector has important challenges to face in the 21st century. Amidst them, food safety and appropriate waste management stand out. Fruit and vegetables are one of the most consumed commodities globally, accounting for more than 42% of total food wastage. The continuous rise in population, in addition to technological advancements, has led to an imbalance in demand supply, resulting in increased food wastage globally. Although source reduction and recycling have shown promising results, more evaluations concerning economics and environmental impacts need to be given importance. The need of the hour lies in finding a possible method towards effective utilization for fruit and vegetable waste to generate value-added products which are more eco-friendly, cheaper and sustainable. Valorization of fruit and vegetable wastes (FVW) constitutes an important potential source for valuable natural products and chemicals. FVW management can be carried out following different processing routes, though now-a-days, the best solution is to find an adequate balance between conventional waste management methods and some emerging valorization technologies. Presently, both conventional and emerging technologies must be considered in a coordinated manner to enable an integral management of FVW. By doing so, impacts on food safety and environment can be minimized whilst wasting of natural resources is avoided. Depending on the characteristics of FVW and on the existing market demand, the most efficient emergent processing technologies must be promoted in the long term, in detriment of the conventional ones used now-a-days.

◆◆◆◆◆◆

Dry flower technology

Priyanka Kakkar
Department of Horticulture
G.B Pant University of Agriculture and Technology
Pantnagar -263145 (U.S. Nagar), Uttarakhand

ABSTRACT

Fresh flowers are perishable in nature. By using drying techniques flowers and other ornamental plant parts are dried to increase their longevity. Drying of flowers is a method of preservation of flowers or the method of removing moisture from the flowers and dried flowers are the everlasting flowers thatform suitable plant materials by drying. The methods involve in drying are sun drying, air drying, press drying, oven drying, etc. Drying flowers is an exotic physical process with the unique ability to preserve a life appearance and color in beautiful blooms. Dried flower products can add value to the products like greeting cards, wall hangings, bouquets, potpourri,etc. Dry flowers and plant materials have attained importance in the floriculture industry with the increasing awareness for natural eco-friendly products. Found that the demand for these products has increased in such a way that India constitutes two-thirds of dry flower export of the total floriculture export and it offers a lot of opportunities for the floriculturist, entrepreneurs and industrialists, etc. Presently this industry has become a fertile area and the mainstay for commercial exploitation.

◆◆◆◆◆◆

Development and evaluation of instant Wood-apple (*Limonia acidissima Groff*) chutney mix

Vigya Mishra, Ritul, Shubham Gangwar
Department of Post Harvest Technology, Banda University of Agriculture and Technology,
Banda, 210001 (U.P.)

ABSTRACT

The present study was conducted on "Development and evaluation of instant Wood-apple (*Limonia acidissima* Groff) chutney mix" during session of 2021-22 at the Department of Post Harvest Technology, Collage of Horticulture, Banda University of Agriculture & Technology , Banda. An experiment was undertaken with a goal to standardized pre-treatment for preparation of Wood-apple powder, this powder will be used for making of instant wood-apple chutney mix. Wood-apple powder (WAP_4) prepared after blanching of wood-apple pulp for 3 minute and drying @ 70°c (± 3°c) temperature was found as the best in terms of total soluble protein and total pectin content. Instant wood-apple chutney mix (IWACM) was prepared using different recipes with addition of wood-apple powder, coriander leaf powder, green chili powder, garlic powder, ginger powder and ground fennel in different proportion. The ($IWACM_{4)}$ was prepared with addition of wood-apple powder, coriander leaf powder, green chili, powder, garlic powder, ginger powder and ground fennel powder in proportions of 54:18:7:7:3:2 ($IWACM_4$) with addition of 9% salt were adjudged best on the basis of overall acceptability score. The ($IWACM_4$) was also score highest in organoleptic properties. The chutney was also found good source of pectin, vitamin C and total phenol's. The instant wood-apple chutney (IWACM) mix will prove to be very useful in terms of taste, nutrition and functional value. The instant wood-apple chutney mix with excellent sensory acceptability, nutritional benefits and economic viability could add excellent sensory acceptability and nutritional benefits.

Keywords: - *Chutney mix, Overall-acceptability, Standardize,Powder,Wood-apple*

◆◆◆◆◆◆

Development of Wood-apple (*Limonia acidissima* L.) based Instant Chutney Mix Powder

Ritul, Vigya Mishra, Shubham Gangwar and Shankar Rajpoot
Department of Post Harvest Technology, Collage of Horticulture,
Banda University of Agriculture and Technology, Banda, 210001 (U.P.)

ABSTRACT

The present study was conducted to standardize a recipe for the preparation of Wood apple (*Limonia acidissima* Linn) based Instant Chutney Mix Powder (ICMP) by blending different levels of wood apple powder with other spices like coriander leaf powder, green chili powder, garlic powder, ginger powder and ground fennel in different proportion. Salt content of the ICMP was kept 9 per cent. Blanched and pre-treated wood apple pulp was dried in a cabinet dryer at 55±2° C till a constant weight was achieved and converted into powder. All the recipes ($ICMP_1$ to $ICMP_6$) were assessed for their physical and biochemical composition and sensory quality. Sensory analysis of reconstituted chutney powder was done on 9-point hedonic rating scale. Recipe $ICMP_4$ was adjudged the best followed by $ICMP_2$ on the basis of overall acceptability score. Instant wood apple chutney mix powder was also found to be a good source of pectin, vitamin C, antioxidants and phenols. The instant chutney mix (ICMP) was found to be a highly acceptable food in terms of taste, convenience and nutrition. Such product with excellent sensory acceptability, nutritional benefits and economic viability could add variety to the category

of convenience foods with rich nutritional value of under-explored fruits like wood apple.

Keywords: - *Wood apple*, *Chutney powder, Convenience food, Instant food*

◆◆◆◆◆◆

Studies on low calories, preservatives free RTS from pulp and seed powder of jamun fruit (*Syzygium cumini* Skeels) using artificial Stevia (*Stevia rbaudiana* L.)

Lavkush Pandey[1], Sanjay Pathak[2], Shiv Poojan[3], Kuldeep Kumar Shukla[4]
Fruit Science, A.N.D.U.A.T. KumarganjAyodhya
A.N.D.U.A.T. KumarganjAyodhya
Integral University, Lucknow, OUAT, Bhubaneswar, Odisha

ABSTRACT

Syzygium cumini Skeels, belongs to the family Myrtaceae. It is one of the highly productive and underutilized fruit crop in India. *Syzygium* fruit is considered as protective food since they are a rich repository of nutrient, minerals and vitamins which provide immunity from diseases. This immunomodulatory function is primarily due to the bioactive phytometabolites which are antioxidants and have radical scavenging properties. Flavonoids, anthocyanins, organic acid, carotenoids and polyphenols are bioactive compound in fruit. Stevia is natural sweeteners which is act as preservative because it have antimicrobial, antioxidant and colour retention potential. Stevia is natural sweeteners which is act as preservative because it has antimicrobial, antioxidant and colour retention potential. Beverage is not only provides essential hydration however, itis preservative free RTS.Jamun pulp and seed is highly potential in the reducing the blood sugar level without any preservative for long duration.The present investigation was concluded to "Studies on low calories, preservatives free RTS from pulp and seed powder of jamun fruit (*Syzygium cumini* Skeels) using artificial Stevia (*Stevia rbaudiana*L)." The studies comprised with two experiments. In first with 5 treatments(1) Jamun Powder: T_1 (Pulp Powder), T_2 (75% Pulp Powder +25% Seed Powder), T_3 (50%Pulp Powder +50% Seed Powder), T_4(25% Pulp Powder+75 % Seed Powder), T_5(100% Seed Powder)and (2) Jamun RTS: T_1 (100% Sugar), T_2 (25% Stevia +75 % Sugar), T_3 (25% Stevia +75 % Sugar), T_4(75% Stevia +25 % Sugar), T_5(100% Stevia) laid out in completely randomized design with four replication.

Keywords: Jamun, Stevia, RTS, Antioxidants, Carotenoids and CRD.

◆◆◆◆◆◆

Functional and nutraceutical Significance of Karonda (*Carissa carandas* L)

Deepansh Sharma[1], Kirandeep Kaur Kang[1] and Harpreet Kaur[2]
[1]Department of Fruit Science, College of Horticulture and Forestry, Punjab Agricultural University, 141004
[2]Department of Food and Nutrition, College of Community Science, Punjab Agricultural University, 141004

ABSTRACT

In India, Karonda (*Carissa carandas* L.) also called ‘Christ Thorn Tree’, is still an underutilized fruit but is a nutritionally and functionally rich which can be served to everyone may be poor or rich due to its untapped potential. The fruits are a rich source of iron and vitaminC and thus have antiscorbutic properties and are useful inprevention of anaemia. Karonda is reportedly useful incuring stomach-ache and is anthelmintic.The root extracts are used in lumbago, chest complaints andvenereal diseases. In Ayurveda, the unripe fruits are used asastringent, appetizer, antipyretic, antidiabetic. It is used by tribalhealers in the Western Ghats region of Kodagu in Karnatakain traditional systems of medicine. The chemical investigations on *C. carandas* had led

tothe isolation of several substances including â-sitosterol,lupeol, mixture of cardenolides, carissone and a new sub-stance, carindone. *C. carandas* fruits have been used asa dietary supplement or medicinal food for centuries andare of increasing importance to consumers. A natural'foodcolourant cum nutraceuticals supplement'has been preparedfrom the ripe karonda fruits. The formulation hadbeen named as 'Lalima'. 1 ml of this pigment suspensionformulation is sufficient to give lovely red colour to oneserving of any colourless beverage (100 ml) such as lemonade.One serves of such supplemented beverage may in additioncontain 469.2 ìg anthocyanin, 12.7 mg flavonoids,14.1 mg phenol, with total antioxidant activities to be 390 ìM Trolox Equivalent. At present, many commercialfruit products are available in the market hence the present study will possibly act as bridge between nutraceuticalfood and industrial pharmaceutical potentials of *C. carandas*.

◆◆◆◆◆◆

Evaluation of the antioxidant properties of leaves and fruits of *Pyracantha crenulata* (D.Don) M. Roem.

Sugandha Pant[1], Preeti Chaturvedi[1], Jyoti Bajeli[2], Aakansha Verma[1], Sheeba Belwal[2] and Kavita Negi[3]

[1]Department of Biological Sciences, [2] Department of Horticulture,
G.B. Pant University of Agriculture and Technology, Pantnagar
[3]Co-founder and CEO, Kimalaya Naturals Pvt. Ltd.

ABSTRACT

A laboratory experiment was conducted to evaluate the antioxidant properties of leaves and fruits of a medicinally miraculous wild fruit crop-*Pyracantha crenulata* (D.Don) M. Roem. (Ghingharu). The experiment consisted of five different concentrations of methanolic and aqueous extracts of leaves and fruits. The antioxidant activity was assessed through1,1-diphenyl-2-picrylhydrazyl (DPPH) and Ferric Reducing Antioxidant power (FRAP) assays. Moreover, the totalphenolic and flavonoid contents were also calculated.The highest antioxidant activity was observed in the leaves' methanolic extract for which the DPPH scavenging activity had the lowest IC_{50}value (26.12±0.009 µg/ml) and the highest FRAP activity (27.63±1.04 µg Gallic acid equivalents/mg extract). The methanolic extract of leaves also showed the maximum phenolic (16.21±0.04µg GAE/mg) and flavonoid content (24.487±0.03 µg/mg Quercetin equivalents/mg). A positive correlation of total phenol and flavonoid contents exhibited with the FRAP values whereas a negative correlation of these constituents was with the IC_{50} values of the DPPH assay. The study concluded that the methanolic extract of the leaves and fruits possesses a significantly higher antioxidant activity than the aqueous extracts and the leaves of *P.crenulata* possess better antioxidant properties than the fruits.

◆◆◆◆◆◆

Fruit and vegetable waste management

Bhavana Dhaker
Department of Vegetable Science
Swami Keshwanand Rajasthan Agriculture University, Bikaner, Rajasthan-334006

ABSTRACT

The fruit and vegetable sector generate large amounts of waste. In industrialized countries, fruit and vegetable waste (FVW) is mainly generated before reaching consumers, due to programmed over production and unfulfillment of retailer quality standards. FVW poses environmental problems due to high biodegradability,

represents a loss of valuable biomass and nutrients as well as an economic loss. Different reduction, reuse and recycle strategies to tackle FVW have been proposed. This option list in order of priority is commonly known as waste hierarchy**.** The World and Agriculture Organization calculated that one-third of the edible parts of food intended for human consumption get lost or wasted. In the fruit and vegetable sector definitions are more controversial. The latter has been defined as the inedible parts of vegetables that are discarded during collection, handling, transportation and processing. According to the definitions reported above, it should be defined fruit and vegetable loss rather than waste. FVW can be generated in different steps of the food supply chain, from farm to fork, including thus both pre- and post-consumer stages. The entire food supply chain (agricultural production, postharvest handling, storage and consumer phase). Management of fruit and vegetable waste (FVW) is an important issue that requires to be adressed by modern society, due to theenvironmental impact and the high value of this waste. Among FVW, salad waste is particularly challenging due to its high water content. The ideal strategy maximally exploits salad waste as a source of both value added compounds, such as polyphenols and fiber and water. To achieve this goal, traditional strategies such as anaerobic digestion and composting could be combined with novel sustainable technologies.

◆◆◆◆◆◆

Post harvest losses of fresh horticultural produce and their management

Sujeet Kumar Patel, Divyansh Mishra, Vipin Kumar, Abhishek Pratap Singh
College of Horticulture and Forestry
Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya 224229(U.P.)

ABSTRACT

Post-harvest losses of vegetables and fruit occur at all points in the value chain from production in the field to the food being placed on a plate for consumption. Post-harvest activities include harvesting, handling, storage, processing, packaging, transportation and marketing. Total post harvest losses in fruits and vegetables are 20-40%. This loss is caused by the mechanical losses, microbial losses, physiological losses and inadequate methods in harvesting, transportation, storage and marketing facilities and legislation result in favorable conditions for causes of secondary causes of loss. The loss can be reduced by implementing the important cultural methods, careful handling and packaging. The use of appropriate chemicals at pre and postharvest stage may prolong the availability of fresh produce for a long period of time by protecting them from pathogens and other environmental factors.Also controlled atmosphere storage and redurization at low temperature has been found to be effective for fruits and vegetables. The freshness of fruits and vegetables after harvest is controlled by water content, respiratory rate, ethylene production, endogenous plant hormones and exogenous factors such as microbial growth, temperature, relative humidity and atmospheric compositions.

Keywords: *Post Harvest Losses, Storage, Processing, Packaging, Transportation and Marketing etc.*

◆◆◆◆◆◆

Transforming horticulture through flower's waste

Parul Joshi
Doon Group of Institutions, Shyampur, Rishikesh

ABSTRACT

Flowers are an integral part of human life and are being used widely in religious places, marriages, festivals, funerals, hotel decorations and many more. After their use a large part of waste is generated from it. Unsold and damaged flowers from floral markets also share a major part in floral waste. These wastes are

thrown on the roadsides or on to the rivers consequently creating environment pollution with extensive burden of landfills. Also the floral waste when mixed with municipal solid waste it increases the amount of leachate which can percolate into surrounding groundwater, thereby polluting the water sources. Besides the flowers used for religious purposes or decoration, another major contribution in floral waste is from the industries that use flowers as raw material, such as during extraction of essential oils. Several studies have concluded that degradation of floral waste is a very slow process as compared to kitchen waste degradation. These waste flowers have various applications such as in cosmetics, food, liquor and textile industries, compost, biogas, biofuel, bio-ethanol, pigments, dyes, food products, soap making bio-surfactants production, incense sticks, handmade paper production and many more. Also these waste are a good source of lingo-cellulose and organic matter, hence it can be used as a potential resource for bioenergy production and other useful products. Effective management and strategies are required to covert this floral waste into wealth. Awareness on converting this floral waste into various products or manure to the flower vendors and entrepreneurs will reduce the heap of floral waste and can help to bring a transformation in the society

◆◆◆◆◆◆

Edible flowers : discovering taste along with nutrition pallet

Sachi Gupta[1], Sanjay Pathak[2], Shweta Singh[1], K. J. Singhand[1] and S. K. Tewari[1]
[1]CSIR- National Botanical Research Institute, Lucknow
[2]ANDUAT, Ayodhya, Uttar Pradesh

ABSTRACT

Edible flower is raising interest as rich source of bioactive compounds. Consumption of the edible flowers forms new trend in human nutrition in some countries. Despite the fact that not all nations use flowers as food, their use has generally expanded, as has the interest of researchers from other fields of study since they are thought of as novel sources of nutrients and bioactive substances. Therefore, the determination of bioactive compounds content in their petals presents important tasks for their evaluation as natural source of antioxidants for human diet. Rose (*Rosa spp*), Lotus (*Nelumbo spp*), Nasturtium (*Tropaeolum spp*), Chrysanthemum (*Chrysanthemum spp*), Hibiscus (*Hibiscus spp*), Lavender (*Lavandula spp*), Chamomile (*Matricaria spp*), Marigold (*Tagetes spp*), Purslane (*Protulaca spp*) etc. have been used in the culinary arts for centuries. Different parts such as flowers, leaves, roots can serve as an essential ingredient in a recipe, provide seasoning to a dish, or simply be used as a garnish, tea, relishes, jam or salads. Flowers are part of many regional cuisines, including Asian, European and Middle Eastern cuisines. A powerful argument for their ingestion is new knowledge on the nutritional content and makeup of edible ornamentals. Compared to regular vegetables and fruits, edible flowers have a very high antioxidant capacity. Compared to other vegetables, the flowers of purslane have the highest nutritional value, specifically omega-3 fat. Chamomile is often consumed to reduce anxiety and also improve quality sleeping. The levels of total phenolic compounds (TPC) and the antioxidant capacity significantly higher in *Tagetes erecta*, followed by *Spilanthes oleracea* and *Tropaeolum majus*. Therefore, the overlap between edible ornamentals nutritional and organoleptic properties can support both appealing flavor and improved health.

Keywords: Edible flower, bioactive compounds, antioxidants, health etc.

◆◆◆◆◆◆

Nutritional evaluation of papaya peels powder: a waste product

Deepak Joshi and Neetu Dobhal
Departmentof Foods and Nutrition,
G. B. Pant University of Agriculture and Technology, Pantnagar

ABSTRACT

Papaya peels are one of the waste products of papaya which are not utilized for any purpose and the disposal of which is compounded by the legal restrictions. The present study was conducted with the objective of evaluating the nutritional quality of raw and ripe papaya peel powder. The study included analysis of proximate composition, minerals, vitamins, dietary fibre, antinutritional factors and phytochemical composition using standard methods. For the study, papaya fruits were obtained from Chaddha Farm in Kaladhungi, Nainital. Papaya was collected in two stages i.eraw(stage after 50–60 days of flowering) and ripe (stage after 155–165 days of flowering) and peels powder was developed. The results of study showed significantly higher values of crude fibre (14.60%), crude protein (20.12%) and total antioxidant activity (66.80%) in raw papaya peel powder whereas ripe papaya peel powder was found to have higher content of phosphorus (460.3 mg%) and potassium (2080 mg%). Tannins and saponins were the main antinutritional factors present in both raw and ripe papaya peels powders. The total dietary fiber content in raw and ripe papaya peel powder was 50.45 and 38.41%, with higher amount of insoluble dietary fiber *i.e.* 35.14 and 26.4%, respectively, which makes both the powders beneficial for people with constipation.

On the basis of findings of the present study, it can be concluded that both raw and ripe papaya peel powders are nutrient-dense specifically rich in dietary fiber and protein. The regular consumption of papaya peel powders and their incorporated products in daily diet may be helpful in managing the life style disorders in the population.

◆◆◆◆◆◆

Temple floral waste: a potential source to generate revenue

Sachi Gupta, Shweta Singh, K. J. Singhand S. K. Tewari
CSIR- National Botanical Research Institute, Lucknow

ABSTRACT

India a culturally vibrant nation practices religion strictly and celebrate festivals frequently. In this practice large quantity of flower is discarded as the waste from temples, mosques, churches, *dargahs*, *gurudwaras*, hotels, banquets and houses. It has been estimated that about 8 million tonnes of floral waste is dumped into rivers and other water bodies in India every year, which pollutes and chokes these water bodies and leading to environmental degradation. Being offering to God, flowers do not find its appropriate way to the conventional waste disposal system. The techniques for their proper disposal should be identified as Vermicomposting, Anaerobic digestion, Dyeing, Paper manufacturing etc. These not only provide eco-friendly way for proper disposal but also produce utility products like incense sticks, manure, natural dye, handmade paper and bio gas. Therefore, these technologies should be placed appropriately for eco-friendly floral waste disposal along with economic gains to the beneficiaries.

Keyword: Floral waste, waste disposal, decomposition, entrepreneurship, potential products

◆◆◆◆◆◆

Formulation of QPM noodles and assessment of its nutritional value and sensory quality

Vandana and Sarita Srivastava
Dept. of Foods and Nutrition, College of Home Science,
G.B. Pant University of Agriculture and Technology, Pantnagar

ABSTRACT

Quality Protein Maize (QPM) which was developed by the International Maize and Wheat Improvement Center, CIMMYT in Mexico has recently attracted abundant attention due to its high content of essential amino acids *i.e.* lysine and tryptophan.Nowadays, noodles are consumed in many Asian countries and it is liked by all age groups. Commercial noodles available in market are rich in carbohydrate, deficient in protein, vitamin and other vital nutrients. Incorporation of QPM flour in noodles is an effective way to improve protein quality of noodles. In the present investigation, Vivek QPM 9 variety developed by VPKAS, Almora has been used for formulation of noodles. Box Behken design in response surface methodology was used for optimization of level of ingredients. Optimized noodles are formulated using RWF: QPM flour in 1:1, gluten (12 gm), guar gum (0.2 gm) and 53 ml water used for dough making. Nutritional analysis revealed that optimized QPM noodles were significantly superior than controlled refined wheat flour noodles (RWF) in terms of total ash, crude protein, crude fat, crude fiber, calcium, iron and zinc content. Total dietary fibre, tryptophan content, lysine content and in vitro protein digestibility was also significantly higher in optimized QPM noodles. Consumer acceptability study showed that formulated optimized QPM noodles were liked and acceptable by mass. Thus, it can be concluded that optimized QPM noodles can be utilized as a healthy snack food for both children and adults.

◆◆◆◆◆◆

Effect of xanthan gum based composite edible coatings on the post-harvest fruit quality of peach (*Prunus persica* L. Batsch) cv. Early Grande

Kusum Farswan[1], Omveer Singh[1] and Ratna Rai[1]
Department of Horticulture[1], College of Agriculture,
G.B. Pant University of Agriculture and Technology,
Pantnagar-2631454, U.S. Nagar, Uttarakhand, India

ABSTRACT

Peach (*Prunus persica* L. Batsch.) is one of the most delicious stone fruit grown in temperate and sub-tropical regions of the world. Peaches are highly perishable in nature and have a short life span under ambient conditions. Surface coating of fruits have been tested over the years in order to extend the storage life of peach fruits. One such approach was used in this experiment by using environment friendly xanthan gum based edible coatings. The functionality of these coatings improved with incorporation of calcium gluconate as texture enhancer and ascorbic acid as an anti-oxidant and they eventually reduced the postharvest enzymatic and oxidative deterioration of peach fruits as compare to control uncoated fruits. Study was undertaken at refrigerated conditions (10°C and 75% RH) for a period of 20 days. Fruits were dipped in different concentrations of xanthan gum (1.0% & 1.5%) supplemented with or without calcium gluconate @ 1.5 % and ascorbic acid @ 1.0%. All the physico-chemical and functional characteristics were determined at every 5day interval until 20 days of storage. Among nine coating formulations, 1.0% xanthan gum incorporated with calcium gluconate @ 1.5% as texture enhancer and ascorbic acid @ 1.0% as an antioxidant was found most promising coating treatment in controlling the weight loss, persevering physico-chemical and functional qualities attribute and also diminishing decay to a

greater extent throughout the storage period up to 20days and thereby extended the shelf life and maintain quality of peach fruits.

Keywords: Peach, xanthan gum, edible coatings, postharvest quality

◆◆◆◆◆◆

Evaluation of the antioxidant properties of leaves and fruits of *Pyracantha crenulata* (D.Don) M. Roem.

Sugandha Pant[1], Preeti Chaturvedi[1], Jyoti Bajeli[2], Aakansha Verma[1], Sheeba Belwal[2]and Kavita Negi[3]

[1]Department of Biological Sciences, G.B. Pant University of Agriculture and Technology, Pantnagar
[2] Department of Horticulture, G.B. Pant University of Agriculture and Technology, Pantnagar
[3]Co-founder and CEO, Kimalaya Naturals Pvt. Ltd.

ABSTRACT

A laboratory experiment was conducted to evaluate the antioxidant properties of leaves and fruits of a medicinally miraculous wild fruit crop-*Pyracantha crenulat*a (D.Don) M. Roem.(Ghingharu). The experiment consisted of five different concentrations of methanolic and aqueous extracts of leaves and fruits. The antioxidant activity was assessed through1,1-diphenyl-2-picrylhydrazyl (DPPH) and Ferric Reducing Antioxidant power (FRAP) assays. Moreover, the totalphenolic and flavonoid contents were also calculated.The highest antioxidant activity was observed in the leaves' methanolic extract for which the DPPH scavenging activity had the lowest IC_{50}value (26.12 µg/ml) and the highest FRAP activity (27.63 µg Gallic acid equivalents/mg extract). The methanolic extract of leaves also showed the maximum phenolic (16.217µg GAE/mg) and flavonoid content (24.487 µg/mg Quercetin equivalents/mg). A positive correlation of total phenol and flavonoid contents exhibited with the FRAP values whereas a negative correlation of these constituents was with the IC_{50} values of the DPPH assay. The study concluded that the methanolic extract of the leaves and fruits possesses a significantly higher antioxidant activity than the aqueous extracts and the leaves of *P.crenulata* possess better antioxidant properties than the fruits.

◆◆◆◆◆◆

Effect of drying methods and leaf age on quality and storability of Moringa leaf powder

Rajat Singh[1], R.A. Kaushik[2], K.D. Ameta[3], Susheel Songara[4] and Akshay Raj Singh Pawar[5]

Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, 208002, Uttar Pradesh
Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan.
Rajasthan College of Agriculture, Udaipur, Rajasthan.

ABSTRACT

The present investigation entitled "Effect of Drying Methods and Leaf Age on quality and storability of Moringa Leaf Powder" was conducted at the Post Harvest Technology Laboratory, Department of Horticulture, Rajasthan College of Agriculture and Department of Processing and Food Engineering, College of Technology and Agriculture Engineering, MPUAT, Udaipur, Rajasthan , from January to June, in the year 2021- 2022.The study was carried out by using 3 different drying methods (tray drying, heat pump drying and fluidized bed drying) and two different types of leaf. The experimental design used for the study was completely randomized

design with three replications. The various physico-chemical observations were recorded on 0, 30th, 60th and 90th DAS (days after storage) at ambient temperature.

Among different types of drying methods (tray drying, heat pump and fluidized bed drying), Fluidized bed drying method was found to be more effective in maintaining best quality physico-chemical characteristics (vitamin A, ascorbic acid, total phenol, crude fibre, crude protein, calcium, potassium, phosphorus, colour, etc.) of moringa leaf powder when compared to other drying methods. Old leaf retained higher quality characteristics as compared to fresh leaf. There was slight reduction in quality parameters with storage irrespective of the drying methods and type of leaf used.The effect of drying on physico-chemical properties of moringa leaf powder was found to be significant on ash content, crude fibre, vitamin A content, TSS, water activity and bulk density in fresh as well as old leaf during storage. The values of ascorbic acid content, calcium content and CIE L was found to be non-significant in fresh leaf samples, but in old leaf samples ascorbic acid was only non-significant during entire storage period.

Keywords: Moringa, Drying, physico-chemical properties.

◆◆◆◆◆◆

Physicochemical Property Report of Kedar Valley and Chamoli Honey From Uttarakhand

Hashib Ansari[1],Meena Agnihotri[1], M.S. Khan[1], Harminder Singh Baweja[2], K. Lakshmi Rao[3]
[1]Govind Ballabh Pant University of Agriculture and Technology, [2]Dr. Yashwant Singh Parmar University of Horticulture And Forestry, [3]Former Assistant Director C.B.R.T.I Pune

ABSTRACT.

Honey is a wholesome food that honey bees make. Its composition is greatly influenced by the weather circumstances and the type of flowers the bee uses. In this study, ten samples of honey from different parts of Uttarakhand's Chamoli and Kedar valleys were evaluated in terms of quality factors at the Intertek Total Quality, Assured laboratory in Gurgao, the physicochemical characteristics of the honey, including its moisture content, specific gravity, hydroxymethylfurfural content, acidity, total reducing sugars, sucrose content, ash content and F-G ratio and Fieh's test were assessed. Kedar Valley and Chamoli honey's moisture values were 18.23 and 18.4 g/100g, respectively. The total reducing sugars were between 77.65 and 77.89 g/100 g, while the sucrose concentration was under the quantitation limit.,HMF (hydroxymethylfurfural) content ranging from 47.24 and 4.2 mg/kg,respectively .Fiehe's test for both samples were found negative.

Keywords: Kedarvalley ;Chamoli; physicochemical properties.

◆◆◆◆◆◆

Improving storability of harvested guava fruits using chemicals

Pooja Singh and Navin Singh
Department of Horticulture,GovindBallabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India

ABSTRACT

Guava fruits are widely used by consumers and the food industry for a variety of applications. It is one of the most important and favorite fruits of tropical and sub-tropical region but due to its perishable nature it is difficult to store the fruits for longer duration at room temperature. In order to use the fruit in processing

industries for proper utilization of fruits and for making orchard more profitable, it is necessary to increase the shelf life by possible convenient means. The investigation was conducted in the Postharvest Laboratory of the Department of Horticulture, during December, 2021 to investigate the effects of Calcium chloride, Naphthalene acetic acid and Salicylic acid at varying concentrations on physico-chemical characteristics and overall acceptability of guava cv. L-49. The experiment was conducted in two factorial completely randomized designs with 13 treatments and 3 replications. The trial was carried out at ambient temperature 15-21°C at 90% R.H in winter season of 2021. The treated fruits were stored at room temperature for 12 days.Finding of investigation revealed that among all the treatments, T_3 treatment ($CaCl_2$; 3%) followed by T_{12}(Salicylic acid; 300 ppm) was found effective in reducing the physiological loss in weight of the fruits along with maintaining higher TSS, Tritatable acidity, Total sugar and overall acceptability characters up to 9 days of storage under ambient storage as compare to other treatments. Hence, it can be concluded that post-harvest treatment of calcium chloride (3%) and Salicylic acid (300 ppm) was effective in extending the shelf life, maintaining physico-chemical attributes of guava cv. L-49 for approximately 9 days under ambient storage condition.

◆◆◆◆◆◆

Fruit and vegetable waste as a sustainable source of nutraceutical compounds

Diksha P Rathod[1],T. R. Ahlawat[2], M. Sarkar[3]and A. D. Chaudhary[4]
Department of Vegetable Science, ACHF, NAU, Navsari
Department of Fruit Science, ACHF,NAU, Navsari
Dept. of Vegetable Science, COA, NAU, Waghai (The Dangs)
Director of Research, NAU, Navsari

ABSTRACT

Nowadays there is an increase in diet-related health problems thereforeneed for the supplement dietbecomes essential. These fruits and vegetables contain essential compounds and oils present insmall amounts. Nutraceuticals are compounds derived from a food or a part of it(byproducts likepotato peels, tomato pomace, onion skin etc.) to providehealth benefits for human beings by treating or preventing diseases. Bioactive compounds from vegetable and fruit waste act as a pool for the production of nutraceuticals.They are classified as compounds containing antioxidants, dietary fibers, natural pigments, vitamins, organic acids and polyphenols.Synthetic pigments from petrochemicals have been extensively used in a wide range of food productswhich have adverse effects on human health thus there is a need for sustainable production of naturalpigments.Wastes/by-products are a rich source of natural pigments such as: Anthocyanins, Betalains, Carotenoids, Lycopene and Chlorophylls.Various methods like solvent extraction, maceration, enzyme assisted, ultrasound assisted, microwave-assisted, electric pulse fieldand subcritical fluid extraction have been explored for their merits and values.High amount of total dietary fiberwas recorded from pea hulls (91.5%), from garlic husk (62.23%)and from pumpkin pomace (76.94%).High amount of betalains pigment(472.11 mg/l)was extracted from beetroot peels, 94.7% carotenoids from tomato pulp and 82.83 mg/100g anthocyanins from eggplant peel.High amount of phenolic content was observed in citrus peels.Agro-industries must invest in technologies through international collaborations which can convert the by-products generated into bioactive compounds for getting the maximum recovery of the nutrients.

Keywords: Fruit and Vegetablewaste-byproducts, Bioactive compounds,health benefits,Sustainability, Natural pigments

◆◆◆◆◆◆

Impact of gum based essential oil enrichment edible coating on postharvest quality of guava fruit cultivar VNR Bihi

Maneesh Kumar[1], P.N. Rai, V.P. Singh, Omveer Singh, Aakashdeep Kamboj
G.B. Pant University of Agriculture and Technology Pantnagar-263 145, Uttarakhand, India.

ABSTRACT

The experiment entitled "Effect of gum based essential oil enriched edible coatings on postharvest quality of guava (*Psidium guajava* L.) fruits cv. VNR Bihi" was conducted in the postharvest laboratory, Department of Horticulture, G. B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand). The aim of the experiment was to investigate the influence ofarabicand guar gum enriched with essential oil as antifungal and antibacterial at varying concentrations on physico-chemical characteristics and shelf life of guava fruits. The experiment was carried out in two factorial completely randomized design with 13 treatments and 3 replications. The experiment was conducted at ambient temperature Condition (18-22°C) at 90% relative humidity during winter season (January) of 2021. The changes in fruit weight, diameter, physiological loss in fruit weight, decay, pH, TSS, titratable acidity, ascorbic acid, total sugars, reducing sugars, non-reducing sugars, TSS : acid and sugar : acid were recorded under each treatment over a storage period of 15 days after harvesting, at 5 days interval. Functional edible coating formulation of guar gum 4% + lemongrass oil 1% found most effective in reducing physiological losses of fruit weight, decay and maintaining physico-chemical parameter of fruits. Higher total soluble solids (14.19°B), ascorbic acid (90.43 mg/100 g), acidity (0.31 %), total sugars (12.13 %), shelf life (18 days) and minimum decay per cent (7.02 %), physiological loss in weight (4.16 %) were recorded in fruits coated with guar gum 4% + lemongrass oil 1%. Overall, it can be concluded that guar gum coated fruits retained more desirable texture and other postharvest quality attributes under ambient storage conditions at various storage intervals.

◆◆◆◆◆◆

Biotechnology: an eco-friendly approach for wastewater management in pulp and paper industry

Raveena Thakur, Bhupender Dutt and Rajneesh Kumar
Department of Forest Products, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-Solan (HP) -175001

ABSTRACT

In a world of increasing population, the demand for paper and its products is tremendously increasing and the meeting up of the demand comes up with a price of large amount of wastewater generation, containing dissolved wood-derived substances and residual process chemicals which adversely affect the environment. Owing to the increased environmental awareness, these potentially highly polluting raw wastewaters from the mills cannot be directly released in nature. Instead, recycling of the wastewater with the help of microbes is becoming an attractive alternative for many pulp and paper mills as it also offers potential savings in the cost of fresh water. Recycling of the wastewaters can be done either by closing up the systems in the mill or by treating the wastewaters such that they can be reused. Wastewater purification is usual carried out by a sequential approach.-sedimentation and an aerobic microbial process called the activated sludge operation, or an anaerobic digestion. The activated sludge process, operates through successive action of many different microbes active in the sludge and carried on site in large aerated tanks. The success of the process is dependent on successful maintenance of the dissolved oxygen as well as good settling of the sludge. The settlement, in turn, depends on the type of microbial flora involved; the presence of excessive amounts of filamentous bacteria forming a matrix

for flock forming bacteria can cause significant settlement problems. Several enzymes isolated from microbes such as lignin peroxidise, manganese peroxidise and laccase can be potentially used in wastewater management in pulp and paper industry.

Keywords: Activated sludge, Environmental awareness, Microbes, Wastewater

◆◆◆◆◆◆

Efficacy of pre and post-harvest treatment of plant growth regulators on quality and shelf life of ber fruits cv. Umran

Anil Sharma and Harsimrat K. Bons
Department of Fruit Science, Punjab Agricultural University, Ludhiana (141004).

ABSTRACT

The present investigation on"Efficacy of pre and post-harvest treatment of plant growth regulators on quality and shelf life of ber fruits cv. Umran"was carried out at Punjab Agricultural University, Ludhiana during year 2021. Fifteen year's old uniformly grown ber plants of cultivar Umran planted at 7.5 × 7.5 m spacingwere sprayed with different chemicals *i.e.* hexanal formulation (0.15 %, 0.20 % & 0.25 %), salicylic acid (1mM, 2mM & 3mM) and sodium nitroprusside (50µM, 100µM and 150µM) along with control (water spray) at pit hardening and colour break stage.Fruits were divided into two lots. In first lot, fruits after harvesting wasanalysed for physio-chemical parameters.After that fruits were also treated after harvest with above mentioned chemicals and stored at low temperature(6.5±1^{0}C and 90-95 % RH) for 28 days. Treatedfruits were analysed for physio-chemical parameters at 0, 7, 14, 21 and 28 days of storage. Among all the pre-harvest applications, sodium nitroprusside @ 100µM resulted in maximum fruit weight (25.91 gm), fruit length (4.71cm), fruit diameter (3.57 cm), fruit volume (23.32 m^3), pulp content (90.96 %) and pulp stone ratio (85.83). In case of post harvestapplication,sodium nitroprusside treated fruits recorded maximum TSS/ acid ratio total sugars, non-reducing sugars and salicylic acid treated fruits recordedhighest pectin content than control treatment. From above studies, it is concluded that pre and post harvestapplication of sodium nitroprusside @ 100µMresulted in better physical and chemical attributes along with improved shelf-life of ber fruits cv. Umran up to 28 days under cold storage conditions.

Keywords: Sodium nitroprusside, spray, chemical attributes and shelf-life.

◆◆◆◆◆◆

Post-Harvest handling techniques of horticultural crops to ensure Food security

Hardeep
Department of Horticulture, Maharana Pratap Horticultural University, Karnal, Haryana

ABSTRACT

Temperature managementholds paramount importance in preserving fresh horticultural commodities, post-harvest quality, safety and shelf life. It starts with the efficient removal of field heat through initial cooling and continues throughout the cold chain comprising refrigerated transportation, cold storage at wholesale distribution centers, refrigerated retail display and cold storage at home. Management of temperature and relative humidity is quite crucial for minimizing water loss. Commercially, the various technical practices are also utilized in addition totemperature and relative humidity management such ascuring of root, bulb and tuber vegetables; elimination of excess surface moisture;straightening out of defects; waxing; heat treatments (hot water or air,

vapor heat).Some special chemical treatments using sprout inhibitors, scald inhibitors,growth regulators, calcium, ethylene-action inhibitors and post-harvest fungicide are applied to commodities for de-greening citrus and ripening of climacteric fruits. In order to red reduce microbial contamination and ensure food safety, treatments to manipulate the environment can also include packaging, control of air movement- circulation, control of air exchange- ventilation, removal of ethylene- exclusion, controlled or modified atmospheres, effective water disinfection and other hygienic practices. Use of cultivars with long post-harvest life, use of an integrated crop management system that provides the maximum yield and quality, use of proper harvesting and post-harvest handling procedures to maintain quality and safety of horticultural crops and their products are integrated strategies for increasing food security by reducing post-harvest losses and waste.

Keywords: Growth regulators, Curing, Waxing and Vapor heat treatment

◆◆◆◆◆◆

Value-addition in Vegetables Crops

Lav Kumar[1], Suraj Luthra[1],ShaniKumar[1],Mritunjay Rai[1]
[1]Research Scholar, Department of Vegetable Science, College of Horticulture and Forestry, ANDUAT, Kumarganj, Ayodhya (U.P.)

ABSTRACT

India is the one of the top vegetables producing country in the world. Vegetables are good source for dietary nutrients such as vitamins, fibers and minerals. Development of vegetable products is always crucial since it promotes the longevity of vegetables and raises their quality through the inclusion of value. In India, a variety of vegetables that have a high nutritional value are accessible but are not being used to their full potential. These crops have a great chance of preserving the nation's economic sustainability. Despite their high processing potential, many vegetables are underutilized in terms of processing. Per capita consumption of vegetable in India is lower than daily requirement. It happens due to high post-harvest losses (20-40%) of fruits and vegetables in India. It is observed that the current status in availability of vegetables only meet half of the requirement of vitamins and minerals. Therefore, it is necessary to processes the available vegetables so it is important to evolve the system of processing of vegetables by The development of vegetable product is always important as it is help is mentioning long life of the vegetables and it also improve the quality of vegetable by the addition of value in it. In India there are various types of under-utilized vegetable are available because they are not utilizing properly although they have very high nutritive value. These crops have high potential in maintaining sustainability in terms of economy of country. Many of the vegetables are under estimate in terms of processing although they have high processing capacity.

Keywords: Value addition, Vegetable, Sustainability, Per capita

◆◆◆◆◆◆

Banana Byproducts as Bio-Products and its Agri-Preneurial Potential

Patel, JollyJ. [1]; Singh, Susheel[2]; Ahlawat, T.R.[3] and Italiya, A. P.[4]
Department of Soil Science, Navsari Agriculture University (NAU), Navsari- Gujarat
Depart. Natural Resources Management, ASPEE College of Horti.NAU, Navsari

ABSTRACT

Banana ((*Musa paradisiaca*) is an important fruit crop and India is one of leading producer and consumer among other countries in the world. Primarily banana crop is grown for their fruit but it is also subjected to

several post-harvest process which generates quantum of byproducts and wastes. Consequently, many untapped resources are lost without appropriate agricultural waste management practices, causing severe ecological problems. Banana post-harvest waste, *viz.*, pseudostem, leaves and suckers, are dumped in rivers, lakes, or low-lying areas where it generates greenhouse gases and thus poses a serious threat to the ecosystem. Recently, due to environmental awareness, as ecological and renewable characteristics, banana post-harvest waste was gaining interest and used to extract fibers, biofuel, biogas as well as rich source of major, macro- and micro-nutrients. Looking at this perspective, entrepreneurs should take this golden opportunity and do the needful for such kind of business. Thus, farmers or entrepreneurs should cultivate more banana trees in unproductive lands of coastal and hilly areas for extra income from the useless wastes and ensure an eco-friendly environment. Women can also be employed in the production of different bio-products from banana wastes and thus, they can contribute to their livelihood improvement. Hence by-product could be potential bio-products and also have immense potential to be an agri-enterpreneur.

Keywords: Banana, Bio-Products, Eco-Friendly, Employment, Pseudostem

◆◆◆◆◆◆

Potential of marigold in oil industry

Ashmita Sahu, VK Rao, Anamika Sajwan
Department of Horticulture, G.B Pant University of Agriculture & Technology,
Pantnagar (263145), Uttarakhand

Wild marigold *(Tagetes minuta)* is valued for its essential oil. It is an erect and grows 1-2 m tall, profusely flowering, annual aromatic plant originated from South Africa. It is found in between altitudes of 1000 – 2500 m and grown in the areas of Himachal Pradesh, Jammu and Kashmir and Uttarakhand where it occurs in natural habitat as a weed in crop fields. It is suitable for cultivation in wide range of soils from sandy loam – clay loam with pH 4.5 – 8.0. Better quality of essential oil is produced in moist temperate regions where nights are cool during growth and flowering season of the plant.For high-quality essential oil, the crop during the reproductive phase should have an average temperature of 12–30°C. It yields 0.25- 0.5% essential oil.The essential oil is used in the perfumery pharmaceutical, food flavouring and agricultural industries. The oil and absolute are employed in compounding high grade perfumes and for flavouring alcoholic beverages, frozen dairy desserts, candy, baked goods, gelatins, puddings and condiments. Dried leaves are used as medicinal tea and for culinary purpose imparting aroma to soups, food and vegetable preparations. The plant as a companion crop controls nematodes, slugs and at times suppresses weeds. Dried powder can be used to control weeds in rice. Oil and its constituents have insecticidal, antibacterial, antifungal, antiviral and mosquito larvicidal activities. India can increase the area under cultivation and can become an important exporting country of wild marigold products.

◆◆◆◆◆◆

Enhance the shelf life and reduce the post-harvest losses of fruit and vegetable by using the essential oil

Vipin Kumar
Fruit Science,College of Horticultureand Forestry
ANDUAT, Kumarganj, Ayodhya

ABSTRACT

Fruit and vegetable are the richest sources of vitamins and minerals in human diet. The consumption is steadily rising due to of its nutritious qualities. It is estimated that, about 30 to 40 percent of fruit and vegetable

spoiled after harvesting. The post-harvest management and disposal of fresh fruits and vegetables is big concern worldwide. Although, the large quantity of post-harvest losses of horticultural produce have been managed by synthetic chemicals that could positively affected the human health. As a substitute using the essential oil such as cinnamon, geranium, citronella, mint, eucalyptus, lavender, thyme, rosemary, citrus, basil etc. for control of post-harvest losses, improving overall quality and enhancing the shelf life of fruit and vegetable. In this way we can easy prevent the post-harvest losses and stagnant the natural quality of horticultural produces as well as improved the human health and consciousness.

Keywords: Essential oil, Fruit and vegetable, Post-harvest losses, Shelf life

◆◆◆◆◆◆

Active MAP of Mushroom under two different gaseous conditions

Neha Devrani[1] and Rahul K. Anurag[2]
[1]VCSG UUHF, Bharsar, Uttarakhand
[2]Agricultural Structure and Environmental Control Division
ICAR-CIPHET, Ludhiana-141004 (Punjab)

ABSTRACT

The experiment was carried out at the Laboratory of CIPHET, Ludhiana to evaluate the difference in the effect of two different gaseous concentration at two different temperatures under active Modified Atmospherein extending the shelf life of button mushroom. Mushrooms were weighed (200g each sample) with the weighing balance and placed in 4 different jars and were sealed using vacuum grease, teflon tape and septum making sure that the containers are airtight. The remaining mushrooms were packed in 20 trays weighing 150 Kg each and were sealed at two different atmospheres*i.e.*, 5% and 10% CO_2 with air sealing machine. After that, the trays and jarsat 5ÚC temperature werekept in the refrigerator and traysandjarsat 10ÚC temperature in the BOD incubator for 5 days at 0,1,3,4 and 6 at subsequent days. Now the quality changes were observed like physiological loss in weight during 6 days (weighing balance), gas concentration (%) in packed mushroom at 5ÚC and 10ÚC (Headspace analyzer), estimation of phenol at 760nm wavelength (UV-VIS spectrophotometer) and color determination of mushroom by hunter calorimeter.Oxygen composition influenced by temperature, gradually decreased showing that respiration rate is reduced. Decrease in respiration rate delays enzymatic degradation of complex substrates, thereby extending the shelf life of the produce. CO_2 composition rose at 5 and 10 °C samples that implies the breakdown of energy reserves like proteins, carbohydrates into simpler molecules is high at this temperature. CO_2 composition at 10° C gradually reduced which leads to microbial growth. MAP resulted in a substantial maintenance of L value in the range of 75-85 in button mushroom during 6 days of storage under the two different temperatures while storage. However, the retention of color was largely dependent upon the dynamics of in-pack gaseous atmosphere inside the polymeric film packages. At the end of storage, the L was non-significantly affected in all mushroom samples stored at both two temperatures of 5 and 10 °C indicating that the in-pack atmosphere of O_2 and CO_2 in these packages was beneficial for maintaining the moisture content of mushrooms.

◆◆◆◆◆◆

Effect of holding solutions on vase life and flower quality of cut flowers of Rose (First Red)

Neha Devrani and Jitendra Kumar
Doon (PG) College of Agriculture Science and Technology
Camp Road Selaqui-248008, Dehradun, Uttarakhand, India

ABSTRACT

Rose is always regarded as the queen of flower. Investigations pertaining to extend the vase life of cut flowers by chemical treatments after harvest have been made with varying success.Theexperimentwas carried out under ambient condition at Laboratory, Department of Horticulture, Doon (P.G) College of Agriculture Science and Technology, Dehradun, Uttarakhand to find out the better preservative and its concentration in extending the vase life of cut rose "First Red". The experiment was laid out in Completely Randomized Design with one factor *i.e.*, effect of preservative solution. It includes two preservatives at two different concentration that means having 5 treatments *viz.*, control tap water (T_1),sucrose @ 20g/l (T_2), sucrose @25g/l (T_3), calcium chloride 100ppm (T_4) and calcium chloride 200ppm (T_5). In all there were five treatments replicated two times with three flowers in each replication.Thus, there will be four treatment combinations replicated two times in Completely Randomized Design. Observations to be recorded before applying treatment and after applying treatment on daily basis on the change in fresh weight of flower, vase life, flower diameter, solution uptake, abscission of petals and overall acceptability.It is apparent from the observed data the maximum vase life(15.67 days) was observed in Treatment T_3, minimum vase life(12 days) was observed in Treatment T_1, maximum diameter (6.97cm) was observed in Treatment T_5 ,minimum diameter (4.86cm) was observed in Treatment T_1 , maximum water uptake(44ml) was observed in Treatment T_5, minimum water uptake (34ml) was observed in TreatmentT_1 , maximum abscission(3.22%) was observed in Treatment T_3, minimum abscission(1.85%) was observed in Treatment T_1, maximum weight(10.09g) was observed in Treatment T_3 and minimum weight (7.91g) was observed in Treatment T_4. Therefore, considering the vase life and other characteristics of flower, it was concluded that the preservative calcium chloride performs significantly superior to sucrose. Infact calcium chloride at concentration 200ppmwas found to be the best preservative in enhancing the vase life and quality of flower.

◆◆◆◆◆◆

Biofortified Vegetables: A way forward to combat mall nutrition and ensure food security

Himanshu Singh, Neha, SwetaSoni, Neetu, Sunil Kumar and Ajeet Singh
Department of Vegetable Science, College of Horticulture, Banda University of Agriculture and Technology, Banda (U.P.)- 210001

ABSTRACT

Increasing the amount of vitamins and minerals in a crop through plant breeding, transgenic methods, or agronomic practises is a process known as biofortification. Due to an unbalanced and inappropriate diet, malnutrition affects more than half of the world's population, particularly women and young children. Malnutrition and hunger are currently developing nations' two main challenges. Under five-year-old children in India make up about 43.5% of the chronically undernourished population. An emerging, promising, affordable and sustainable method of providing micronutrients to a population with limited access to varied meals and other micronutrient therapies is biofortification. The low-cost strategy is to develop plants to increase the bioavailability of specific micronutrients

in consumable foodfor poor countries and their people who cannot afford high-quality food. The daily diet should include a variety of vegetables. Vegetables that have been biofortified can therefore help to reduce the lack of micronutrients. Three methods—agronomic biofortification, traditional plant breeding and genetic engineering—can be used to achieve biofortification. The concentration and bioavailability of micronutrients in the edible crop tissues can be improved through genetic engineering. Most vegetable crops, including cassava, beans, potatoes, orange sweet potatoes (OSP), cowpeas, pumpkin, etc., have used its techniques. There have been released both conventional and transgenic variants. Promoting the creation, cultivation and consumption of biofortified vegetables is necessary to prevent a number of health problems. Thus, increasing the consumption of a variety of non-staple foods in society is the most effective solution to end undernutrition as a public health issue in developing countries.

◆◆◆◆◆◆

Utilization of banana pseudo-stem for value added products

Anjali S. Javiya[1], C. S. Desai[2],J. M. Mayani[3]and Pooja R. Naik[4]
Navsari Agriculture University (NAU), Navsari- Gujarat -396450

ABSTRACT

Banana (*Musa paradisiaca* L.) is an important fruit crop mainly grown in tropical and sub-tropical areas. The major banana producing states are Maharashtra, Kerala, Tamilnadu, Gujarat, Bihar, West Bengal, Assam, Andhra Pradesh and Karnataka. In India, it occupies about 9.24 lakh ha area with the production of about 330.06 lakh MT (Anon, 2019). Apart from fruit, it generates huge quantity of biomass as waste in the form of pseudostem, leaves, suckers etc. The trunk of the banana tree is called the pseudostem formed by the tight overlapping leaf stalk bases in cylindrical form. The middle of the pseudostem is tender and edible which is known as the banana central core. The pseudostem central core contains rich quantities of calcium, potassium, protein, crude fiber, iron and magnesium. On an average, about 60-70 tonnes of pseudostem are thrown away and disposing it presently farmers are spending about Rs. 15000 to 20000 per ha. On w/w basis, central core constitutes about 10-15 % of pseudostem, which comes to around 7- 10 t/ha. Tender cores of the banana pseudo-stem powder iswellknown remedy for urinary disorders, stomach troubles like diarrhoea, dysentery and flatulence. Italso helps for removal of stone in kidney, gall bladder and also to control obesity.Hence, there is a scope to utilize this waste and develop high value products *viz.*, microcrystalline cellulose powder from fiber, mordent and organic liquid fertilizer from sap, fortified edible products from banana pseudostem central core like jam, candy, pickle, bar, cookies, powder, ice-cream, noodles, juice, squash, nectar, green tea *etc*. It is also used for preparinghandicrafts, ropes, fabrics, Papers etc.

Keywords: Bananapseudostem, Central core, Fiber, Fortification, Biomass, Potassium

◆◆◆◆◆◆

Studies on physio-chemical characteristics of sweet orange [*Citrus sinensis* (L.) osbeck] genotypes

Pooja Mishra, R. B. Ram
Department of Horticulture, Babasaheb Bhimrao Ambedkar University
(A Central University) Lucknow- 226025(U.P.), India

ABSTRACT

The genus Citrus, comprising some of the most widely cultivated fruit crops worldwide, includes an uncertain number of species. It is a genus of flowering trees and shrubs in the family Rutaceae.The genus Citrus

is native to South Asia, East Asia, Southeast Asia and Australia. Sweet orange is considered as most important crop of citrus group because of its multifold nutritional and medicinal value.The fruit is being produced in the hills and is liked by people for its sour and sweet taste. In the local language, it is called Malta. Due to the lack of a proper market network, there is no much commercial importance of this crop in the region but due to luscious taste and flavors its values have remained paramount importance as a commercial crop. Keeping in view the above facts in mind, an investigation was proposed to carry out to explore the superior genotypes grown in theBageshwar region of Uttarakhand.Tengeno type (T1,T2…T10) with three replication were evaluated for their physio-chemical characteristics. Data was analyzed by using CRD method. Highest juice percent was recorded in T5 (40.25%) followed by T3 (39.37%).The value of reduced sugar and total sugar of all genotypes were at par with established cultivars. T5 and T3 genotype can be further explored to be recognized as improved cultivar under Bageshwar condition.

Key words: Citrus sinensis, physio-chemical characteristics, sweet orange genotype

◆◆◆◆◆◆

Fruit Coating and Waxing

Deepak Meena, Deepa H. Dwivedi, Mahaveer Meena
Department of Horticulture,
Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh 226025

ABSTRACT

Presently, fresh fruits are most demanded in the market because of good nutritional value. Due to perishable nature of fruit, it has a very short shelf life. Major losses in quality and quantity of fresh fruit occur by microorganisms, insects, pre and postharvesting conditions during transport and preservation. In the modern era, the application of bio based material as a way of enhancing the shelf life of highly perishable produce is promising. Edible coatings can provide an additional protective coating for fresh produce and can also give the same effect as modified atmosphere storage in modifying internal gas composition. Many important tropical fruits are climacteric in nature, such as banana, mango, papaya, avocado and guava. These fruits ripen rapidly during transit and storage, thus often requiring rapid shipment by air. There is an opportunitywith climacteric fruit, however, to slow down ripening after harvest andthus, extend the shelf life. This can be done with controlled atmosphere (CA)storage, modified atmospheric packaging(MAP), or with edible coatings. Waxing depressed fruit internal oxygen and increased internal carbon dioxide, modestly with dilute coatings at 15°C but more dramatically with higher wax concentrations and storage temperatures.

◆◆◆◆◆◆

Extraction of plant bio-colours for dyeing dry flower Lagurusovatus

Kanika Samyal and Bharati Kashyap
Dr. YS Parmar UHF NauniSolan (HP)

ABSTRACT

The present investigation was carried out using fifteen dye sources (*Beta vulgaris*,*Bixaorellana*, *Bougainvillea* spp, *Capsicum annuum*, *Carthamustinctorius*, *Celosia argentea*, *Cosmos bipinnatus*, *Curcuma longa*, *Euphorbia pulcherrima*, *Lilium* hybrids, *Peltophorum pterocarpum*, *Punica granatum*, *Rosa hybrida*, *Tagetes erecta* and *Woodfordia fruticosa*) which were assessed for dye extraction using two solvents *i.e.* water and acetone. Out of the two solvents used for extraction acetone was observed to be the best solvent. Maximum score

(4.50) for overall acceptability in*Lagurusovatus*after dyeing was observed for bio colour extracted from rose, marigold, turmeric, cosmos and lilium. Three dye assistants *i.e.* sodium chloride, acetic acid and hydrochloric acid along with two mordants *i.e.* alum and ferric chloride were used to intensify the obtained colour.Out of the different dye sources; rose, marigold and turmeric were found to be the best source of biocolour*w.r.t.* overall acceptability scores. It was found that the biocolour was successfully extracted using acetone as a solvent, alum as a mordant and sodium chloride or acetic acid as dye assistants in case of turmeric and marigold, whereas; sodium chloride or hydrochloric acid were found to be suitable dye assistants for rose.The best dyed samples were kept under two storage conditions *i.e.* open and wrapped in cellophane sheets for a period of 90 days. It was found that the dyed flowers of *Lagurusovatus* showed good overall acceptability when stored under wrapped conditions as compared to open conditions even after 90 days of storage. Various value-added products like dry flower arrangements, maize spathe doll, rakhis, greeting card, wall hangings, file covers, dry flower sticks and wall pictures were prepared from lagurus grass after dyeing with the bio-colours.

◆◆◆◆◆◆

Standardization of technology for minimal processing of fresh cut potatoes (*Solanum tuberosum* L.)

Patel NilamV.; Dev Raj and Mayani, J. M.
Department of Post Harvest Technology, ASPEE College of Horticulture,
Navsari Agricultural University, Navsari – 396 450

ABSTRACT

The experiment was conducted to know the effect of various treatments on physico-chemical properties *viz.*, weight loss, TSS, acidity, total sugars, calcium, starch and enzymatic browning as well as sensory parameters (colour,texture, flavour and overall acceptability) and total plate count (CFU/g) and divided into three parts.Observations were taken at 0, 4, 8, 12 and 16th day of storage. Part 1 showed the effect of blanching and calcium chloride ($CaCl_2$) on quality and texture of fresh cut potatoes using 10 treatments with control and three levels of blanching (B_1=1 min, B_2= 2 min and B_3= 3 min)along with calcium chloride (C_1= 0 %, C_2= 0.5 %, C_3= 1.0 %). Results indicated that T_{10}(3 min blanching + 1.0 % $CaCl_2$)was found more shelf stable and very good texture with higher retention of nutritional value with minimum browningandhighersensory score which was used as common treatment fornext part. The second part showed the effect of citric acid (C_1 = Control, C_2 = 0.05 %, C_3 = 0.1 %) and KMS (K_1 = Control, K_2 = 0.05 %, K_3 = 0.1 %). Among 9 treatments, T_6(0.05 % citric acid + 0.1 % KMS for 15 min dipping) was noted best with respect to quality, acceptability and safety. The part 3 revealed the effect different packaging*viz.*, HDPE, LDPE and PET of 100 and 200 gauges on fresh cut potatoes and revealed that T_4(LDPE bags of 200 gauges) was found best among all treatments. It can be concluded that minimally processed fresh cut potatoes can be prepared by blanching for 3 minutes at 95^{o}C along with 1.0 % $CaCl_2$ and cooling for 15 minutes bydippingin the solution of 0.05 % citric acid and 0.1 % KMS followed by excess water removal. The fresh cut potatoes can be successfully stored for 16 days at refrigerated temperature when packed in 200 gauge LDPE bags with acceptable quality.

◆◆◆◆◆◆

Session-7

Plant Protection and Quarantine Management

INVITED LECTURE

I-1 Decision Support Systems for integrated foliar disease management in the Apple

K P Singh
Department of Plant Pathology
G B Pant University of Agriculture & Technology, Pantnagar-263145

Foliar disease management advisory of apple (FDMAA), a computerized decision support system is used to help apple growers make decisions about spray schedule activities that need to be done in order to produce the desired quantity and quality of the apple. Foliar disease management involves 10–16 fungicide treatments per season, depending on the weather conditions and disease pressure, which represent >75 % of the annual fungicide costs in apple production in north west Himalayas. DSS focusing on use of timely applied and reduced fungicide rates in control of foliar diseases of apple has been tested in field trials since 2003. We compared the traditional spray schedule treatment and the DSS-based spray practices in several orchards' trials in five apple locations over 9-year period. Efficacy of the control of scab caused by *Venturia inaequalis*, the main fungal disease in apple has been tested to determine the economic advantage of DSS use. In DSS based spray schedule practices, the advantage in reduction of application fungicides spray by 50 to 70% of the traditional spray schedule. At Nort-west Himalaya, the fungicides were applied at different phenological growth stage between bud swell stage/ green tip to dormant stage after natural leaf fall (Nov-March), whereas in DSS-FDMAA, only 2 or 3 spray at initation of primary infection and cultural practices during dormant after natural leaf fall stage. In the integrated production system, special attention will be paid to current foliar disease warning systems which will be related to cultivar susceptibility, spraying techniques and timing of spray applications. Biologically/culturally-based tactics reduce fungicides use through alternative practices that replace some, or even all, of the fungicides needed to control a foliar disease. Finally, future aspects and possible improvements on scab, powdery mildew and blotch control strategies are interpreted.

◆◆◆◆◆◆

I-2 Palynological studies of pollen grains of Some Fruit Crops

Pramod Mall, Mahendra Singh and Khanika Pal
G. B. Pant University of Agriculture and Technology, Pantnagar, Uttrakhand, 263145

The sustainable development of agriculture has necessitated the reorientation of the present crop production technologies. A pollen grain is a marvellous product evolved by flowering plants to continue their generation. Pollen studies are also helpful to know about the quality of pollen collected by foraging bees. It also gives the idea about pollen morphology and thus one can know about the pollen source in a particular area to start bee keeping and on the basis of pollen contents in honey of various months, the floral calendar can be prepared in a particular locality inorder to facilitate the beekeepers.

Therefore, the study were undertaken for detailed pollen morphological study of nine bee floras of fruit crops belonging to six different families from tarai region of Uttarakhand, which are Water melon (*Citrullus lanatus*), Pear (*Pyrus amygdaliformis*), Peach (*Prunus persica*), Apricot (*Prunus armeniaca*), Plum (*Prunus cerasifera*), Mango (*Mangiferaindica*), Litchi (*Litchi chinensis*), Ber (*Ziziphus mauritiana*) and Pomegranate (*Punicagranatum*) at Honey Bee Research and Training Centre, Pantnagar, Uttarakhand during 2011-2014.It has been found that the common shape of pollen is spherical. It was also observed that almost all the pollen grains from a family were similar in morphological descriptions. The morphology structures of different pollen grains were entirely different. The exine surface of pollen grains was observed with pointed spines, smooth, thick, thread like and hexagonal structure. Thus, the purpose of this study is to provide the reference information on nectar and pollen source for honeybees and to evaluate the morphological difference in pollen grains of selected bee flora.

◆◆◆◆◆◆

I-3 Challenges of Pest Management in Horticultural Crops Under Protected Cultivation

Rajesh Pratap Singh
Professor
Department of Plant Pathology, College of Agriculture
G. B. Pant University of Agriculture and Technology,
Pantnagar- 263 145, Udham Singh Nagar (Uttarakhand)

Under protected environment various horticultural crops can be taken all around the year and crops could be grown under the inclement climatic conditions when it would not be otherwise possible to grow them under the open field conditions. With the advancement in agriculture various types of protected cultivation practices like - green house, glass/poly house, Trench Planting, Low tunnel, High tunnel and Rain shelter, suitable for a specific type of agro-climatic zone have emerged. Among these polyhouse cultivation is most common and widely adopted.Though green/poly house technology is more than 200 years old, but in India, poly house cultivation started during early nineties. There is a vast scope for expansion of poly house production in India.

While creating favourable environment in the greenhouse for growing high value crops; we also create a favourable habitat for their insect pests and diseases. High plant densities, training, pruning and the resulting microclimate are favourable to disease spread. Air exchange with the outside is restricted, so water vapour transpired by the plants and evaporated from warm soil tends to accumulate, creating high humidity.High day time temperatures, poor ventilation and cultural practices provide ideal conditions for the rapid multiplication of plant pathogens.These factors affect the disease development up to great extent. Under protected conditions ETL of most of the insect pests and diseases are lower and requires more monitoring and care. Since high value crops are grown under protected conditions right from nursery raising and seedling plantations to harvesting, not only crop need very well planned disease and pest management strategies rather prior to erecting protect structure, design related issues especially choice of cladding material, entry, height, insect screens, ventilation components and irrigation system should be planned in such a way that should minimizes leaf wetness and humidity at the plant canopy level.

First step towards sustainable plant protection is to analyse why and which insect pest and plant pathogens are able to increase their population densities until reaching damaging levels. Methods to improve the accuracy and speed of diagnosis are needed, particularly for diseases.Knowledge of environmental factors that allow or prevent pest or pathogen to reach economic injury levels may help us to design integrated management strategies by integration of cultural practices, use of resistant cultivars, natural enemies/microbial antagonists, air circulation, humidity control, sanitation, disease-suppressive composts etc. Application of integrated pest management practices along with selection of suitable pesticides and plant protection equipment will ensure good quality and safe products to the consumers at the same time, enhancing economic returns to the growers.

◆◆◆◆◆◆

I-4 Field Efficacy Of Certain Novel Insecticides And Botanical Against Dbm (Plutellaxylostella) In Cabbage Crop At Tarai Region Of North Western Himalayas

R.M.Srivastava and Tanuja Phartiyal
Department of Entomology
G.B.Pant University of Agriculture and Technology,
Pantnagar,U.S.Nagar,Uttarakhand.

The present experiment was conducted with 8 treatments (including control)at Vegetable Research Centre of G.B.Pant University of Agriculture and Technology, Pantnagar, U.S.Nagar,Uttarakhand during 2014-15.The data of Both season with each spray indicates that per cent reduction in population of *P.xylostella* in T6 emamectin benzoate 25% SG has shown best control followed by T7 thaimethoxam 25%WG, T8 Acetamiprid 20%Sp ,imidacloprid 17.8 SL , T-4 srishti shastra(botanical pre mix),T3 NSKE 10%and least control was found in T2 NSKE 5%.Even though highest control was observed in treatment T6 but results were satisfactory with T3 and T4 and can be recommended as to least impact on natural enemies.

◆◆◆◆◆◆

Oral Presentation

Repellency test of some botanical plants against banana pseudostem weevil

Inee Gogoi[1] and Priyanka Borbaruah[1]
[1]Department of Entomology, Assam Agricultural University, Jorhat-13, India

ABSTRACT

Laboratory experiments were carried out in the department of Entomology of Assam Agricultural University,Jorhat, Assam, India to evaluate the repellency test of some plant extracts *viz., Azadirachtaindica, Meliaazedarach, Clerodendruminerme, Xanthium strumarium* and *Lantana camara*against banana pseudostem weevil, *Odoiporuslongicollis*. The adult pseudo stem weevils were collected from damaged banana plantations and placed in plastic buckets along with larger pseudo stem pieces.For conducting choice tests, five uniform size pieces of pseudo stems were dipped in five plant extracts and one pseudo stem was dipped in distilled water as control and later all pseudo stems were air dried and then pseudo stems were placed in big circular plastic basins and all the six were kept at equidistant positions from each other in the basin. Thirty mature pseudo stem weevils were placed in the middle of the basin. Based on the data on screening of plant extracts for their repellency, extract of *Lantana camara*was found to be most effective with lowest settlement response of weevils i.e 0.33 at 48 hours after treatment followed by *Azadirachtaindica, Clerodendruminerme, Meliaazadirach*and *Xanthium strumarium*with settlement response 1.33, 3.33, 4.00 and 4.00 respectively. Thus, these botanicals possess repellent activity against the target insect which can be the alternative for synthetic insecticides.

Keywords: *Azadirachtaindica, Meliaazedarach, Clerodendruminerme, Xanthium strumarium*,*Lantana camara*

◆◆◆◆◆◆

Integrated Pest Management in Vegetable Cultivation- Tapping the untapped Potential

Umakant Pandey, Rakesh Tiwari and Rohit Kumar
HCL Foundation, SAMUDAY, Hardoi, Uttar Pradesh

ABSTRACT

Vegetable cultivation is a most challenging compare with cereal production. It starts from selection of variety, intercultural operation- nutrient and pest management and it affect the quality and quantity of vegetable. Several studied revealed that pesticide usage in vegetable cultivation is very high as result the cost of cultivation also is very high. Due to lack of better agriculture practice alternative which are reduce the pesticide use. HCL Foundation tried a unique intervention plan that build confidence of farmer on use of IPM tools to reduce the use of pesticide without hampering the productivity of crop. HCL Foundation philosophy of growing the health vegetable and fruit free from harmful pesticide to reduce health complication by adopting this type of farming. The pilot study was conducted in Hardoi district of Uttar Pradesh by HCL Foundation, SAMUDAY to impact assessment of IPM tool- pheromone trap in vegetable cultivation against polyphagous pest Spodoptera litura intensive vegetable field of Tomato, Brinjal, Chili and Capsicum. In our pilot project we got positive result, the pre study before installation of IPM tools resulted that first month after transplantation 7-10 no of spray of insecticide were common. It number have been increased as crop grown to mature stage. During whole cropping season approximately 35-40 no of sprayed in a season, per cost about 60-100 Rs. After incorporate IPM practice and

adoption of improved package of practice the number of spray had been reduced from 40 to 8 no of spray. To conclude, the use of IPM tools reduce the pesticide load on environment and cost incurred in a season by up to 60-80%.

◆◆◆◆◆◆

Rootstock breeding for resistance to fusarium wilt and gummy stem blight in Cucurbitaceous vegetable crops

Kowsalya K B[1], Sulochana K H[1]

[1]Division of Vegetable Crops, ICAR- Indian Institute of Horticulture Research, Bengaluru, Karnataka

ABSTRACT

Among the cultivated vegetable crops, Cucurbitaceae forms the largest group and it consists of about 118 genera and 825 species (Jeffrey, 1990).Most of the cultivated cucurbit crops including melons are susceptible to various biotic and abiotic stresses (Mondal *et al*., 2020). Major production constraints are soil-borne pathogens, of which fusarium wilt and gummy stem blight are of major importance. Fusarium wilt, caused by *Fusarium oxysporum f. sp. niveum* (E.F. Sm.) Synd. & Hans., or FON is the most serious disease globally, causing 100% yield loss (Callaghan *et al.,* 2016). Gummy stem blight (GSB) is an emerging and devastating disease caused by *Didymella bryoniae*,poses a serious threat to cucurbits cultivation. It is reported to be seed-borne (Lee *et al.,* 1984), air-borne (Van Steekelenburg, 1983) and soil-borne (Keinath, 1996; Burton, 1998), causing up to 15-50% yield losses (Keinath *et al.,* 1995). Management of these diseases has strongly relied on the use of chemical soil disinfestation. However, a shift from chemical to non-chemical means of control is underway to ensure environmentally safer measures to accomplish international regulations. Disease-resistant cultivars were developed to limit damages incited by soilborne fungi. However, so far, no commercial hybrids have shown complete resistant to the race 1, 2 of FOM and to *D. bryoniae*. But only sources of partially effective quantitative resistances have been reported in melon (Crino*et al.,* 2007) and watermelon (Gusmini *et al.* 2005). So, rootstock breeding is one of the best strategies we can opt for securing yield stability under disease conditions in a sustainable manner. Apart from providing resistance to diseases, grafting is said to increase vegetative growth, plant height and fruit quality compared to the non-grafted ones. Providing resistant rootstocks to susceptible scions prevent primary source of infection, resulting in reduced incidence of disease (Davis *et al.,*2008). Globally, to manage soil borne pathogens through non-host resistance, Lagenaria and interspecific Cucurbita hybrid rootstocks are mostly used for grafting watermelon (Burton *et al.,* 2009). Grafting onto former resulted in early flowering while the latter was found to be more vigorous with increased fruit weight, 40% increase in fruit lycopene content and increase in total yield was observed. However, the above-mentioned rootstocks have been reported to have undesirable effect on quality parameters (Pal *et al.,* 2020). Thus, to eliminate the problems of incompatibility and the detrimental effects on fruit quality, great efforts have been devoted to find or breed watermelon rootstocks, mainly of Citrullus species, as a result, *Citrullusamarus* (Alejandro *et al.,* 2017) and *Citrullus lanatus var. citroides* possessing resistance to FW and GSB have been identified. But, till date there are no reports of *Citrullus sp.* rootstocks showing combined resistance for fusarium wilt and gummy stem blight in watermelon. Therefore, rootstock breeding programs could address the need to develop new hybrid varieties by combining the desirable characteristics such as disease resistance, fruit quality and adaptability to environmental stress. (Huh *et al.,* 2002).

◆◆◆◆◆◆

Infestation of Seed Borer in Jamun Genotypes

[1]Vani N.U, [2]P.C. Tripathi, [3]B.R. Jayanthi Mala
[1]PhD Scholar, Department of Horticulture with Specialization in Fruit Science, IGKV, Raipur
[23]ICAR-IIHR, Bengaluru

ABSTRACT

An experiment was conducted at the ICAR-IIHR, Bengaluru, Karnataka, to ascertain infestation of seed borer in 65 jamun genotypes during the years 2021–2022. Jamun (*Syzygium cuminii* L) is a huge, widespread evergreen tree native to the Indian subcontinent. The tropical and subtropical regions of India contain the largest portion of jamun trees.Jamun is attacked by a number of insect pests and a eulophid seed borer (*Anselmella kerrichi*)that has lately been discovered to be generating significant economic losses in the production of jamun. Fruits of each replication were keenly observed for infestation and noted as infected if symptoms were found. Among the studied genotypes SS-6 got completely infected with seed borer followed by KHA-14 (96%), Patna (92%) and Collection-7 (88%) whereas PGR-9 found least infestation (2%) preceded by Savadatti (6%), Selection-45 and Selection- 58 (8%). The beginning of the monsoon season marked the peak incidence of insect pests during the experiment period. Therefore, detailed investigations on insect pests concerned with the impact of weather conditions in jamun may assume practical importance. This experiment concluded that genotypes PGR-9, Savadatti, Selection-45, Selection- 58, Dhoopdal, Chikkodi and PGR-8 were least infested with eulophid seed borer and can be further utilized for breeding purposes.

◆◆◆◆◆◆

Laboratory evaluation of certain new generation insecticides against crawlers of papaya mealybug, Paracoccus marginatus

Swastika Gogoi and Mousumi Phukon
Department of Entomology, Assam Agricultural University, Jorhat -13

ABSTRACT

The exotic polyphagous pest known as the papaya mealybug, *Paracoccusmarginatus* originated in Central America was first described in 1992 by Williams and Granara de Willink. Due to the presence of a waxy covering and a high reproductive capability their management becomes challenging. The present study was carried out to test the efficacy of five new generation insecticides (imidacloprid 17.8 SL, thiamethoxam 25 WG, chlorantraniliprole 18.5 SC, spiromesifen 22.9 SC, lambda cyhalothrin 5% EC) against the crawlerstage along with one standard check (profenofos 50 EC) during 2020-22 in Post Graduate Laboratory, Department of Entomology, Assam Agricultural University, Jorhat, Assam. The laboratory-raised sprouting potatoes were used to raise the mealybugs that were present in the infected leaves and fruits. Bioassay of chemicals against *P. marginatus* was carried out by following the leaf disc method and mortality counts were made at 12, 24 and 48 hours after treatment. The LC_{50} values of the insecticides were determined using probit analysis. Experimental findings revealed thiamethoxam 25 WG (0.01 per cent concentration) to be the most effective against the crawlers of papaya mealy bug with the highest recorded per cent mortality of 60, 72 and 87 per cent after 12, 24 and 48 hours, respectively. The LC_{50} values againstthiamethoxam 25 WGwere 0.012, 0.004, 0.001 per cent after 12, 24 and 48 hours after treatment.Among the five tested insecticides, thiamethoxam 25 WG showed more toxic effect with the least LC_{50} value over the crawler stage.

◆◆◆◆◆◆

Persistence of Paclobutrazol in Soil And its Residues in *Sapota* Leaves, Buds and Fruits

Susheel Singh, Vanrajsinh H. Solanki, Nitisha S. Patel, Rohan Kansara, Avnish Kumar Pandey and K.G. Patel
Food Quality Testing Laboratory, NM College of Agriculture,
Navsari Agricultural University (Gujarat)-396450

ABSTRACT

Soil application of paclobutrazol (PBZ) has been efficacious in promoting flowering and increasing yield in many fruit crops particularly the perennial fruit crops with an alternate bearing habit of fruiting and regarded as moderately hazardous to humans, with a remote possibility of being genotoxic and carcinogenic. PBZ has been characterized as a persistent stable compound in soil and water matrices with a half-life of more than a year under both aerobic and anaerobic conditions. However, its use in mango is quite common and now attempts are made to optimize the application in other crops like sapota. No scientific studies have been published that investigate the residues and degradation dynamics of PBZ in soil and its residues in sapota leaves, buds and fruits. A Field experiment was conducted for two consecutive years by drenching PBZ (Cultar 23 SC, w/w) in the tree basins at the rate of 5.0 and 7.5 g a.i./tree respectively diluted in 10 L of water per tree. The dissipation of PBZ in soil followed the Single First-Order Rate degradation model and the dissipation half-life of PBZ worked out in sapota tree soil was 43.77 and 49.51 days for the lower and higher doses, respectively. The PBZ residues were detected up to 270 days in sapota fruit, leaves and buds. The PBZ residues detected from the sapota fruits collected on 120 and 180 days were 11.89 & 13.73 ng/g which is marginally exceeding the MRL value fixed by the European union *i.e.* 10 ng/g for stone fruits.

Keywords : *Paclobutrazol, residue, Persistence, dissipation, MRL*

◆◆◆◆◆◆

Environmental Risk Assessment: An Integral Component of Comprehensive Pest Risk Analysis

Dalsaniya Nirali, Singh Susheel, Ahlawat, T.R. and Patel, R. D.
[1,]NAHEP-CAAST, Agricultural University, NMCA, Navsari Agriculture University (NAU),
Navsari- Gujarat

ABSTRACT

Numerous pest species, including insects, mites, fungi, bacteria, nematodes, rats, weeds and others, compete with people for food, lower the quality of agricultural products and spread diseases to both domesticated and wild animals and people. As a result, since people started to live and cultivate, they have managed pests. Currently, behind habitat destruction, invasive alien species pose the greatest threat to biodiversity. While the movement of plants and animals across habitats and ecosystems is a natural process as ecosystems are inherently dynamic in nature and it also cause the lose of some naturally habited species.This phenomenon is being accelerated due to globalization as well as domestic human movement. If many species are inadvertently transported to new habitats, others are purposefully introduced for financial gain or other reasons. Approx. 1,20,000 non-native species of plants, animals and microbes have invaded just six countries - the US, the UK, Australia, South Africa, India and Brazil. Furthermore, biological invasions are widely expected to become a more serious issue in the future. So, the Government of India legislated the Destructive Insects and Pests (DIP) Act in 1914. This Act has

been modified through a various of notifications that have been issued periodically. It also includes a provision for domestic quarantine, which limits the transportation of certain planting material from one state to another state.Thus, pest risk analysis must be comprehensive type and it should also consider the various environmental risks involved.

◆◆◆◆◆◆

Genetic control of yellow vein mosaic virus disease tolerance in Okra [*Abelmoschus esculentus* (L.) Moench]

Dr A I Patel, Dr J M Vashi and Dr C G Intwala
Department of Vegetable Science,
ASPEE College of Horticulture and Forestry,
Navsari Agricultural University, Navsari (Gujarat)

ABSTRACT

Yellow vein mosaic virus (YVMV) and enation leaf curl virus (ELCV) are major viral diseases of okra [*Abelmoschus esculentus* [L.] Moench] in the tropical and sub-tropical areas; threatening its commercial cultivation. The okra production in India, is hindered by occurrence viral diseases, like Yellow Vein Mosaic Virus (YVMV) disease and Okra Enation Leaf Curl Virus (OELCV) disease, spread by an insect vector, namely whitefly (*Bemisia tabaci* Gen.), which affect okra production in terms of yield and fruit quality as well. The study aims to screen okra genotypes against viral diseases assess the extent of marketable yield loss due to YVMV infection. Okra geneticists across the world tried to understand the inheritance pattern of YVMV disease tolerance without much success. Therefore, the inheritance pattern of YVMV disease in okra was revisited by employing six generations (P , P, , F , F, , BC and BC,) using 84 advanced breeding lines derived from the resistant sources against YVMV in okra and were planted during Summer-2021 at Vegetable Research Station, ASPEE College of Horticulture and Forestry, N.A.U., Navsari. Among 84 advanced breeding lines, two resistant lines (NOL-17-05 and NOL-19-08) and two susceptible lines (NOL-21-56 and NOL-21-84) were identified and crossed with in resistant X susceptible manner to obtain four hybrids. Their advanced generations *viz.,* F_1 and F_2 generations and backcrosses *viz.,* BC_1 and BC_2 were also made to study their segregation pattern for YVMV resistance; thereby to reveal the gene action involved in these resistant lines. Qualitative analysis for YVMV resistance revealed the involvement of a single dominant gene in resistant varieties *viz.,* NOL-17-05 and NOL-19-08 which can be utilized to develop high yielding YVMV disease resistant/tolerant varieties or hybrids.

◆◆◆◆◆◆

Mass multiplication of predator *Chrysoperla* sp. for managing sucking pests of horticultural crops

Dipti Joshi and R. P. Maurya
Department of Entomology, G. B. Pant University of Agriculture and Technology,
Pantnagar-263145, U.S. Nagar, Uttarakhand

ABSTRACT

There are numerous insect pests which attack onhigh yielding horticultural crops including vegetable, fruit, ornamental cropsetc. Pests like aphids, thrips, whitefly, leafhopper and mealybugs are the major threat for these horticultural crops. Keeping the ill effects of chemical pesticides, the chemointesive practices should be discouraged and more emphasis should be given on the adoption of biointesive or ecofreindly approaches.

Among the bioagents predatory lacewings has great importance owing to its wide host range and adoptability. These lacewings feed on the soft bodied insects and their eggs. In present work, emphasis has been given on the laboratory mass rearing of native predatory lacewing, *Chrysoperla* sp. This bio-agent is easily available in nature and can be reared in laboratory conditions. An experiment was carried out where the adultsof *Chrysoperla*sp.were collected from different horticulture crop ecosystems and the mass multiplication was carried out in laboratory conditions. For the regulation of preferred environment, BOD was used and temperature and relative humidity were kept at 25!±2 and70%±5. Degenerated eggs of *Corcyra cephalonica* were provided to the larval instars as the larval stage is the only predatory stage. After pupation, adults were utilized for the egg laying in mass quantity. Total life cycle ranges for around four weeks. Eggs of *chrysoperla*sp. were again isolated and kept under observation. Timely release of larval instars can be done in the field for managing preferred pests. This technique is not only the low cost technique but also the environmental friendly.

◆◆◆◆◆◆

POSTER

Physical and biochemical screening of brinjal genotypes against root knot nematode for use in tomato grafting

Pooja Pahal[1], Indu Arora[1], Vinod K. Batra[1], Anil Kumar[2] and Kalpana Yadav[1]
[1]Dept. of Vegetable Science, [2]Dept. of Nematology,
CCS Haryana Agricultural University, Hisar-125004

ABSTRACT

Root-knot nematodes (RKNs) are the major problem in tropical and subtropic alclimatic zonescausing significantdamage, especiallyinprotectedstructures.Root knot nematodes *(Meloidogyne incognita*) infecting particularly vegetable crops are one of the most wide spread pathogens limiting world agricultural productivity. In order to identify resistant cultivars and rootstocks forgrafting of tomato and to recommend suitable eggplant cultivars for grafting to farmers for both protected and open field cultivation, there is a need to screen existing eggplant genotypes against nematode resistance.

In this study, brinjal genotypes were screened for nematode resistance as rootstocks for tomato grafting to overcome the problem of root knot nematode in open field and protected cultivation. 23 genotypes of brinjal were screened in Screen house of Nematology, CCSHAU, Hisar in pots having sterilized soil and inoculated with 1J2/g soil with *Meloidogyne incognita* after 10 days of transplanting. G-19 and G-20 genotypes were found highly resistant with RKI of 1.00, G-6 and G-8 were found resistant with RKI of 2.00 and 2.66 and G-5 and G-14 were found highly susceptible with RKI of 5.00 and rest of genotypes were moderately resistant. Phenol test was performed for few screened genotypes which were found either highly resistant, moderately resistant and highly susceptible among the 23 genotypes. In genotypes, G-19 and G-20 showed high phenol content (0.22-0.28 mg/g), while G-6 and G-8 were resistant with a phenol content of (0.17-0.20 mg/g) and G-5, G-10, G-14 and G-22 were susceptible genotypes with lower phenol content (0.13-0.16 mg/g). It was concluded that higher phenol content in roots of resistant genotypes is responsible for nematicidal activity and therefore rootstocks offer nematode resistance to grafted plants.

◆◆◆◆◆◆

Compatibility of entomopathogenic fungi *Beauveria bassiana* with some promising plant based oils

Bhaswati Saikia and Mousumi Phukon
Department of Entomology, Assam Agricultural University, Jorhat, Assam, India.

ABSTRACT

An experiment was conducted at Physiology laboratory of Department of Entomology, Assam Agricultural University, Jorhat, India to check the compatibility of botanicals (Neem oil, Karanja oil, Jatropha oil and Citronella oil) with entomopathogenic fungus (Beauveria bassiana). 40% of global crops were lost to pest every year due to pest infestation in respect to which use of pesticide became a easy solution along with its hazardous effect. But in recent times, botanicals and entomopathogens played a potential role in controlling pest more effectively. And when mixtures of both was developed, due to their synergistic effect, the compatibility would enhance the control of insect pest. Hence, the research work was conducted to study the compatibility of botanicals with entomopathogenic fungus (Beauveria bassiana). The efficacy of the entomopathogenic fungus was tested by studying the compatibility with oil each with four consecutive concentration. The treatments *viz.*, T1:Neem oil+

B.bassiana (Neem oil@ 2.00+B.bassiana, Neem oil@ 1.00+B.bassiana, Neem oil@ 0.50+B.bassiana), T2: Jatropha oil+ B.bassiana (Jatropha oil@4.00+B.bassiana, Jatropha oil@2.00+B.bassiana, Jatropha@ 0.50+B.bassiana), T3:Karanja oil +B.bassiana (Karanja oil@2.50+B.bassiana, Karanja oil @ 1.00 +B.bassiana, Karanja oil@ 0.25+B.bassiana), T4:Citronella oil+B.bassiana (Citronella oil@ 1.00+B.bassiana, Citronella oil @0.50+B.bassiana ,Citronella oil@0.30+B.bassiana). The radial growth of the entomopathogenic fungus at each treatment was calculated from 3,5,7 and 14 DAT where T4:Citronella oil + B.bassiana (Citronella oil@0.36+B.bassiana) was found to be highly compatible as compared to others. Therefore, Beauveria bassiana with citronella oil@0.36 concentration could be a potential combined bioagent in the management of pest by an integrated approach which would be cost effective as well.

◆◆◆◆◆◆

Evaluation of neem oil against papaya mealybug, *Paracoccus marginatus*

Bondita Bora and Inee Gogoi
Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

ABSTRACT

Papaya mealybug, *Paracoccusmarginatus* is an invasive pest which is gaining attention in recent years. The management of this devastating pest has become a concern in recent years.

The neem seed oil was evaluated during 2020-2022 in Post Graduate Laboratory, Department of Entomology, AAU, Jorhat against the crawler and adult stages of papaya mealybug, *Paracoccusmarginatus*.Leaf Disc bioassay was carried out with five different concentrations of neem seed oil along with a control. For crawler stage the concentrastions were 0.5, 1.0, 1.5, 2.0 and 2.5. Similarly, for adult stage the concentrations were 1.0, 1.5, 2.0,2.5 and 3.Incrawler stagethehighe stpercentmortality of 54.00,65.00,76.00 and 85.00 were recorded at concentration of 2.50% neem seed oil after 12, 24, 48 and 72 hours of treatment, respectively. Similarly, in adult stage the highest mortality of 60.00, 71.00, 82.00 and 85.00 per cent was recorded at 3.00 per cent concentration of neem seed oil after 12, 24, 48 and 72 hours of treatment, respectively. After an exposure period of 12, 24, 48 and 72 hours the LC50 values against the crawler stage were obtained as 3.141, 2.220,1.426 and 0.828 per cent. In case of adults, the LC50 values obtained after an exposure period of 12, 24, 48 and 72 hours was 3.427, 2.240, 1.668 and 1.365 per cent. Thus neem seed oil showed the insecticidal potential against the devastating papaya mealybug which can be the alternative for chemical insecticides.

Keywords: Papaya mealybug, Neem seed oil

◆◆◆◆◆◆

A simple and effective managementstrategy for grapevine stem borer, *Celosterna scabrator*

Deependra Singh Yadav[1] and Gokul S. Shankhpal[2]
[1]ICAR-National Research Centre for Grapes, Pune 412307
[2]Lovely Professional University, Phagwara 144411

ABSTRACT

Celosterna scabrator (Coleoptera: Cerambycidae) was reported for the first time as a pest of grapevines in 1968by Upasani*et al*. Since then, it has been a major pest of grapevines in Maharashtra and Karnataka states of India.The yield loss due to *C. scabrator* was estimated to be 30.10-56.26% in infested vines. A simple and

effective management strategy based on regular monitoring and manual removal of grubs of *C. scabrator* was developed and validated at farmers' vineyards in Nashik between February 2020 to February 2022. It was found that regular monitoring at 10 days interval during December to April and manual removal of *C. scabrator* grubs using screwdriver at the initiation of appearance of frass near the plant was highly effective. The experiment was conducted in seven *C. scabrator* infested vineyards at Sarole Khurd, Nashik and the level of infestation ranged from 6.15 to 20.35% before imposing the management. After following this practice for two fruiting seasons 2020 and 2021, the infestation level ranged from 0.17 to 0.55 per cent during 2022 resulting in total 96.84 per cent reduction in the infestation and total savings of Rs. 1.88 lakh per year in these seven vineyards. This was also validated at Nashik and Solapur during October 2021-April 2022 in two other farmer vineyards and the level of infestation was 12.25 & 22 per cent, respectively. The strategy provided 100% control of *C. scabrator* and resulted in yield statistically at par with healthy vines and significantly superior over infested untreated vines.

◆◆◆◆◆◆

Uttarakhand Kiwi and Plant Parasitic nematodes: Distribution and association

Arun Veratiya, Shilpi Rawat, Satya Kumar, Deepak Prakash, Meena Allada, Vaishanavi, Ayushi and Abhishek

Department of Plant Pathology, College of Agriculture,
GBPUAT, Pantnagar-263145

ABSTRACT

Kiwi (*Actinidia deliciosa* Chev.) belongs to family Actinidiaceae also known as Chinese gooseberry and this horticulture wonder got its name kiwi from New Zealand. The production of kiwi in India is 13000 MT over an area of 5000 ha. It plays a significant role in the economy of Uttarakhand as it is produced all around the year because of the favourable environmental conditions and geographical locations. But plant parasitic nematodes have been a prominent limiting factor in kiwi output. Its output is declining due to parasitic nematodes such as *Meloidogyne Spp., Aratrichodorus Spp., Helicotylenchus spp., Paratylenchus spp., Tylenchus spp., Heterodera spp.* and *Pratylenchus spp*. which are present in all Kiwi growing parts. From Uttarakhand root knot nematode (*Meloidogyne spp*.) and other nematode species have been intercepted for the first time from the kiwi growing areas. The present investigation was attempted to study the status and distribution of root knot nematode (*Meloidogyne spp*.) and other important plant parasitic nematodes associated with kiwi in four districts of Uttarakhand. Four districts of Kumaon region of Uttarakhand state viz; Almora, Champawat, Nainital and Pithoragarh were surveyed and eight genera of plant parasitic nematodes Meloidogyne spp., Pratylenchus spp., Helicotylenchus spp., Tylenchorhynchus spp., Ditylenchus spp., Criconemoides spp., Aphelenchus spp and Tylenchus spp were identified and found to be associated with Kiwi plantations. *Meloidogyne spp.* was the predominant species with maximum population in all the surveyed areas with 100 per cent frequency of occurrence and average population ranges from 775/200 cc of soil to 2489 nematode /200cc soil. Correlation between plant parasitic nematode populations and abiotic factors uncovered noteworthy correlations. Soil moisture showed its positive significant correlation with *Meloidogyne spp*., *Helicotylenchus spp*., *Ditylenchus spp*. and *Pratylenchus spp*. Soil pH showed negative correlation with the population buildup of *Meloidogyne sp*p., *Pratylenchus spp*., *Helicotylenchus spp*. and *Tylenchorhynchus spp*. On the premise of the outcomes of the survey, it can be inferred that root knot nematode (*Meloidogyne spp*.) is a serious threat to kiwi growing area in Uttarakhand. Instant attention of the researchers and kiwi growing community is required to take appropriate decision to restrain their assist spread. Kiwi farmers need to be aware about the threat so that timely preventive management strategies could be taken so as to increase the quality and yield of kiwi crop.

◆◆◆◆◆◆

Mass production of Bio-agents for management of mealy bugs

Rajnni Dogra and R. P. Maurya
Department of Entomology, G. B. Pant University of Agriculture and Technology,
Pantnagar-263145, U.S. Nagar, Uttarakhand

ABSTRACT

Mealy bugs are important pests for horticultural crops like mango, guava, litchi, ornamental plant, etc. different species of mealy bug like- *Drosicha mangiferae, Maconellicoccus hirsutus, Ferrisia virgate, Planococcus citri, Paracoccus marginatus*, etc. are present in various horticultural crops and loss due to mealy bug is becoming a serious threat in production. They suck plant sap mainly from the phloem tissues and reduce vigor of plant resulting in poor fruit quality. The production of natural enemies for the management of insect pests comes under biological management. Some important coccinellid species *Cryptolaemus montrouzieri, Hippodamia variegate, Cheilomenes sexmaculata, Hyperaspis maindroni and Brumoides suturalis* belonging to order coleoptera are found to be predatory on mealy bugs. Success in biological can be best obtained from the native species of natural enemies. So the native strain of *Cheilomenes sexmaculata* was collected from different horticultural crop ecosystems and its mass production was done in laboratory conditions. The mass production of coccinellids in laboratory requires living host for the multiplication. Hence, the simultaneous culture of mealy bug was also done on sprouted potato tubers in a container covered with muslin cloth. BOD incubator was used for rearing and temperature 27^0C±2 and relative humidity 65%±5 were maintained. The mass multiplication of *Cheilomenes sexmaculata* takes place on mealy bugs colonies maintained on sprouted potatoes. Separated culture for the production of host was maintained. Further efficacy of these bio-agents on the host can be tested in the laboratory. Timely release is an important step towards the successful control of insect.

◆◆◆◆◆◆

Mass production of Predatory bug (*Eucanthecona furcellata*) in laboratory condition

Deepika Jeengar[1] and Ravi Prakash Maurya[2]
Department of Entomology, College of Agriculture, GBPUAT, Pantnagar, Uttarakhand

ABSTRACT

Eucantheconafurcellata (Wolff) (Hemiptera: Pentatomidae)is potential predator bugs on various agriculture (Cotton, Castor,Pigeonpea, Chickpea, Mungbean) and horticulture crops (Citrus, Apple, GuavaCashewnut, Cabbage,). It has predacious nature as both nymph and adult.It bears astylet as it suck the hemolymph from soft body insectespecially leaf feeding caterpillars including lemon butterfly, Cabbage butterfly, Slug caterpillar, Tobacco cutworm, Bihar hairy caterpillar, Pod borer and other lepidopterous larvae. This predatory bug is frequently noticed in field during *Kharif* season.In present work, different stages (eggs, nymphs and adults) of this predatory bug were collectedfrom different crop ecosystems. The laboratory mass production of *E. furcellata* can be done on lepidopterous larvae like *Corcyra cephalonica*, *Spodopteralitura*, *Spilosomaobliqua*, *Galleria mellonela*. The work on mass rearing of this predator began in laboratory conditions on *Spodopteralitura* (Lepidoptera: Nocutidae) whichreared on castor leaves. Rearing of predatory bug was started in plastic troughs. The optimum temperature 27C^0+-2C^0 and relative humidity 65+_5% was maintained in the laboratory for rearing of this bug. Incubation period of *E. furcellata* lasted for 5-7 days.There were five nymphal instars and the nymphal period completed in 19 – 21 days. First instar nymphs were not predacious and required only intake of water. After second instar, all stages feed voraciously on larva of*Spodoptera*.Female

bugs were larger and had more longevity compared to male bugs. Since *E. furcellata* has shorter life cycle, higher fecundity and high survival ability. Field release can be done by different method- egg sprinkle on foliage, eggs in plastic cups attached to the branch of lower canopy of plants, nymphs and adult also released on the foliage of different ecosystem.

◆◆◆◆◆◆

Impact assessment of Climate change and suitable adaption strategies for insect Pests of Potato: Indian scenario

Anuj Bhatnagar[1] and S. Subhash[1]
[1]ICAR-Central Potato Research Institute-Regional Station, Modipuram, Meerut, U.P-250110

ABSTRACT

Potato is grown in almost all Indian states under diverse climatic conditions. Among the various factors related to insect pest and diseases, potato farmers are increasingly forced to face water stress change, changes in rainfall patterns and its intensity, frost and fog etc. These conditions are generally interpreted to climate changes. Potato production is highly dependent on climate and weather factors. All climate change projections are based on simulations and therefore involve uncertainties. However, it is clear that climate change will not only affect the cultivation system but also change the pressure of insect pests of potato. Whitefly, aphids, thrips, hoppers and mite may become more serious in last two decades on potato crop because they are not only sucking the sap from tender parts but also transfer number of viral diseases, resulting degeneration of crop. The three years pooled data revealed that highest thrips and whitefly population was recorded in September planted crop with high incidence of stem necrosis and apical leaf curl disease, respectively. The high temperature (30-35 ^{0}C) and dry weather during early October is favorable for the development of stem necrosis disease. Similarly, whitefly activity was also trigger on early crop due to high temperature and moderate humidity. At present most of the potato seed is grown in North-western plains under low sucking insect pest period in order to keep it virus free but change in climate, in certain regions aphids/whiteflies/thrips will occurs in more virulent forms, resulting threat particularly to virus free seed production in India. There is a urgent need to critically and scientifically assess the impact of climate change on the insect pests of potato. The best economic strategy for Indian farmers is to use IPM practices, monitor insect pest occurrence and their buildup on potato crop.

◆◆◆◆◆◆

Use of IPM modules in the management of diamondback moth in Cabbage

Akhilesh Kumar, Smita Singh, TK Singh,Manju Shukla and AK Pandey
JNKVV-Krishi Vigyan Kendra, CoA, Rewa-486 001 (M.P.)

ABSTRACT

The diamondback moth (DBM), *Plutella xylostella* (L.) is the most destructive insect pest of cabbage and even more difficult pest to control and other cruciferous vegetables worldwide and one of the planet's worst agricultural pests. The loss in crop yield caused by this pest varies from 31 to 100%. Its cultivation is spread across tropical to temperate climatic conditions and constitutes the most important component in the diets of various cultures. The production of healthy and insect pest-free cabbage to fetch a remunerative price in the market, more attention has been paid towards the plant protection measures. Under extensive cultivation, cabbage suffers from the diamondback moth (DBM) that affects the production and quality of the yield. In IPM modules of DBM in cabbage use of Chinese cabbage as trap cop after every 11 rows of cabbage and Emamectin

benzoate 5 SG @ 0.35g/l at 10-15 days interval (RP-1) in cabbage crop under irrigated condition. On farm trial were conducted in different location of Rewa (MP) on 05 famers' field with three treatments in 2021-22. To evaluate the performance of recommended practice in cabbage, Use of Chinese cabbage as trap cop after every 11 rows of cabbage and Emamectin benzoate 5 SG @ 0.35g/l at 10-15 days interval (RP-1) was found very effective to reduce the DBM damage and compared with farmers practices (FP) was found more DBM damage than recommended practice (RP). Average economics and benefit cost ratio of both FP and RP plots were worked out. In RP-1 net profit was recorded Rs. 274925.00/ha while in FP Rs. 14225.00/ha as net profit was recorded. Average benefit cost ratio was 4.27 while 3.12 in FP. The highest average yield was recorded in RP-1 as 378.00 q/ha with lowest DBM population was 0.90 larva/plant. The assessed technology use of Chinese cabbage as trap cop after every 11 rows of cabbage and Emamectin benzoate 5 SG @ 0.35g/l at 10-15 days interval (RP-1) was very effective and more profitable to farmers and most economic for the management of crop losses in cabbage in comparison with farmers practices and increasing the yield.

◆◆◆◆◆◆

Species composition of field rodents in Rabi vegetables of Upper Brahmaputra Valley Zone, Assam, India

Mousumi Phukon, Ratul Kumar Borah And Archita Bhagawati
Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

ABSTRACT

A study was conducted to determine the species composition of field rodents in rabi vegetable cropping system of upper Brahmaputra valley zone, Assam, India during 2015-16 and 2016-17. Rodents were trapped at fortnightly interval using Bandicoot and Sherman traps at three villages of Jorhat district *viz.*, Neul gaon, Allengmora and Bekajan. And the trapped species were brought to the laboratory of All India Network Project on Vertebrate Pest Management, Department of Entomology, Assam Agricultural University, Jorhat for identification. Four species of field rodents *viz.*, *Bandicota bengalensis*, *Bandicota indica*, *Mus booduga* and *Dremomys lokriah macmillani* were identified. Among the identified species *Bandicota bengalensis* was recorded as the most abundant species (85.83% and 81%) followed by *M. booduga* (9.16% and 11%), *B. indica* (1.66% and 3%) and *D. lokriah macmillani* (3.33% and 5%) during 2015-16 and 2016-17 respectively. Also, the field rodents showed species richness (0.626 and 0.651) and species diversity (-0.612 and -0.712) during 2015-16 and 2016-17 respectively.

◆◆◆◆◆◆

Efficacy of *Bacillus Subtilis*, *Pseudomonas fluorescens* and *Trichoderma* Spp. for the control of tomato early blight

Mahmadjuber M.Sherasiya[1], Viral P.Prajapati[2] and Susheel Singh[3]
[1,2] NAHEP-CAAST, NMCA, Navsari Agriculture University, Navsari, Gujarat-396450
[3]Co-PI, Unit-4, NAHEP-CAAST

ABSTRACT

Tomato is widely consumed and is having prominent place in vegetarian diet.The management of early blight of tomato is considered to be one of the most challenging plant diseases all across the globe. This disease was predominantly being managed through the synthetic chemicals/fungicides during last 2 to 3decades. But indiscriminate use of these chemicals have devastating impact on the environment and human's health. Thus, reducing toxic chemical load as well as managing the early blight disease particularly in tomato is a new frontier

to the scientific fraternity. An attempt was made to evaluate the microbial antagonists to determine its efficiency to control the tomato early blight in greenhouse and field condition. Isolates of *Trichoderma*, *Bacillus subtilis* and *Pseudomonas fluorescens* were used as microbial antagonists.Fungicides and water were used as the reference and control tests, respectively. In both the greenhouse and field condition, all treatments markedly decreased the disease index as a percentage when compared to the control. The disease index measured in percent for fungicides was equivalent to the disease index measured in percent for the majority of chosen antagonists. Compared to the control, all treatments showed significantly greater yields. Results obtained in the study indicates a significant decrease in disease index which was also reflected in the higher yields of tomato treated with different antagonist with respect to control. Therefore, microbial antagonists could be prove to a potentialalternative to manage the early blight of tomato under greenhouse and field conditions.

◆◆◆◆◆◆

Development of eco-smart management practice against Fusarium wilt of banana exploring bacterial endophytes

Bishal Saikia[1] and Popy Bora[2]
[1]Department of Plant Pathology, Assam Agricultural University, Jorhat-785013, Assam
[2]Regional Agricultural Research Station, Titabar, AAU

[1]**ABSTRACT**

Fusarium wilt in banana is one of the most devastating disease threatening banana industry globally. We studied the potential of banana root endophytic *Bacillus* spp against the causal agent *Fusarium oxysporum* f. sp. *cubense* through pot experiment. The *in vivo* assays in tissue cultured banana plants treated with *Bacillus vallismortis (Bv)* (OM585584), *B. amyloliquiefaciens(Ba)* (OM232770) and *B. subtilis (Bs)* (ON386193) in different combinations against *Fusarium oxysporum* f. sp. *cubense* recorded significantly superior performance of consortium of *Bv* + *Bs* + *Ba* in terms of percent disease incidence at 7 DAS (7.50% with 88.15% disease reduction over control), 14 DAS (11.20% with 83.73% disease reduction over control), 21 DAS (9.72% with 83.73% disease reduction over control)and 28 DAS (3.70% with 96.07% disease reduction over control) which was followed by *B. vallismortis*. All the biagents proved plant growth promoting ability, however, the highest PGP was observed in consortia than single *Bacillus* spp in terms of increase in number of leaves per plant (10.33 nos.), pseudostem girth (20.40 cm) and plant height (58.57 cm) when treated with *Bv* + *Bs* + *Ba*at 90 DAP. Similarly the chlorophyll a (0.695 mg/g), chlorophyll b (0.477mg/g) and total chlorophyll (0.926 mg/g) content was also found highest in the consortia 30 DAS. The biochemical parameter such as phenol content in both root and leaves were also significantly superior in treated plants as compared to control. Our study put forths study on Bacillus-banana-pathogen interaction for field application endophytic consortia as growth promoter and against Foc in banana for sustainable production system.

◆◆◆◆◆◆

Study on the life cycle of red pumpkin beetle (*Aulacophora foveicollis*)

Diplina Yein, Dr Mousumi Phukon, Bhaswati Saikia
Department of Entomology, Assam Agricultural University, Jorhat 785 013, Assam, India

ABSTRACT

The Red pumpkin beetle (*Aulacophora foveicollis*) is one of the important pests of cucurbits. Owing to its damage, a study on its biology was carried out. Adults of *Aulacophora foveicollis* were collected from host plants like *Cucurbita moschata, Cucumis sativus, Lagenaria siceraria*. Breeding and rearing of the field

collected insects were done in plastic trays which were smeared with soil and were covered with a muslin cloth to prevent the escape of the beetles as well as for free circulation of air. Fresh and healthy leaves were supplied every day as feed. Studies on the developmental parameters of *Aulacophora foveicollis* were carried out and maintenance of the insect culture was done in the Physiology Laboratory, Department of Entomology, Assam Agricultural University, Jorhat.The study revealed that the length and breadth of the egg was 0.67 ± 0.06 mm and 0.57 ± 0.06 mm; while that of the 1st , 2nd ,3rd and 4th instar grub was 2.03 ± 0.26 mm, 4.59 ± 0.56 mm, 7.71 ± 0.18 mm, 11.20 ± 0.86 mm and 0.39 ± 0.02 mm, 0.66 ± 0.11 mm, 0.84 ± 0.11 mm, 3.03 ± 0.24 mm respectively; for the pupae it was 5.17 ± 0.34 mm and 3.06 ± 0.21 mm; for the adult male and female it was 6.81 ± 0.65 mm, 7.85 ± 0.82 mm and 2.69 ± 0.31 mm, 3.04 ± 0.30 mm respectively. The duration of the eggs, 1st , 2nd , 3rd , 4th instar grub, pupae, adult male and adult female was 11.4 ± 2.63, 4.2 ± 0.42, 4.3 ± 0.48, 3.6 ± 0.51, 4.9 ± 0.73, 13.1 ± 1.19, 42.0 ± 1.5 and 45.0 ± 1.71 days respectively.

◆◆◆◆◆◆

Efficacy of Some Plant Extracts Against Banana Pseudo Stem Weevil, Odoiporuslongicollis Oliver

Annabhatula Sasidhar, Inee Gogoi, Jabanika Hazarika
Department of Entomology, Assam Agricultural University, Jorhat-785013

ABSTRACT

Banana is one of themost popular fruit crops cultivated throughout the world. In India, banana ranks first in production and third in area among fruit crops. It accounts for 13 per cent of the total area and 33 per cent of the production of fruits.Banana pseudo stem weevil, *Odoiporuslongicollis*is considered as a predominant and also a major constraint for the production of banana on worldwide basis, especiallyin India. A preliminary investigation was carried out in Post graduate laboratory, Department of Entomology, Assam Agricultural University,Jorhat to determine the LC_{50} values of plant extracts *viz. Xanthium strumarium*, *Lantana camara, Clerodendroninfortunatum, Meliaazaderach*and*Azadirachtaindica*along with imidacloprid as standard check. In case of Solvent plant leaf extracts, the LC_{50}values of*X. strumarium* was found to be 32.507, 30.19 and 21.082, for *L. camara* it is 14.454, 11.65 and 9.741 %after 24, 48 and 72 hours after treatment. In case of aqueous plant leaf extracts, LC_{50} values were found to be 75.881, 58.708 and 39.02 % in case of *X. strumarium*. Similarly, *L. camara* showcased 21.863, 17.829 and 15.791 %..Based on LC_{50} values, order of toxicity was Imidacloprid> *Lantana camara*> *Azadirachtaindica*> *Clerodendroninfortunatum*> *Meliaazaderach*> *Xanthium strumarium* in case of both aqueous and solvent leaf extracts.

◆◆◆◆◆◆

A study on Nematode Adjustment to Environmental Stress

[1]Niraj Kumar Prajapati and[2]Awaneesh Chandra
[1]Dept. of Horticulture, Tilak Dhari Post Graduate College, Jaunpur - *222 002* (U.P.)
[2]Dept. of Entomology, Government Degree College, Varanasi - *221 305* (U.P.)

ABSTRACT

Nematodes are a diverse group of invertebrates and are abundant as parasites or free-living forms in soil, freshwater and marine environments. The more than 15,000 species described are most likely only a subset of the phylum Nematode. They live in the soil as eaters, fungivores, omnivores, predators, or plant parasites. Nematodes are a group of organisms that exhibit diverse adaptations to extreme soil and plant environments. The most common life cycle of nematodes includes an egg, four instars and an adult. Rest refers to a resting

state in which metabolism and activity slowdown in response to environmental stress. In contrast to diapause, hibernation ends when the environmental stress subsides and the worm resumes normal activity. Diapause and menopause are important for seasonal survival and long-term egg longevity in some species, but in others, changing the sex ratio can increase the chances of survival in the next generation. A more direct and immediate response to conditions involves cohesion or the formation of relatively hardy hibernators. Many nematodes can go into diapause in response to environmental stress and going into hyphae or other extremes allows for long-term survival in unusually stressful environments. These dormant survival stages may constitute a significant proportion of nematode populations in some terrestrial environments.

Keywords: Stress,nematodes,survival,habitat,environment.

◆◆◆◆◆◆

Screening against leaf curl virus in Bell pepper (*Capsicum annuum var. grossum*) germplasm

Gandikota Brahmani,S K Jindal,Abhishek Sharma and Sayeed AH Patel
Department of Vegetable Science,Punjab Agricultural University, Ludhiana,
Punjab, India, 141 004.

ABSTRACT

Chilli leaf curl virus is an important disease caused by begomovirus transmitted by vector whitefly (*Bemisiatabaci*). It is the most destructive viral disease causes severe yield loss. This virus causes leaf curling, rolling and puckering, thickening and swelling of veins, shortening of internodes and petioles leading to stunted plant growth along with sterility. Therefore, screeningof germplasm for biotic and abiotic stresses is a crucial step in resistance breeding programmes. Keeping this in view, the present investigation was undertaken at Vegetable research farm, Punjab Agricultural University, Ludhiana.Fifty bell pepper genotypes were screened against leaf curl virus with the standard check PSM-1. The experiment was laid out in a randomized complete block design with three replications under artificial conditions at nursery stage. All genotypes were screened and categorized into various groups *i.e.*, moderately resistant, moderately susceptible and highly susceptible classes based on their Percentage Disease Index (PDI) values. Among 50 genotypes screened, 15 were moderately resistant (PAU SM-28, PAU SM-61, PAU SM-71, PAU SM-16, PAU SM-43, PAU SM-20 and PAU SM-5), 27 genotypes were moderately susceptible (PAU SM-99, PAU SM-96, PAU SM-35, PAU SM-12 and PAU SM-26) and9 genotypes were highly susceptible (PAU SM-104, PAU SM-103, PAU SM- 93, PAU SM-94, PAU SM-78, PAU SM-101, PAU SM-66, PAU SM-72 and PAU SM-40). Hence it can be concluded that, all the resistant genotypes can be recommended to farmers for cultivation as well asthey can also be utilized in resistance breeding of bell pepper.

◆◆◆◆◆◆

Effect of biotic and abiotic formulations on quality production and control of Black spot of rose cv. Grand Gala

Anamika Sajwan, Santosh Kumar, R. P. Singh
Department of Horticulture, College of Agriculture, G.B.P.U. A & T, Pantnagar – 263145, U.S.Nagar

ABSTRACT

The majority of a flower's quality is a varietal attribute, but geographical and climatic circumstances also have a significant impact. Numerous fungal infections affect crops during their peak flowering season,

decreasing their market value. The present investigation was undertaken at the Model Floriculture Centre, G. B. Pant University of Agricultural and Technology, Pantnagar during 2016-2017. The experiment was conducted to test the different concentration and time of application of biotic formulationi.e., *Bacillus subtilis* var. *amyloliquifaciens* strain FZB24 (manufactured by Novozyme South Asian Pvt. Ltd. under the brand name Taegro) and abiotic formulationi.e., sodium bicarbonate (Baking soda) and acetic acid (Vinegar) on quality production and control of Black spot disease of rose cv. Grand Gala under field condition. The most effective method for boosting high-quality production, longer vase life and black spot management was determined to be foliar spraying with the standard chemical carbendazim 50% WP @ 500g/ha, 6 sprays at 7 days interval, followed by carbendazim 50% WP @ 500g/ha, 3 spray at 14 days intervalswhich was at par with *Bacillus subtilis* @ 1000 g per hectare, 6 spray at 7 days interval. While sodium bicarbonate and acetic acid have no discernible impact on the growth and disease control.

◆◆◆◆◆◆

Smart Nanosensors for Pesticide Residue Detection in Horticultural Crops: An Overview

Sourabh Maheshwari and JP Purwar
Department of Entomology, College of Agriculture, G. B. Pant University of Agriculture & Technology, Pantnagar-263145, U.S. Nagar, Uttarakhand, India

ABSTRACT

The horticulture sector in India is one of the fastest growing segments of agriculture, but it also faces a number of new challenges. Climate change, postharvest losses, bio-security concerns, emerging alien pests and pathogens, pesticide resistance and quality consciousness regarding pesticide residues are among the most prominent. Out of these challenges, Pesticides residues face major critics especially in export of horticultural commodities in global market, due to indiscriminate, unscrupulous and unscientific use of pesticides. This makes the commodities lade with pesticides exceeding the permissible limits and posing potential threats to human health, pollinators and non-targeted organisms. Although various techniques are being used from a very long time for the detection of pesticide residues like HPLC, Colorimetric Assays, ELISA, GC-MS and Electrophoresis etc. But, such approaches faced several constraints especially in on-site and real-time detection of Pesticides residues. Additionally, they are costly and inappropriate in emergency cases and even prone to variations in the environmental conditions. With the development in the field of nanotechnology, quick pesticide detection can be done with the modest and economically viable nanosensors for detecting, different pesticidal entities contaminating the horticultural crops. These nanosensors recognize enzymes, antibodies, molecularly imprinted polymers and aptamers which show high specificity and detect at a level much lower as compared to their macroscale analogs. Electrochemical Nanosensors made out of nanomaterial carrying Chitosan-Iron oxide nanocomposite and CuO NPs with 3D Graphene Composites are being used for detecting Malathion with Detecting sensitivity limits of 0.001ng/ml and 0.01nm respectively. Similarly, Optical NanoSensors are being used to detect Dimethoate and Metribuzin with detection limit of 0.002 ppm and 6.8 X 10^{-8} M respectively. Such sensors are rapid for detecting residues and contamination in the concerned commodities effectively and efficiently that can make a successful horticultural crop production, free of pesticide residues.

◆◆◆◆◆◆

Survey of Guava orchards infected with Root Knot Nematode (Meloidogyne enterolobii) causing Sudden Decline

Meena A1 , Satya Kumar2 , Shilpi Rawat3 and Abhishek Kumar4
1,2,3,4 Department of Plant Pathology G. B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand, India

ABSTRACT

Meloidogyne enterolobii was considered a minor root-knot nematode species, but nowadays this root-knot nematode species is spreading quickly and emerging as a major disease in crops due to which M. enterolobii has gained special attention recently. Even Mi genes which confer natural resistance to the root-knot nematodes are proven to be ineffective against M. enterolobii it has a wide host range of vegetable crops like tomato, okra, capsicum, sweet potato etc., fruit crops like guava, melon, fig etc and ornamentals. M. enterolobii is posing a serious threat to guava throughout the world. It was reported first in the state of Tamil Nadu in guava orchards. The farmers were facing the unique problem of the "Sudden Decline" of guava trees leading to the complete destruction of orchards. Recently in 2018, it was reported in Udham Singh Nagar district in the Tarai region of Uttarakhand, where the guava is suffering a variety of sudden decline symptoms which may pose a serious threat to the guava cultivation of the state. Guava (Psidium guajava L.) is an important fruit crop in our country and known as the poor men's apple it is highly prone to soil-borne root invaders *viz.* root-knot nematode affects the crop growth and productivity in its early stages. Guava being a transplanted crop farmers purchase saplings from nurseries or other farmers and the possibility to introduce the nematode into the new area either attached to roots or in the soil. Therefore, considering the economic importance of the disease, the present investigation mainly focused on conducting a survey in the Udham Singh Nagar and Bareilly districts where guava orchards are well established. The survey was done to estimate the severity and prevalence of the wilt complex disease, the species diversity in the soil and the Meloidogyne population in root knots formed on guava roots. The different isolates of Fusarium were also isolated from the root vascular bundles from the areas surveyed. However, the Fusarium was isolated from six blocks (Kichha, Sadar, Mirganj, Rudrapur, Gadarpur and Bazpur) and preserved for further studies. The tomato seedlings were grown in sterilized soil and transplanted into the pots filled with soil collected from different blocks to allow the formation of root knots and further identification of Meloidogyne species based on their perineal pattern will be done.

◆◆◆◆◆◆

Physicochemical Property Report of Kedar Valley and Chamoli Honey From Uttarakhand

Hashib Ansari[1],Meena Agnihotri[1], M.S. Khan[1], Harminder Singh Baweja[2], K. Lakshmi Rao[3]
[1]G. B. Pant University of Agriculture and Technology, Pantnagar-263145, U.S. Nagar, Uttarakhand
[2]Dr. Yashwant Singh Parmar University of Horticulture And Forestry
[3]Former Assistant Director C.B.R.T.I Pune, Maharashtra

ABSTRACT

Honey is a wholesome food that honey bees make. Its composition is greatly influenced by the weather circumstances and the type of flowers the bee uses. In this study, ten samples of honey from different parts of Uttarakhand's Chamoli and Kedar valleys were evaluated in terms of quality factors at the Intertek Total Quality, Assured laboratory in Gurgao, the physicochemical characteristics of the honey, including its moisture content, specific gravity, hydroxymethylfurfural content, acidity, total reducing sugars, sucrose content, ash content

and F-G ratio and Fieh's test were assessed. Kedar Valley and Chamoli honey's moisture values were 18.23 and 18.4 g/100g, respectively. The total reducing sugars were between 77.65 and 77.89 g/100 g, while the sucrose concentration was under the quantitation limit.,HMF (hydroxymethylfurfural) content ranging from 47.24 and 4.2 mg/kg,respectively .Fiehe's test for both samples were found negative.

Keywords: Kedar valley ; Chamoli; physicochemical properties.

◆◆◆◆◆◆

Economical artificial diet for mass rearing of the greater wax moth, galleria mellonella l. (lepidoptera: pyralidae) as a host for entomopathogenic nematodes

Parul Suyal, Renu Pandey, Nisha Mehra and Moorthy
Department of Entomology, College of Agriculture, GBPUAT,
Pantnagar-263145, U.S. Nagar, Uttarakhand

ABSTRACT

Greater Wax Moth (*Galleria mellonella* L.) are most commonly used for mass-multiplication of entomopathogenic nematodes. An investigation on economical modification and comparative analysis of artificial diets of *G. mellonella* was carried out in insect pathology laboratory, department of entomology, GBPUAT, Pantnagar during 2021-2022. Different diets were assessed in comparison with standard diet (wheat flour, corn, dry milk, baking yeast, honey and glycerin) and natural beewax. Modifications based on change in quantity of components, addition of vitamin E and vitamin-B complexes, replacement of sorbitol and baking yeast with glycerin and dry yeast, respectively showed reduction in the cost of production and increase in food conversion efficiency in *G. mellonella*. The economics of test artificial diets showed that the costs of diet 1 was 34.28 % and 83.25 % of the cost of natural beewax and standard diet, respectively and diet 3 was 32.99 % and 80.12 % of the cost of natural beewax and standard diet, respectively. The conversion of ingested food ECI% (48.24% and 47.27%) and digested food ECD% (55.46% and 53.44%) into growth and development was highest for both the diets 1 and 3, respectively. The results also indicated that the addition of vitamin E and vitamin B complexes in test artificial diets showed increased growth rate in diet 1 (0.60) and diet 3 (0.58) as compared to diet 2 (0.52). The results therefore suggested that diet 1 and diet 3 can be successfully used for mass-multiplication of the *G. mellonella* which further supports the mass-multiplication of entomopathogenic nematode.

◆◆◆◆◆◆

Effect of different post emergence weed management practices on weed dynamics and growth parameters of lawn grass

Ashmita Sahu, T. Tirkey and SK Tamrakar
Department of Floriculture and Landscape, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya, Raipur - 492012

ABSTRACT

The experiment was carried out to research the "Effect of different post emergence weed management practices on weed dynamics and growth parameters of lawn grass" was carried out during the period of 2021-22 at College of Agriculture, IGKV, Raipur. The experiment was set up in a randomized block design with 9 treatments and 3 replications. Treatments consisted of Control, One hand weeding, Twice hand weeding, Halosulfuronmethyl, Metsulfuron methyl, 2,4-D dimethyl amine salt, Ethoxysulfuron, Carfentrazone ethyl, Metsulfuron methyl + Chlorimuron ethyl. The dominant weed species observed at the experimental site

was broad leaf weeds. The result indicates that the highest reduction in weed density and lowest weed dry weight was observed with the application of treatment T16 2,4-D Dimethyl amine salt 58% SL 600 g/ha as compared to the other treatments. The WCI and WCE were highest in the treatment T16 2,4-D Dimethyl amine salt 58% SL 600 g/ha as compared to the other treatments.

Keywords : Herbicides, Bermuda grass, weed management, grass growth

◆◆◆◆◆◆

Biostimulants on horticultural crops: their impact under Abiotic Stress condition

Damini and J. Patel
Department of Fruit Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat

ABSTRACT

Abiotic stresses have a significant impact on plant growth, development and production quality; they can significantly decrease crop yield if they occur during the phenological periods of the plant when it is most susceptible to stress.Focusing on horticultural species, the tolerance to abiotic stresses is a crucial trait because their cash value is usually higher than field crops, they require more resources for cultivating and they provide a source of numerous nutrients including fiber, minerals and carbohydrates, which are crucial in a healthy diet.The use of biostimulants as agronomic aids has grown in significance as fertilizer applications are reduced.They can increase the yield of cropping systems or reduce crop yield losses caused by abiotic stressors.Indeed, these products containing bioactive molecules have a boost effect on plants and increase their adaptability to face harsh environmental conditions, acting on primary or secondary metabolism.The various responses of plants treated with biostimulants must be correlated with the phenotype variations.Finding strong correlations between the use of biostimulant treatments and crop performance also requires the construction of an appropriate experimental strategy and statistical data analysis.Thus, the biostimulant mode of action can be understood through plant responses at the physiological, biochemical and molecular levels.

Keywords: Abiotic stresses, horticultural species, biostimulants, bioactive molecules, crop yield

◆◆◆◆◆◆

Intergated Pest Management in Horticultural Crops Under Protected Environment: Principle and Practices

Vinay Kumar[1], Poonam Maurya[2], Shikha Jain[2], Ramkumar[1]
[1]Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (Uttar Pradesh) 221005
[2]Division of Fruit and Horticultural Technology, ICAR-Indian Agricultural Research Institute, Pusa, New Delhi-110012.

ABSTRACT

The abundance of food in sheltered areas, along with the warm, humid weather, creates an ideal setting for the growth of pests. The natural enemies that keep bugs in check outside are frequently absent in enclosed spaces. Because of these factors, pest problems frequently arise indoors more quickly and severely than they do outside. Arthropod pest damage to greenhouse crops varies depending on the pest and the season. The type of crop has a significant impact on the amount of damage that can be tolerated. Producers of vegetable crops generally can accept a higher level of damage than those of ornamental crops that are produced for their

aesthetic value. Integrated pest management (IPM) is a methodical strategy to pest control that includes a number of tactics and methods in order to either lower insect populations or mitigate their negative economic effects. It is a site-specific pest management technique that depends on accurate pest identification and comprehension of the biology of the pests. A higher-quality crop and a cleaner environment make it simpler to see how an investment in IPM can pay for itself over time.

Keywords: Natural Enemies, IPM, Site-specific pest management, Green house

◆◆◆◆◆◆

Seasonal incidence of insect pest infesting potato crop and their correlation with weather parameters in Tarai region of North western Himalayas

Tanuja Phartiyal and R.M.Srivastava
Department of Entomology, College of Agriculture, G.B. Pant University of Agriculture and Technology, Pantnagar, U.S. Nagar, Uttarakhand.

ABSTRACT

Field trials were laid out to evaluate the bioefficacy and phytotoxicity of acaricide, Bifenthrin 8% SC against European red mite, *Panonychus ulmi* Koch. and two spotted spider mites, *Tetranychus urticae* Koch. infesting apple orchards in Mukteshwar area of Nainital district of Uttarakhand during the year 2020 and 2021. Different dosage *viz.* 1000, 750 and 500 ml/ha. of Bifenthrin 8% SC (Rainbow sample) were compared with conventional acaricides *viz.* Bifenthrin 8% SC (Market sample), Propargite 57% EC, Hexythiazox 5.45% EC and control wherein only water was sprayed. All the concentrations significantly reduced the population of mite over control . Mite population was effectively controlled by application of two sprays of Bifenthrin 8% SC (Rainbow sample) @ 1000 ml/ha followed by Bifenthrin 8% SC (Rainbow sample) @ 750 ml/ha and Bifenthrin 8% SC (Rainbow sample) @ 500 ml/ha. No any phytotoxicity symptoms were noticed in terms of leaf injury, wilting, vein cleaning, leaf necrosis, epinasty and hyponasty during the observation period.

◆◆◆◆◆◆

Sources of Plant Disease in Horticultural Nurseries and Their Management of soil pathogens

Rahul Singh Raghuvanshi[1], Subhash Chandra[2], Vishwa Vijay Raghuvanshi[3]
Acharya NArendra Deva University of Agriculture and Technology
Kumarganj, AyodhyaUttarpradesh

ABSTRACT:

Introduction Nurseries are used to grow and propagate plants. Nursery plants are often grown in greenhouses, which are glass or plastic buildings designed to protect young plants from adverse weather conditions. One of the greatest challenges of nursery or greenhouse caretakers is fighting the many types of diseases that can afflict plants.Soil is a complex habitat where a large number of different microorganisms including fungal pathogens interacting with plants. These soil pathogens always depend on host to survive and reproduce.They prefer to live within the soil and causing diseases in plants particularly tree seedlings.

Infested SoilMany plant pathogens can be found in soil. Fungi such as Cylindrocladium, *Pythium, Phytophthora*, Fusarium, Rhizoctonia and Thielaviopsis, crown gall bacteria (Agrobacterium) and most nematodes reside in the soil.Most plant pathogens have a stage in their life histories that can rest in a dormant

state and survive periods of time when temperatures are extreme or moisture is not sufficient for growth. Some pathogens have evolved a strategy of becoming dormant in the dead leaves, stems, branches and roots where they previously caused disease. Some pathogens must have living plant tissues in order to grow, reproduce and survive. Most viruses like tomato spotted wilt and cucumber mosaic only survive in living plant cells.

ConclusionThere are other sources but these are the first to suspect when trying to answer the question "Where did the disease begin?" Every nursery manager should be aware of the sources of pathogens for each crop grown in their particular operation and should plan to eliminate those sources of disease to the greatest extent possible. Money can be saved by not losing plants during production and by minimizing the expense of purchasing and applying disease control chemicals.

◆◆◆◆◆◆

Genetic control of yellow vein mosaic virus disease tolerance in Okra [*Abelmoschus esculentus* (L.) Moench]

A I Patel, J M Vashi and C G Intwala
Department of Vegetable Science, ASPEE College of Horticulture and Forestry,
Navsari Agricultural University, Navsari (Gujarat)

ABSTRACT

Yellow vein mosaic virus (YVMV) and enation leaf curl virus (ELCV) are major viral diseases of okra [*Abelmoschus esculentus* [L.] Moench] in the tropical and sub-tropical areas; threatening its commercial cultivation. The okra production in India, is hindered by occurrence viral diseases, like Yellow Vein Mosaic Virus (YVMV) disease and Okra Enation Leaf Curl Virus (OELCV) disease, spread by an insect vector, namely whitefly (*Bemisia tabaci* Gen.), which affect okra production in terms of yield and fruit quality as well. The study aims to screen okra genotypes against viral diseases assess the extent of marketable yield loss due to YVMV infection. Okra geneticists across the world tried to understand the inheritance pattern of YVMV disease tolerance without much success. Therefore, the inheritance pattern of YVMV disease in okra was revisited by employing six generations (P , P, , F , F, , BC and BC,) using 84 advanced breeding lines derived from the resistant sources against YVMV in okra and were planted during Summer-2021 at Vegetable Research Station, ASPEE College of Horticulture and Forestry, N.A.U., Navsari. Among 84 advanced breeding lines, two resistant lines (NOL-17-05 and NOL-19-08) and two susceptible lines (NOL-21-56 and NOL-21-84) were identified and crossed with in resistant X susceptible manner to obtain four hybrids. Their advanced generations *viz.,* F_1 and F_2 generations and backcrosses *viz.,* BC_1 and BC_2 were also made to study their segregation pattern for YVMV resistance; thereby to reveal the gene action involved in these resistant lines. Qualitative analysis for YVMV resistance revealed the involvement of a single dominant gene in resistant varieties *viz.,* NOL-17-05 and NOL-19-08 which can be utilized to develop high yielding YVMV disease resistant/tolerant varieties or hybrids.

◆◆◆◆◆◆

Session-9

Horti-Extension, Marketing, Certification and Horti-business

INVITED LECTURES

I-1 Status and Potential of Fruits & Vegetables Export from India

Dr B.S. Negi

India's diverse climate ensures the availability of all varieties of fresh fruits & vegetables. It ranks second in fruits and vegetable production in the world, after China. As per National Horticulture Database (ThirdAdvance Estimates) during 2021-22, total horticulture production is estimated to be 342.33 Million Tonne from an area of 28.07 million ha, comprising of 107.24 million metric tonnes of fruits and 204.84 million metric tonnes of vegetables. The area under cultivation of fruits stood at 7.05 million hectares while vegetables were cultivated at 11.35 million hectares.

The vast production base offers India tremendous opportunities for export. During 2021-22, India exported fresh fruits and vegetables worth Rs. 11,412.50 crores/ 1,527.60 USD Millions which comprised fruits worth Rs. 5593 crores/ 750.7 USD Millions and vegetables worth Rs. 5745.54 crores/ 767.01 USD Millions. The processed fruits and vegetables including of pulses exported to be Rs. 12,858.66 crores/ USD 1,724.88 million which comprised of processed vegetables including of pulses Rs.8308.04 crore/ USD 1114.19 million and processed fruits and juices Rs.4550.62 crores/ USD 610.69 million in 2021-22.

Grapes, Pomegranates, Mangoes, Bananas and Oranges account for the larger portion of fruits exported from the country while Onions, Mixed Vegetables, Potatoes, Tomatoes and Green Chilly contribute largely to the vegetable export basket.

Major destinations for the Indian fresh fruits and vegetables are Bangladesh, UAE, Nepal, Nethand, Malaysia, Sri Lanka, the UK, Oman and Qatar.Major destinations for the Indian processed fruits and vegetables are USA, UAE, China, Netherland, UK and Saudi Arab.

India will have to take up the issues of farm subsidies, market denials and high import duties at all bilateral (FTAs), regional (e.g. RCEP) and multilateral (WTO) trade forums if it is serious about pushing its farm exports.

Among internal actions needed are long term measures to tackle the issues of low productivity, over dependency on monsoon and lack of post-harvest infrastructure that lower the net supply of agriculture commodities and leads to knee jerk reactions in the form of export bans. It's time India stopped over- promotion of cereals and let demand and supply forces guide production and trade decisions.

Imposing export bans deprives farmers of getting the best prices for their produce. India needs to remove quantitative restrictions on exports for improving its image as a supplier. To deal with temporary shortage of specific agriculture commodities, export duties (that are less trade distortive than export quotas) should be used.

Besides this, an action strategy can be developed encompassing the following points:

- Precision Farming under RKVY and MIDH around Clusters
- Adoption and Certification of Global GAP
- Shift to High Value Crops and Processible Varieties
- Traceability with Block chain Technology
- MSMES FURTI Projects around Agro Clusters

- Detailed product and country wise export strategy
- Capacity Building of all key stakeholders
- States to work on Export Baskets
- Quality Control Labs and National Portal
- CreationofinformationsharingmechanismbetweentheStateandCentreonSPSissues
- Creating Agri Export Start-ups, India Agri Export Council, Global GAP Program, Commodity Trade Boards, Institutional Partnerships
- Working with the States
- Market Promotion and promoting Brand India.

◆◆◆◆◆◆

I-2 Extending Commercial Cultivation of Onion in Eastern Parts of Uttar Pradesh

Amar Jeet Gupta, Major Singh, S.S. Gadge, Rajeev Kale, N. Rai and V. Mahajan
ICAR-Directorate of Onion and Garlic Research,
Rajgurunagar-410 505, Pune (Maharashtra)

Onion is an important commercial crop which can improve livelihood of small and marginal farmers. It also plays a crucial role in food and nutritional security of human beings. Though, the eastern parts of Uttar Pradesh especially Mirzapur has congenial climatic conditions for onion production at commercial level, the cultivation of onion was limited to only *rabi* season at small level, mostly for kitchen gardens. There is tremendous scope to cultivate onion during *kharif* at commercial level to achieve more profit than *rabi* season and other traditionally growing vegetables. Therefore, it was decided to promote onion varieties and other production technologies of ICAR-DOGR in eastern parts of Uttar Pradesh. A total of 422 field demonstrations on onion cultivation were conducted in *kharif* and *rabi* seasons during 2018-19 to 2021-22 in Mirzapur district. About 300 progressive farmers were selected from 26 villages of Chunar taluka, Mirzapur (UP). For the first time, *kharif* onion production was initiated at commercial level in Chunar taluka of Mirzapur. Farmers have earned a net income of Rs. 0.70-0.80 lakh per acre through production of onion bulbs about 80-100 q from Bhima Super and Bhima Dark Red varieties during *kharif*. The production and productivity of onion in Mirzapur has been increased after intervention of ICAR-DOGR in collaboration with Agrimitra FPC, Mirzapur and GKRDF, Varanasi.The demonstrations led to conclusion that the eastern parts of Uttar Pradesh is suitable for *kharif* onion production.*Kharif* onion, which is confined to Maharashtra, Karnataka and Tamil Nadu, was extended to non-traditional regions such as eastern Uttar Pradesh and north eastern region of India. During the last five years, more than 400 farmers have started *kharif*onionproduction in Mirzapur, with the help of the state government, the production of *kharif* onion is being increased to 2000 ha.The Technical Folder as well as a Documentary Film on "Extending commercial cultivation of onion in eastern parts of Uttar Pradesh: A Success Story" have been published/ released to boost up the *kharif* onion production.

◆◆◆◆◆◆

I-3 Transfer of Technology Approaches In Horticultural Crops Under Different Microclimates: Interventions, Success and Impact

Raj Narayan, S.K. Singh and Mahiwal Singh Sisodia
ICAR-Agricultural Technology Application Resaerch Institute, Zone-II
CAZRI Campus, Jodhpur (Rajasthan)

Horticultural crops play a vital role in the Indian economy by generating employment, providing raw materials to various food processing industries and higher farm profitability due to higher production and export earnings. These are notably important in providing critical nutrients for a balanced diet, improving and beautifying the environment. As in case of other sectors of the economy, the engine of agricultural especially horticulture growth in developing countries like India is transfer of technology. Technology transfer facilitates the movement of soft and hard skills essential for improving farm income. It is actually a structural process of learning, requires a careful well thought out plan, clearly communicable ideas/practices and a range of formal and informal cooperation between technology developers and technology recipient. Similarly, acceptance of new technology also depends upon its ability to bring out economic benefits at all levels of a society while maintaining eco-friendliness, self-sustainability of the system as well as social and cultural compatibility.

According to a report of Food and Agriculture Organization, the future production of food for 10 billion population of the globe by 2050 will be contributed by 10% expansion of land, 20% by intensification of agriculture production and 70% by application of technology. Hence, technologies developed in the form of hard-earned knowledge through research in elite seed and planting materials, equipment processes, methodologies, etc. need to be transferred at an appropriate timing for their effective acceptance, implementation and adoption by the end users. In this context, Krishi Vigyan Kendras, minimum of one in each district across the country, are mainly tasked with the job of localization and harmonization of technologies to make it technically feasible and economically viable, suitable for environmental condition and compatible with the prevailing agriculture system in the targeted area. An entrepreneur or/and progressive farmer, if rightly guided and properly equipped with relevant advance technologies, are expected to feed many families besides their own, through employment generation, directly or indirectly.

Krishi Vigyan Kendras of Rajasthan, Haryana and Delhi have empowered the entrepreneurs, farmers and farm women through various ways and means of technology transfer in the field of agriculture and allied sectors including horticulture. Various horticultural technologies such as seed production, nursery management, protected cultivation, vegetable cultivation, precision farming, fig cultivation, pomegranate cultivation, date palm cultivation, urban and peri-urban farming, integrated farming, disease-pest management, micro-irrigation and fertigation, mushroom cultivation, fruits and vegetable cultivation, processing and value addition etc. have been transferred to the farmers and entrepreneurs. Many farmers and entrepreneurs are setting example by adopting the technologies such as nursery production and management, protected cultivation, mushroom cultivation, scientific cultivation of fruits & vegetables, especially, high value vegetables, fig, pomegranate, date palm, ber, aonla, etc. as well as processing and value addition thereof and they are also a torch bearer for other farmers and entrepreneurs in the area and elsewhere.

A farmer namely Shri. Darshan Singh, has started horticulture crop nursery under the technical guidance of KVK Ambala during 2019 is now earned net income of Rs. 1375000.00. Similarly, Mr. Narpat Singh Charan planted pomegranate during 2014 under technical guidance of KVK Gudamalani (Barmer-II), besides raised and planted lime vegetables. He also reared dairy animals (cow) in his farm. Now Mr. Charan is exporting his produce especially pomegranate to many countries; Malaysia, Bangladesh, Oman, Katar, Dubai etc. and earning Rs. 70-75 lakhs per annum from his farm crops and enterprises.

Crop diversification and intensification are the important components of higher income and efficient resource utilization. KVK Barmer has introduced Fig crop and planted its variety 'Dyna' in 5.0 ha area during 2019-20 at its KVK Farm. Now, this crop has expanded to six blocks of the district in an area of 200 ha. The plants start yielding in 3rd year with 15-20 kg fruit yield per tree, which is sold at Rs. 60-100 per kg. It is a futuristic crop, fetch net income of Rs. 2-3 lakhs per hectare which is quite high as compared to existing traditional crop.

Smt. Sumita Mali is an exemplary progressive woman entrepreneur in the field of processing and value addition of horticultural commodities and a torch bearer for many women of the Pushkar (Ajmer). Mrs. Sunita formed a Pushkar Gramin Agriculture Youth & Employment Farmer Producer Organization, consisting of 510 members with the help of technical guidance and training of KVK Ajmer, which has turnover of Rs, 108.499 lakhs during the year 2021-22. While as she got net return of Rs. 7.58 lakhs individually from various processed and value-added products of aonla, jamun, rose, etc.

Kitchen gardening is a source of nutritional security of the families. Mrs. Seema Vaishnav got technical expertise and hands on training in kitchen gardening and organic fruit and vegetable production from KVK Chittorgarh during 2019-20 and she is earning net income of Rs.1.90-2.00 lakh from organic fruits, vegetables and pulses production as well as vermicompost production. Similarly, Smt. Sharda Devi has established kitchen gardening and started preparation of various value-added products of horticultural commodities, besides neemastra under the technical guidance and training of KVK Churu-II and now earning net income of Rs. 2.56 lakhs. Smt. VimlaSihag has reached at a prestigious place as an agriculturist in arid zone through horticulture. She is cultivating various Agri - horti crop under the scientific and technical guidance of KVK Jodhpur-I and now earning Rs. 4.50-4.75 lakhs net income from ber, gonda and seasonal vegetables, etc.

Judicious use of irrigation water is prime concerned now days. In this regards, Smt. Puja Dhanda taken technical guidance and expertise from KVK Jhajjar in the field of micro irrigation especially in horticulture crops to reduce water input and enhance productivity and quality. She installed drip irrigation system in her fruit crops orchards especially in ber and guava and now earning net profit of Rs. 15-16 lakhs from ber, guava, gram and milk production. Mushroom cultivation emerged as an excellent horticultural enterprise, fetching remunerative earnings. Shri Keshav Dev and Shri Ashok Kumar have got knowledge and expertise in mushroom production technology from KVK Sikar-I and KVK Ambala and they established their mushroom units during 2017-18 and 2020-21, respectively. Mr. Keshav now producing mushroom worth of Rs. 1.75 – 2.00 lakhs from 500 bags and 500 kg spawn worth of Rs. 70000-90000. Likewise, Mr. Ashok Kumar earned net profit of Rs. 8.00-8.25 lakhs from a unit of 2500 mushroom bags.

◆◆◆◆◆◆

I-4 Plantation Crops The Future of High Value Horticulture

Elain Apshara, S.
Principal Scientist (Hort.) & Head InCharge
ICAR- CPCRI, Regional Station, Vittal, Karnataka- 574 243.

In Horticulture Sector, contribution of plantation crops to agricultural growth, production, consumption and commerce is immense. ICAR- Central Plantation Crops Research Institute- CPCRI, with its 100 year old lineage, involved in improvement of coconut, arecanut and cocoa, which are widely cultivated as small holders crops compared to tea, coffee and rubber plantations. CPCRI is the International Gene Bank on coconut for South East Asia and Middle East (ICG-SAME) and National Active Germplasm Sites (NAGS) for coconut, arecanut and cocoa holding 455, 182 and 530 accessional respectively. Concerted efforts put in over years in conserving, evaluating and utilizing genetic resources of these perennial crops resulted in development of high yielding varieties, 21 in coconut, 11 in arecanut and 8 in cocoa, which enhance the production, productivity, quality and profitability of farmers. These high value crops were tested in different agro climatic zones through AICRP centres for their climate resilience and breeder seeds were supplied for establishment of mother gardens to meet the regional requirements. Research achievements of CPCRI on its mandate crops in improvement, production, protection, post-harvest technology, agri incubation and socio economic upliftment were taken to multiple stakeholders with strong collaboration with the developmental agencies such as, Coconut Development Board (CDB), Directorate of Arecanut and Spices Development (DASD) and Directorate of Cashewnut and Cocoa Development (DCCD) under Ministry of Agriculture and Farmers Welfare and co-operatives like CAMPCO (The Central Arecanut and Cocoa Processing and Marketing Co-operative Ltd.) and farmer production organizations/ companies. Systematic and strategic approaches followed in incorporating and implementing the basic and advanced technologies developed by the institute impacted the sustainability of coconut, arecanut and cocoa in our country now and will influence the future as well.

◆◆◆◆◆◆

I-5 Prospects of Protected Cultivation for Floriculture under Western Himalayan Regions

Ranjan K. Srivastava, B.D. Bhuj, Ajit Kumar and Satish Chand
Department of Horticulture
G.B. Pant University of Agriculture & Technology, Pantnagar (Uttarakhand)

Floriculture is a fast-emerging sector and the demand for floriculture produce is increasing over a period of time. India is endowed with wide range of climatic conditions and particularly the western Himalayan region which has varied range of soils, man power along with variety of agro climatic conditions which thereby enable us to grow different types of flower crops almost throughout the year. The flowers are generally grown in open field conditions and therefore they do not meet the international as well as domestic standards of export. Therefore, it is advised to grow many of the cut flowers under protected conditions for making it available all the year round, thus protecting them from fluctuations in temperature and providing higher remunerative to the growers which is thereby not possible in the open field. The major flowers that can be well suited in these areas are rose, lilium, alstroemeria, gerbera, carnation and chrysanthemum.

◆◆◆◆◆◆

I-6 Future prospects of quality research and development in Medicinal & Aromatic Plants to fulfill the expectations of society and nation

Rakesh Kumar Upadhyay
CSIR-Central Institute of Medicinal & Aromatic Plants Research Centre
Pantnagar

Plants having medicinal or aromatic properties that are used in pharmacy, pharmaceutical industries, and/or perfumery, aroma industries, aroma therapy, food and flavours industries are usually known as medicinal and aromatic plants. The most commonly medicinal & aromatic plants are cultivated in India are *Mentha arvensis* L., *Mentha piperita* L., *Mentha spicata* L., *Cymbopogon flexuosus* L., *Cymbopogon winterianus* L., *Cymbopogon martinii* L., *Vetiver zinzanioides* L., *Withaniasomnifera*L,,*Asparagus racemosus* L., *Ocimumsps*., *Rauvolfiaserpentina* L., *Acorus calamus* L., *Pelargonium graveolens* L., *Stevia rebaudiana* L., *Rosa damascena* L., etc. Among these medicinal and aromatic plants, India is the leader in the production of Mentha & Lemongrass across the world. Medicinal & Aromatic plants having great potential to provide higher returns and income both to the farmers as compared to traditional crops and also having flexibility to adjust in prevalent cropping system. As of now the national campaign is running by government for the doubling of farmers income across the country. Presently Indian cropping system become high input-based cropping system as it requires high level use of agrochemicals& fertilizers, ultimately factor productivity declining day by day and the net income declining. Hence, there is arises demand to develop low-cost cultivation practices with high input use efficiency and productivity levels that's having potential of enhance the farmer income in two to three folds, *i.e.* need of society, famers and nation. Keeping in-view of above context, its is clear that medicinal and aromatic plants having such type of potential and able to enhance farmers income in two to three folds under captive cultivation. Therefore, there in an urgent need to develop climate resilient good agricultural practices for quality cultivation of medicinal & aromatic plants having flexibility to adjust in prevalent cropping system. Introduction of medicinal and aromatic pants *i.e.* successfully grow in problematic areas and ability to introduce new crops in such areas as river bank, undulating area, drought prone areas, flood prone areas, saline areas etc. By introduction of demand-based R&D in MAPs, this new area becomes cultivable land for MAPs and famers also get benefited as additional income from problematic lands also by introduction medicinal and aromatic plants in these areas. Therefore, the need of future is to plan quality research & development strategies and develop climate smart agricultural practices for medicinal and aromatic plants *i.e.* input efficient, adoptable, affordable, applicable, low cost of cultivation, maximum productivity & profitability and also in sustainable manner.

◆◆◆◆◆◆

I-7 Prospects of Date palm cultivation in India

Dr. Atul Chandra
Retd. Professor (Horticulture)
Swami Keshwanand Rajasthan Agricultural University,
Bikaner, Rajasthan, 334006

Date palm(*Phoenix dacetylifera* L.)is basically arid irrigated fruit crop being grown commercially in Kutch area of Gujarat and north western districts of Rajasthan comprising Jaisalmer, Bikaner, Barmer, Jodhpur, Nagaur, Churu, Sri Ganganagar and Hanumangarh. It is very particular to climatic requirements. It is dioecious having male and female on separate trees. The pollination is done manually through dusting pollens on female inflorescence at the time of opening of female spathes. It requires medium winter season with long dry hot period without rains for fruit ripening provided sufficient availability of irrigation water. Rains and high atmospheric humidity during fruit ripening results in spoilage. It ripens in India during July-August months. Optimum temperature for flowering and fruit ripening are 25°C and 40°C, respectively. It tolerates temperatures upto 50°C in summers and 2-3°C during winter months. From flowering to fruit ripening, it requires 3000-4000 Heat Summation Units(HSUs). It is derived by summing up daily average temperatures-10°C(minimum temperature required for growth). Average annual rainfall for Jaisalmer, Bikaner, Jodhpur and Kutch regions are 100-160mm, 305mm, 366mm and 322mm, respectively. For the above districts from pollination to fruit harvesting 170, 150, 145 and 150 rainfree days, respectively are available whereas during that period 4088, 3844, 3500 and 2656 Heat Summation Units(HSUs), respectively are obtained. That is why Jaisalmer and Bikaner are the most suitable districts for growing datepalm in the country. Its fruits have three stages of ripening *i.e. Khalal*(doka) which is hard ripe stage. *Rutab*(dang) is stage of softening of fruits beginning from tip to the whole fruit and *tamar*(pind) in which fruits are fully softened and dehydrated. Doka fruits are either freshly consumed or dry dates(chuharra) are prepared. For fresh dates varieties Barhee, Halawy, Khunezi, Sewi, Jamali, Khalas etc. have been found suitable whereas for dry dates Medjool, Saagai, Khadrawy, Halawy, Zahidi, Shamran etc. and for pind purposes Zahidi, Khadrawy, Halawy, Khalas, Saagai and Zagloul etc. have been found suitable.

It is highly tolerant to salinity and sodicity. It can be grown in the soils upto 4 mmhos/cm at 25°C. Alkalinity should not be more than 1%. Irrigation water upto 1000 T.D.S. can be used for its cultivation and under such conditions drip irrigation system should be followed. Upto 2m depth, soil should be free from hard pan and concretion of calcium carbonate and preferably be sandy/sandy loam with pH between 7.0-8.5 with proper sub surface drainage.

It is highly productive and one single tree is capable of producing 80-200 Kg per year with planting distance of 8m x 8m. It is single stem tree devoid of branches and thus space between the rows can be best utilized for intercropping with field crops(cereals/millets/pulses), vegetables fodder crops and even fruit crops such as pomegranate which have been found very suitable. Recently, its cultivation has been started in dry areas of Tamil Nadu, Madhya Pradesh and Maharashtra etc. Availability of tissue culture plants of datepalm has helped in extending its area in the country. Traditionally, datepalm is propagated through offshoots(suckers) which are produced in limited number from the mother palm trees and there is less survival of offshoots in the field.

Datepalm fruit is very nutritious. One kg fresh date gives 1000 calories of energy compared with 970 calories from banana and 400 calories from mandarin. On the basis of dry weight of fruits, it has as high as 80 per cent carbohydrates mainly in the form of Glucose and fructose. Fruits are very rich in minerals *viz.* calcium, iron, phosphorous, potassium, magnesium and zinc. High content of potassium and very low content of sodium helps in keeping our nervous system and heart healthy. High fibre content in fruits(2.5%) keeps our digestive system proper and presence of antioxidants in the form of tannins minimizes risk of cancer. India is the largest

importer of date fruits in the world and almost 30 percent of total import of date fruits is done by our country. Its increased production in the country will help in reduction of its import and thus will save foreign exchange. Government subsidy in the form of planting material and drip irrigation system under National Horticulture Mission has helped in a big way to the farmers of dry areas for its cultivation in marginal fertility soils and fragile climatic conditions. Date palm tree bears upto 60-70 years and thus provide sustainable income to the farmers and also helps in combating malnutrition. By adopting proper production technologies, net profit of Rs 100000 can be obtained annually per hectare.

◆◆◆◆◆◆

I-8 Diversifying Horticulture: Adaptation, Mitigation, Resilience strategy to meet climate change

H.S. Baweja , Ratan Kumar, Surbhi Pandey , Mahendra Pal and Rohit Bisht
Department of Horticulture & Food Processing, Uttarakhand

Uttarakhand with its unique agro-climatic condition favors fruit crops like Apple, Pear, Plum, Peach, Cherry, Almond, Walnut, Mango, Guava, Aonla and others minor fruit crops *viz*., Chestnut, Pecan Nut, Hazel Nut, Strawberry fruits were grown with adequate production and productivity. However, during the past year existing pressure of farming include a decrease in land held per person, lack of irrigation infrastructure, crop depredation by animals and a waning interest in farming among young people.

Climate change in Uttarakhand will increasingly force people to abandon farming at high altitude and move to plains over the next 30 years, The hilly region of the state also face the adversities of weather, often receiving high rainfall, cloud burst and hailstorms, which ultimately impact the production and economic condition of farmers, for developing Uttarakhand as a horticulture state, all the stakeholders shall be convinced of the idea and they all shall have clarity on the vision.

The Government has run programs for developing globally competitive and environmentally sustainable anchor horticulture crops value chains for all the four agro-climatic zones in the state. Achieving this vision Department of horticulture implement new strategies on Ultra high density plantation of fruits like Apple, Kiwi, Dragon fruits, Rooftop gardening in Urban Areas, protected cultivation in Cluster approach base to ensure prominent place in national production and for establishing Uttarakhand as most modern Horticulture state in the country.

◆◆◆◆◆◆

ORAL PRESENTATION

Temple Floral Waste: A Potential Source to generate Revenue

Sachi Gupta[1], Sanjay Pathak[2], Shweta Singh[1], Jibankumar S. Khuraijam[1] and S. K. Tewari[1]
[1]CSIR-National Botanical Research Institute, Lucknow - 226001, Uttar Pradesh
[2]Acharya Narendra Deva University of Agriculture & Technology, Ayodhya-224229, Uttar Pradesh

ABSTRACT

India a culturally vibrant nation practices religion strictly and celebrate festivals frequently. In this practice large quantity of flower is discarded as the waste from temples, mosques, churches, *dargahs*, *gurudwaras*, hotels, banquets and houses. It has been estimated that about 8 million tonnes of floral waste is dumped into rivers and other water bodies in India every year, which pollutes and chokes these water bodies and leading to environmental degradation. Being offering to God, flowers do not find its appropriate way to the conventional waste disposal system. The techniques for their proper disposal should be identified as Vermicomposting, Anaerobic digestion, Dyeing, Paper manufacturing etc. These not only provide eco-friendly way for proper disposal but also produce utility products like incense sticks, manure, natural dye, handmade paper and bio gas. Therefore, these technologies should be placed appropriately for eco-friendly floral waste disposal along with economic gains to the beneficiaries.

◆◆◆◆◆◆

Storing the Sun for Conventional Gain- Innovative Solar Cold Storage Technology

Anil Chandra, Jitendra Kwatra and S.S. Singh
Directorate of Extension Education
G.B. Pant University of Agriculture & Technology, Uttarakhand- 263145

ABSTRACT

Indian farmers have always struggled with reducing wastage of their produce due to a variety of reasons, including poor market linkages and lack of facilities to store fast perishable items for any length of time. At present, the wide gap between production and availability of vegetables in India is mainly due to the heavy post-harvest losses and fast increase in population. The United Nation's Food and Agriculture Organization (FAO) says India lets as much as 40 per cent of its fruit and vegetable production go to waste. Our country as a whole is, reportedly incurring post-harvest losses of Rs. 2.0 lakh crores per year only in fruits and vegetable crops. Hence, there exists a pressing need to develop a smaller capacity solar based refrigeration system which can be operated independent of the electrical grid and at the same time that can be adopted for the purpose of reducing food produce wastage. This innovative solar cold storage technology can help the farmers to pre-cool the perishable nature farm produce, connect them with buyers and enable them with logistics as well to reach buyers in more markets, by using the cold chain, they can compete with air logistics and reduce logistics cost substantially. This smaller solar refrigeration unit will be a game changer for perishables handling and trade. It will also enable consumers to get these commodities in a fresher condition and in the long term, it will also enable farmers to increase production owing to an increase in their market access and demand.

◆◆◆◆◆◆

Adoption and handholding of villages in Tawang through introduction of Strawberry as a cash crop

Ankit, Sunil K. Singh, Ajitabh Bora, Baikuntha J. Gogoi, Dev Vrat Kamboj and Sanjai K. Dwivedi
Defence Research Laboratory Tezpur Assam 784 001
corresponding author email: ankit.tiwari2601@gmail.com

ABSTRACT

A protected cultivation trial of strawberry was undertaken at Defence Research Laboratory, Research and Development Centre, Tawang for adoption and hand-holding of the border villages of Tawang region. Strawberry cultivars namely Sweet Charlie and Winter Dawn were evaluated in Tawang climatic conditions during the winter season of 2019-20 and both cultivars were found suitable for cultivation under protected structures during the winter season as there was significant marketable yield produced from April to November. Strawberry cultivation was found economically sound as there is a gain of rupees 1.65 per rupee invested during the first year and it can be increased to rupees 3.76 after the third year onwards. To introduce the remunerative crop, its production technology was spun off to farmers of Changbu and Changprang of the Tawang region with the provision of high-quality strawberry runners (2895 nos.), polyethene cladding material of standard thickness and size (200-micron and 11m × 4m, respectively) along with size specification (10m×5m×3m) of protected structure for the construction of low-cost polyhouse. The technology was disseminated through field demonstrations, field visits and training programmes and four more villages Zemithang, Lebrang, 34 Gaon and Ketchenga were also outreached in the same manner.

◆◆◆◆◆

Transfer of Technology Approaches in Horticultural Crops Under Different Microclimates: Interventions, Success and Impact

Raj Narayan, S.K. Singh and Mahiwal Singh Sisodia
ICAR-Agricultural Technology Application Research Institute, Zone-II
CAZRI Campus, Jodhpur (Rajasthan)

ABSTRACT

Horticultural crops play a vital role in the Indian economy by generating employment, providing raw materials to various food processing industries and higher farm profitability due to higher production and export earnings. These are notably important in providing critical nutrients for a balanced diet, improving and beautifying the environment. As in case of other sectors of the economy, the engine of agricultural especially horticulture growth in developing countries like India is transfer of technology. Technology transfer facilitates the movement of soft and hard skills essential for improving farm income. It is actually a structural process of learning, requires a careful well thought out plan, clearly communicable ideas/practices and a range of formal and informal cooperation between technology developers and technology recipient. Similarly, acceptance of new technology also depends upon its ability to bring out economic benefits at all levels of a society while maintaining eco-friendliness, self-sustainability of the system as well as social and cultural compatibility. According to a report of Food and Agriculture Organization, the future production of food for 10 billion population of the globe by 2050 will be contributedby 10% expansion of land, 20% by intensification of agriculture production and 70% by application of technology. Hence, technologies developed in the form of hard-earned knowledge through research in elite seed and planting materials, equipment processes, methodologies, etc. need to be transferred at an appropriate timing

for their effective acceptance, implementation and adoption by the end users. In this context, Krishi Vigyan Kendras, minimum of one in each district across the country, are mainly tasked with the job of localization and harmonization of technologies to make it technically feasible and economically viable, suitable for environmental condition and compatible with the prevailing agriculture system in the targeted area. An entrepreneur or/and progressive farmer, if rightly guided and properly equipped with relevant advance technologies, are expected to feed many families besides their own, through employment generation, directly or indirectly.

◆◆◆◆◆◆

Converting science of protected cultivation into commercial and holistic package for higher and sustainable yield, quality and income of vegetable growers

B. Balakrishna, Shankar s Hebbar, G. M. Sandeep Kumar, Anil kumar Nair and Uma Maheshwari

ABSTRACT

Protected cultivation is being practiced extensively in India for the past two decades. Yet it is not completely successful across the states, due to multiple reasons, more specifically due to lack of technical and marketing support for the crops grown under protected environment. The ICAR-IIHR, Bengaluru has developed and spreading the integrated and holistic package in protected cultivation of vegetables (PCV) among large number of farmers across >15 states in India. To make it more successful, the technical support was combined with pre-production tie-up for farmers with identified and genuine marketers and exporters. Holistic package of the institute was spread among > 500 farmers in Karnataka, which includes use of market driven crops and varieties, for both domestic and export; holistic crop management package from soil and bed preparation, application of neem and organic cakes enriched with bio-fertilizers, bio-pesticides, training, pruning; Integrated management of water, nutrient, pest, disease, nematode, particularly use of fertigation, foliar nutrition, botanical pesticides, timely prophylactic and precise management practices; good post-harvest management; and effective marketing practices both for domestic and export market. Technological intervention under these practices were effectively conveyed and adopted completely by farmers in Colour Capsicum, European Cucumber, Tomato, Musk and Watermelon, which has resulted in increased application of bio-products by >150%, %, reduction in chemicals and pesticide usage by >30%, enhancing yield by >160%, quality by >80% and income by >160. Hence, integration of resources, good agricultural practices in a holistic package definitely gives higher productivity and good and sustainable returns.

Keywords: Protected Cultivation, Holistic package, Sustainable Yield, Quality and Income

◆◆◆◆◆◆

Interiorscaping: An innovative idea forhorticulture entrepreneurs

Bansi Pansuriya and Kiran Kumari
Department of Floriculture and Landscape Architecture,College of Horticulture,
S .D. Agricultural University, Jagudan, Mehsana, 384 460

ABSTRACT

The prime objectives of city landscaping and greening is beautification and providing overall good environment for the citizens. The urban population spend most of their time indoor, either home or office. According to a report of World Health Organization, as many as 30% of new or refurbished buildings caused occupants to suffer symptoms known as “Sick Building Syndrome” which is a term used to describe situations

when people experience acute ailments and discomfort, which seem to be linked to time spent in a particular building. Interior landscaping soften the look of concrete walls, add eye-appealing colours and creates healthier indoor environment.The practice of designing, installing and maintaining plants and biophillic components inside building is called 'interior landscaping'. Presently, advancement in building architecture and technology also one of the factors that favour interior scaping and make it easy. There is more scope of interiorscaping in commercial buildings like restaurants, offices and big malls. Interiorscaping is very useful ideas to attract people in commercial buildings. In the hospitality business, providing a soothing atmosphere is critical for ensuring high rates of occupancy whether guest are staying for business or for pleasure.Irrespective of whether the property has a commercial or a residential use, a place with beautiful rich and green landscape usually quite conducive commercially. The development in interior-scaping sector also provides very good business opportunities to other allied sectors like plant nursery, decorative containers, pot and planters, potting media, tools and other equipments business. Nowadays, the ornamental horticulture business has become more complex and competitive, requiring a high level of horticultural knowledge, innovative ideas and business savvy. Therefore, Interiorscaping is good entrepreneurship option for innovative youth having horticultural knowledge and creative instinct.

◆◆◆◆◆◆

An Alternate Option for Income Generation through Strawberry Cultivation of Bundelkhand Region

Subhash Chandra Singh[1], Satyendra Verma[2]
Department of Fruit Science, College of Horticulture,
Banda University of Agriculture and Technology, Banda, U.P. -210001

ABSTRACT

Strawberry is a herbaceous, small, tender and perennial plant.Whose botanical name is *Fragaria ananassa* L. It is a member of the Rosaceae family. Strawberry fruits are Medium Sized (10 to 15 grams), Attractive, Aromatic and Vermilion Colored, Very Soft, Very Tempting, Juicy and Nutritious.Its edible part is about 98%, in which Vit-C and Iron are available in abundance.Often India is a country of many diversities.Each of its regions has a different climate, which does not allow all crops to be grown in the same places.For this reason, there are many such crops, which cannot be cultivated even though they provide high profits to the farmers. Strawberry is one of such crops.Whose cultivation first started in the 1960s in some Hilly Areas of Uttar Pradesh and Himachal Pradesh in India. But due to non-availability of suitable varieties and lack of technical knowledge, no special success could be achieved in its cultivation till now. Till a few years back, strawberry cultivation in India was limited only to cold regions and hilly regions. But due to continuous research and improvements, High Yielding Varieties, Technical Knowledge, Transportation, Storage, Processing and Preservation, today strawberry cultivation is becoming a profitable business. whose also used to make many values added products like Ice Cream, Jam, Jelly, Candy, Strawberry Cake etc.Seeing the appropriate benefits and currently developing new improved species, it is now being successfully grown in tropical and sub-tropical climates. As a result of this, Gulreen Chawla, a law student from Jhansi district of Bundelkhand, has proved this by successfully cultivating strawberries in her district.Apart from cold regions, crops like strawberry can now give more profits to farmers in hot regions like Bundelkhand. Which is a good option for the Bundelkhand farmers to earn profits through Strawberry cultivation alternatively. This crop can also prove to be a boon for the Bundelkhand farmers in future.

Keyword: Strawberry, Cultivation, Profit, Bundelkhand etc.

◆◆◆◆◆◆

On farm production of quality organic inputs for entrepreneurship development and organic production of horticultural crops

R.A. Ram
Ex- Principal Scientist & Head, Crop Production, Central Institute for Subtropical Horticulture, Rehmankhera, Lucknow-226101

ABSTRACT

As per FiBL survey (2022), 3.4 million farmers across 190 countries are now engagrd organic production of various crops on more than 74.9 million ha. of agricultural lands. Total trade of organic produce was 120.6 billion Euros during 2022. At present, in India organic farming is being practiced in 3.59 million ha. At present, imbalanced use of agro-chemicals, especially nitrogenous has resulted in some regions manifesting adverse effects on the environment, polluting soil and ground water resources. Soil quality, especially that of organic matter and micro-nutrients deficiencies are becoming ubiquitous threatening sustainability and quality of produce impacting nutritional security. Soil organic carbon content in most of the cultivated land has been reduced to >0.5 per cent. Under these circumstances, maintenance of soil fertility and crop productivity are the major constraints in agriculture. Now a large number of macro and micro nutrients are also becoming deficient in one or the other parts of the country. After closely working with Organic Farming Systems more than two decades, I am of the view that "on farm production organic inputs could be a cheap and alternative tool to resolve many issues. In various organic farming systems viz; biodynamic, natural, Natueco, Rishi Krishi and homa organic farming inputs are produced with cow products and locally available materials. Biodynamic compost, cow pat pit, BD-500, 501, biodynamic liquid pesticides, vermiwash, Amritpani, Panchagavya, Jeevamrita, Beejamrita, GhanJeevamrita, Agni Astra, Brahmastra, Dashparni Ark, Amrit Jal and other various preparations are rich source of microbial consortia, macro, micronutrients and plant growth promoting substances including immunity enhancers. In this study, we have isolated, characterized and test microbial isolates from various organic inputs against few selected pathogens. Study showed that vermiwash contained maximum number of P-solubilising microbes (26.4x106 CFU ml-1), bacteria (22x106 CFU ml-1) and Azotobacter (22x106 CFU ml-1). In Cow pat pit, maximum number of actinomycetes (96x106 CFU ml-1) and pseudomonas population was observed, whereas Panchagavya contained maximum number of Azotobacter (20.8x106 CFU ml-1). Based on morphological characterization, isolates from vermiwash V10 and V12 were tested positive for all PGP properties and isolates from cow pat pit, CP2, CP7, C8, CP14 & CP16 observed highly positive for Zn solubilization, while CP2, CP7, CP8 & CP14 tested positive for P- solubilization. P8 isolate from Panchagavya, showed maximum PGPR properties including phosphorus, zinc solubilization and siderophore production. Vermiwash isolate V11 and Panchagavya isolate P8 suppressed the growth of selected pathogens by 42.67, 62.72, 21.14, 39.67 and 100, 71.67 45.70 and 66 percent in C. gloeosporioides, C. fimbriota, P. aphanidermatum and F. oxysporum, respectively. Based on above results, it may be recommended that cow products based bio-enhancers can be successfully used for nutrient and pest management in organic farming system. In general these are utilized to treat seeds/seedlings, enhance decomposition of organic materials thereby enrich soil and induce better plant vigour". In organic farming systems, few effective preparations such as BD-500, BD-501, Cow Pat Pit, biodynamic liquid manures/pesticides, Jeevamrita, Beejamrita, Amritpani, Panchagavya etc. are effective tools can be used in organic production of horticultural crops as well as development of entrepreneurship. It is interesting to note that in all these preparations, the basic ingredients are cow based products. In order to give generic name, hence forth, these are named as "Bio enhancers".

◆◆◆◆◆◆

Landscape Gardening- A mitigation strategy for climate change

Jaspreet Kaur, Ranjan K Srivastava, Kuldeep and Maneesh Kumar
Department of Horticulture, G.B. Pant University of Agriculture and Technology, Pantnagar

ABSTRACT

With time, as the population is increasing, the greed and exploitation of natural resources escalated, thus results into rise in green house gases. Eventually rise in greenhouse gases become the prominent reason for climate change and bring global warming, causing direct and indirect effects on earth. Change in climate pattern and insufficiency of natural resources forcing researchers and policy makers to search for a better alternative to create sustainable development. Therefore, before fixing the problem at mass scale, it should be amended at individual level and it can be achieved by adopting or practicing different approaches of landscaping such as indoor gardening, roof gardening, vertical gardening, gardening of highways, rivers, railways, hotels, hospitals, schools, private buildings etc. Along with ornamental purpose, it has been proven as one of the best alternative strategy to minimize the green house gases and concentration of pollutants with the use of different types of plants. plants having low-light-requirement with activated carbon filters possess the capacity for recovering indoor air quality and the plant root zone is considered as potent area for absorption of volatile organic compounds (VOCs). Plants such as *Hedera helix*, *Dieffenbachia compacta*, *Chrysanthemum morifolium* and *Epipremnumaureum* verified the capacity to remove formaldehyde concentration up to 90% within 24 h. Vertical gardening can reduce urban heat island effect. Enhance natural cooling and ventilation process. Living walls in indoor space can lower down the air temperature by 3.6^{o}C and can enhance the thermal resistance upto 0.05-0.09 m^2 K/W. Moreover, green roofs also sequester carbon dioxide through photosynthesis during day time and the store the carbon in the form of stems, branches or roots, conserve energy through reduced heat transfer and keep the lower portion cool by evapo-transpiration, reduces noise pollution, reduces the runoff load on the sewage system, ultimately decreases building energy consumption and absorbs the rain water and reduces overflowing impact on infrastructures.

◆◆◆◆◆◆

Agritourism

Shipra Kumari, Deepa H Dewedi
Department of Horticulture
School of Agricultural Sciences and TechnologyBabasaheb Bhimrao Ambedkar University
Lucknow:-226025

ABSTRACT

Agritourism is a concept of developing and preparing villagers for creating an alternative source of earning and sustaining their heritages.This kind of tourism develops where agricultural activities and tourism interacts.It could be a source of developing rural areas of developing countries like India.Among the different types of tourism , one of transforming agricultural fields is to convert them into agri-tourism sites, mainly in urban areas or their rural outskirts.As agriculture demands only few seasons engagement so they does not have anything else to do in offseason. The study had given a path to the youth to protect their intangible heritages and earn money with their own people.

◆◆◆◆◆◆

On Farm Assessment of Regulation of Bearing Potential in litchi (Litchi Chinensis L.) through girdling of primary branches.

Dhiru Kumar Tiwari[1], S.K. Gangwar[2], R.P. Singh[3], Saurabh Dubey[4], Subhashish Prahraj[5], Chelpuri Ramulu[6], Reeta D. Yadav[7], P.K. Mishra[8] , M.S. Kundu[9] and Ranjan Kumar[10]

[1,2, 4,5,6,7]Krishi Vigyan Kendra, Madhopur (West Champaran-I), DRPCAU, Pusa (Samastipur), Bihar
[3]Krishi Vigyan Kendra, Narkatiyaganj (West Champaran-II), DRPCAU, Pusa (Samastipur), Bihar
[8]Krishi Vigyan Kendra, Masaudha, ANDUAT, Kumarganj (Ayodhya)
[9]Directorate of Extension Education, DRPCAU, Pusa (Samastipur), Bihar
[10]RGM, Madhopur (West Champaran-I), DRPCAU, Pusa (Samastipur), Bihar

ABSTRACT

The litchi (*Litchi chinensis*Sonn.) is one of the most important subtropical fruit known for its taste, beauty, fragrance and aril quality. North West Bihar region is an important place in India for litchi growing. Erratic flowering behaviour of litchi in this region was a major problem. Hence, an On-field assessment trail was conducted by Krishi Vigyan Kendra, Madhopur at different places in West Champaran District of Bihar during two consecutive years *i.e.*, 2020-2021 and 2021-2022 to assess the Regulation of bearing potential in litchi (*Litchi Chinensis* L.) through girdling of primary branchesunder North-Western conditions of Bihar. The treatments consisted of two different girdling diameters *i.e.* T_1- circular girdling 2 mm on 50% primary branches during 1st week of September, T_2- circular girdling 3 mm on 50% primary branches during 1st week of September and one control plot was also kept where farmers practice (Without girdling) was carried out. Results indicated that maximum flowering induced in the T_2 (80.86 % and 80.85 %) followed by T_1 (73.86 % and 76.57 %) whereas, minimum flowering induced in control 29.57 % and 38.14 % respectively in both the years. The effect of girdling on litchi yield was found significant. It can be concluded that flowering may be induced upto 80 % by adopting the girdling technique. Yield and benefit cost ratio can also be enhanced by performing the girdling technique in erratic flowering condition in litchi and this would be beneficial for litchi growers with the sustainable increase in the yield and income.

◆◆◆◆◆◆

Extending commercial cultivation of onion in eastern parts of Uttar Pradesh

Amar Jeet Gupta,Major Singh, S.S. Gadge, Rajeev Kale, N. Rai and V. Mahajan
ICAR-Directorate of Onion and Garlic Research, Rajgurunagar-410 505 Pune (Maharashtra).

ABSTRACT

Onion is an important commercial crop which can improve livelihood of small and marginal farmers. It also plays a crucial role in food and nutritional security of human beings. Though, the eastern parts of Uttar Pradesh especially Mirzapur has congenial climatic conditions for onion production at commercial level, the cultivation of onion was limited to only *rabi* season at small level, mostly for kitchen gardens. There is tremendous scope to cultivate onion during *kharif* at commercial level to achieve more profit than *rabi* season and other traditionally growing vegetables. Therefore, it was decided to promote onion varieties and other production technologies of ICAR-DOGR in eastern parts of Uttar Pradesh. A total of 422 field demonstrations on onion cultivation were conducted in *kharif* and *rabi* seasons during 2018-19 to 2021-22 in Mirzapur district. About 300 progressive farmers were selected from 26 villages of Chunar taluka, Mirzapur (UP). For the first time, *kharif* onion production was initiated at commercial level in Chunar taluka of Mirzapur. Farmers have earned a net income of Rs. 0.70-0.80 lakh per acre through production of onion bulbs about 80-100 q from Bhima Super and Bhima Dark Red varieties during *kharif*. The production and productivity of onion in Mirzapur has been increased

after intervention of ICAR-DOGR in collaboration with Agrimitra FPC, Mirzapur and GKRDF, Varanasi.The demonstrations led to conclusion that the eastern parts of Uttar Pradesh is suitable for *kharif* onion production.*Kharif* onion, which is confined to Maharashtra, Karnataka and Tamil Nadu, was extended to non-traditional regions such as eastern Uttar Pradesh and north eastern region of India. During the last five years, more than 400 farmers have started *kharif*onionproduction in Mirzapur, with the help of the state government, the production of *kharif* onion is being increased to 2000 ha.The Technical Folder as well as a Documentary Film on "Extending commercial cultivation of onion in eastern parts of Uttar Pradesh: A Success Story" have been published/ released to boost up the *kharif* onion production.

◆◆◆◆◆◆

Cordyceps for Health and Business in Himalayan regions

Ranjit Singh
Defence Institute of Bioenergy Research (DIBER) DRDO, Goraparao, Haldwani-263139

ABSTRACT

Cordyceps is popularly known as Caterpillar mushroom or Keera Jadi in the Himalayan regions, is a unique entomogenous medicinal fungus which parasitizes the caterpillar of *Thetarhodes armoricanus*, a lepidoptern Insect. It is known for its multi-medicinal uses and very high cost. It is found in the grasslands above treeline in Himalayan regions from 10000 to 14000 ft AMSL.

Its health benefits include its usefulness against all sorts of respiratory and lung infections, kidney diseases and all sorts of bacterial and viral diseases. It is one of the best immunomodulator and adaptogen. It is considered best natural performance enhancer and also known to increase physical stamina of the body.

Cost of natural specimens in Indian market is around 10-15 Lakhs and 20-25 Lakhs in international market. It is endangered in nature. Because of its endangered nature and very high cost industries have not came forward for the development of its products in India. But now Defence Institute of Bioenergy Research (DRDO), Haldwani has standardized its laboratory culture and transferred its technology to three industries so that they can formulate products using this highly valuable fungus for the benefit of mankind. This medicinal fungus has immense potential and more Pharmaceutical and Nutraceutical industries can come forward and take this technology from DIBER(DRDO) for the benefit of patients, athletes and general public as well.

◆◆◆◆◆◆

POSTER PRESENTATION

Citrus Cultivation – A Viable Option for Diversifying Cropping Pattern of North-West India

Tanjeet Singh Chahal,Vikramjit Singh and Nav Prem Singh
Punjab Agricultural University, Fruit Research Station - Jallowal

ABSTRACT

India's north-western region is reported to have the best agro-ecological conditions for producing various *Citrus* (L.) species. Due to its higher economic returns, comparison to other fruit crops, its cultivation has proven profitable for farmers. Citrus fruits comprise Mandarins (mainly kinnow), Sweet oranges, Limes, Lemons and Grapefruits. These are typically divided into early-season, mid-season and late-season varieties. Moreover, in the north-western regions, Punjab is at the apex, followed by Rajasthan and Haryana concerning area and production. Currently, Punjab produces 12,31,995 tonnes of citrus annually on 52,836 hectares; out of this, Kinnow mandarin covers an area of 44,859 hectares and produces 11,84,098 tonnes annually. On the other hand, the citrus production in Rajasthan and Haryana is 6,75,440 and 5,70,883 on 42,080 and 24,440 hectares, respectively. Furthermore, citrus thrives well in deep, fertile, well-drained soils with an optimum range of pH 5.5 to 7.5. The fruiting time of different citrus species ranges from September to March. As evident from the above data, in previous years, there has been a tremendous increase in citrus production in the north-west region of India owing to high production and an increase in area under cultivation. Progressive farmers prefer to grow citrus instead of mono-cropping because of its high-yielding characteristics and attractive quality that possesses the potential to give a lucrative return in the form of profit.

◆◆◆◆◆◆

Trend Analysis and Forecasting of Area, Production and Productivity in Pea: A Case of Himachal Pradesh, India.

Lalenpui, Ravinder Sharma, Niyati Thakur and Khalandar
Dr. YSP University of Horticulture and Forestry, Nauni, Solan (HP) 173230

ABSTRACT

Farmers can make decisions regarding their future patterns of production and sales of agricultural products within a specific time period with the help of market data prices over time. Price fluctuations in agricultural commodities are a common occurrence because of their cyclical nature of production, considerable ecological imbalances when compared to other crops and seasonal demand for agricultural commodities. The present study is related to the growth, instability and forecasting the area, production and productivity of pea in Himachal Pradesh by using secondary data for the period of 25 years (1995-2020). It was observed that growth in production (2.29%/annum) was found higher compared to area (1.73%/annum) and productivity (0.55%/annum) and the stability index is found to be positive, indicating that there is less danger for cultivation in the district. The increase in production of pea it is only because of area effect. By using ARIMA model, area, production and productivity of pea were forecasted for the next 5 years (2021-2025). ARIMA (0, 1, 1), ARIMA (2, 1, 0) and ARIMA (0, 1, 1) were selected for forecasting area, production and productivity of pea. It was found that forecasted values for area and productivity were constant throughout the forecasted years while production was noticed to have decreased from 16.12 to 15.59 thousand MT from the year 2021 to 2025.

◆◆◆◆◆◆

Problems faced in Vegetable Marketing in Kullu District of Himachal Pradesh, India

Ishita Mandla and Manoj Kumar Vaidya
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan,
Himachal Pradesh, India 173230

ABSTRACT

India has been blessed with a wide range of climate and geographical conditions and is most suitable for growing various kinds of vegetable crops. India is now the second largest producer of vegetables in the world after China. The present study aimed to analyse the constraints in marketing of vegetables in Kullu district of Himachal Pradesh. Marketing is an important operation in vegetable production. The whole of Himachal Pradesh has been divided into ten notified market areas. Its main objective is to safeguard the interest of the farming community. A total of 59 markets are functional in the state out of which 10 are principle regulated markets. The regulated markets established in different parts of the state are providing useful services to the farmers. Although these markets have the basic facilities, other facilities like cold storage, grading sheds, mechanical grading and packing etc. which are important for a regulated market are unavailable. Therefore, to examine the various marketing aspects of vegetables, five traders, five wholesalers and five retailers were selected randomly from the Bhunter market to study the functioning of market.The problems of high chemical prices (43.48%) and inadequate market information (65.22%) were maximum faced by the small category farmers whereas, (92%) of the respondents in the marginal category were facing the problem on non- availability of labour at peak operation time and non-availability of assistance from the financial institutes (76%). Majority of the respondents in medium category were facing the problem of high wage rates (66%) and incidences of insects, pests and diseases (66.67%). The study thus emphasized on various problems associated with the production and marketing of vegetables in the study area.

◆◆◆◆◆◆

Consumer Behavior towards Aloe Vera products and consumption

Sachin Kumar and K K Raina
Department of Business Mnagement, Dr. Yashwant Singh Parmar University of Horticulture and Forestry,
Nauni-Solan (HP) -175001

ABSTRACT

Aloe Vera market is demand driven and 77 percent of consumers use aloe vera in various forms like beauty products, medicinal, sanitizers, Juice etc. About 65% consumers use products single time a day and more than 30% use two or more than two times a day. The pull of consumers is so strong towards top brands that the stores are forced to keep the brand of consumer's choice. Most of the consumers are aware about the quality standards of aloe vera and they just buy the brand name due to popularity of the brand and product itself as seen in advertisements. Most of the consumers get information about the product through advertisement and sales promotion. About 60% consumers use brands like Patanjali and Himalaya because they are the most popular brands in India and are available easily at any store. Decision maker in family regarding the purchase are elders and younger ones. 65% consumers choose brand and quality of the products over the price factor. Customers are not loyal to one brand and shifts easily to another brand according to their use and other factors such as quality, quantity, schemes, offers, gifts and price of the product. According to 90% consumers, price affects the sales of these products most. As, India is the largest market to capture, so marketers and aloe vera industry is

facing cut throat competition from other brands also. So, industries should study the strategy of competitors and then build strategies to attract customers and capture market.

◆◆◆◆◆◆

Crop Insurance is Risk Management and Challenges to Adoption: Central India

Ankit Kumar Maurya
Department of Agricultural Economics, Banda University of Agriculture and Technology, Banda-210001

ABSTRACT

Indian agriculture is still dependent mostly on monsoons, that is highly prone to the vagaries of weather and market forces. Hence a development policy that includes explicit insurance for both farm as well as non-farm activities that helps in the economic development of the country and also increases the income of the farmers/non-farm workers. Crop insurance is a risk management option for the farmers to stabilize farm income and investment in India for which the government has launched various insurance schemes like the Comprehensive Crop Insurance Scheme (CCIS), National Agricultural Insurance Scheme (NAIS) and Modified NAIS (MNAIS), etc. At present, the two most important schemes are functional *i.e.*, Pradhan Mantri FasalBima Yojana (PMFBY) and Restructured Weather Based Crop Insurance Scheme (RWBCIS). Crop insurance in India suffers from the low realization of its benefit to the farmers. There are so many socio-economic factors that affect the knowledge of farmers about crop insurance like age, education, income level, the experience of farming, lack of interest & need, etc. Education plays a major role in understanding policies and the importance of insurance for farmers. Considering the importance of crop insurance in risk mitigation, farmers' adoption of crop insurance is low at 4.80% in the Kharif season and 3.17% in the Rabi season mainly on account of a lack of awareness. However, those who suffer high crop losses and have some formal agricultural expertise are more likely to adopt insurance. The option of adopting crop insurance is favorably influenced by the premium subsidy. Research at the farm level suggested that crop insurance could be an important means of reducing agricultural risk. It is also suggested that the level of agricultural risk is particularly high in the districts of central India and to reduce this risk and increase the income of farmers, it is also recommended that along with efficient crop insurance systems, special priority should be given to improved cropping patterns, improved irrigation services, rural infrastructure and expanded banking services.

Keywords: Monsoon, Risk, Crop insurance, Awareness, Knowledge, etc.

◆◆◆◆◆◆

Role of Woman in boosting up Indian economy through horticulture startup value-chain.

Kuldeep, A.K. Singh and Jaspreet Kaur
G.B. Pant University of Agriculture and Technology, Pantnagar

ABSTRACT

Indian horticulture is the core sector of agriculture, however, horticulture is not only limited to cultivation and production, instead there is tremendous scope for value addition of horticultural goods which can generate enormous amount of income as well as employment. As horticulture includes fruit, vegetables, floricultural, aromatics and medicinal, plantation, spice and condiments crops, all these fields have their own different capabilities and scope for business point of view. A major barrier for startup in horticulture is a lack of knowledge regarding what to process, how to process and where to sell. Despite, it is witnessed that due to hectic and busy lifestyle,

the demand for horticultural products have been raised especially in case of processed fruits and vegetables as well as for aesthetic floricultural commodities. As a result, horticulture is set to assume greater role and importance within the agriculture sector and eventually in the national economy. Moreover, these days, women play an active role in various post-harvest and processing activities. The numbers of women engaged in horticulture entrepreneurshiphas increased continuously in the past two - three decades due to various reasons. They are starting their small-scale business such as making of pickles, jam, jellies, murrabas, squashes, juices etc. from their home. Due to internet facilities, even they are start using online platforms for marketing. The small-scale business is not only restricted to fruits or vegetables but also floricultural ornamental products gaining huge popularity and even it is providing jobs to students.

Keywords: Business, Income, Economy, Scope, Value addition Product,

◆◆◆◆◆◆

Supply and Value Chain of Fruits and Vegetables Agribusiness in Uttarakhand (India): Major Issues and Challenges

Surbhi Pande[1], H.S.Baweja, Rohit Bisht and Harish Chandra Raturi
Deptt. of Horticulture & Food Processing,
Govt of Uttarakhand, Dehradun

ABSTRACT

Horticulture is one of the critical sectors in the economy of Uttarakhand as it is capableto provide much needed opportunity for diversification and increased employment, it can also provide solution to address the scattered and marginal holdings. Area under horticulture crops can be increased by utilization of cultivable wastelands and the farms belonging to absentee landowners. Fruits and vegetables crops being high value crops are important in raising the incomes of the farmers besides creating employment opportunities. Fruits and vegetables sector in India has gained its credibility for providing sustainable income, nutritional security and for providing employment opportunities, both in rural and urban areas. India is the second largest food producer in the world, after china and one of the centers of origin of fruits and vegetables with the total production. Various high temperate fruits and vegetables like apples, pears, peaches, plums,Walnut, Guava,Mango, tomato, Capsicum, Pea, Cabbage green leafy vegetables etc. Are widely grown in Himalayas and tarai region of Uttarakhand and are important to the large food processing industry. Fruits and vegetables is one of the most significant and thrust sector of the economy of Uttarakhand state. The entire supply and value chain of fruits and vegetables in Uttarakhand is laden with the various issues which resulting to poor price realization of growers on one hand and exorbitant prices paid by consumers on the other. Highly inefficient supply chain and cold chain infrastructure is the major impediment in the path of speedy growth of F& V production sector in Uttarakhand. The present study undertakes a thorough review of basic and contemporary literature available and discussed the issues and challenges related to supply chain of fruits and vegetables sector in state of Uttarakhand, India and suggested the corresponding mitigation strategies.

As Uttarakhand economy is based on agriculture, there is a need to develop efficient supply chain which may play an important role in increasing the shelf life of the F&V and in turn reduce the losses and wastages in fruits and vegetables, increase in farmer income, generate employments opportunities for the local peoples and improve the livelihood of the farmers which leads to the development of Uttarakhand and Indian economy as a whole.

◆◆◆◆◆◆

Farmer's awareness level about important welfare schemes for agriculture sector in Dharampur Block of Solan District, Himachal Pradesh

Rachna and Krishan Kumar
Department of Business Management, Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan (H.P) 173230

ABSTRACT

The present study entitled "Farmer's awareness level about important welfare schemes for Agriculture sector'' evaluated the awareness level and farmers attitude towards two important schemes which are e-NAM and Pradhan Mantri Fasal Bima Yojana. The study also assessed the problem faced while adoption of the schemes. The research was conducted in the Dharampur block of Himachal Pradesh District Solan. The sample size of the study was 50 farmers drawn from a convenience sampling design. Moreover, Tabular analysis, percentage method, arithmetic meanand total weighted score method were used for data analysis. The findings of the study revealed that the awareness level of e-NAM is low and Pradhan Mantri Fasal Bima Yojana is medium. The attitude of farmers towards e-NAM scheme is that there is a need of awareness and it is useful for farmers, those who have higher production and towards Pradhan Mantri FasalBima Yojana is that the procedure of the scheme is complex and it stabilizes the income. The findings of the study identified different problems faced by the farmers which are the language used by the bank members, the process of implementation and the use of internet is complex. The findings concluded that, there is a need to improve the awareness level and attitude of farmers towards government schemes for effective implementation.

◆◆◆◆◆◆

Horticulture through AICRP (All India Coordinated Research Project)Network

Jitendra Chauarasia, Rahul Kumar, Ankur Tyagi
Chandra Shekhar Azad University of Agriculture and Technology, Kanpur

ABSTRACT

The All India Coordinated Research Project (AICRP) on Horticulture (fruit)s of the Indian Council of Agricultural Research (ICAR) under the National Agricultural Research System (NARS) is a unique mechanism for testing and recommending the location and need-based technologies depending on the agro-climatic conditions. The mandated Horticulture (fruit) crops are banana, Citrus, guava, grapes, litchi, mango, jackfruit, papaya and sapota. This project was initially named the All India Coordinated Horticulture (fruit) Improvement Project (AICFIP) to work on Citrus, banana, papaya and pineapple as Cell-I and on mango, guava and grape as Cell-II. In 2013, a merger of these two coordinated projects formed the AICRP on Horticulture (fruit)s, which was acknowledged and appreciated by the Planning Commission for evolving a unique mechanism of effective utilization of human resources and budget on a collaborative mode for delivering technologies to different agro-climatic regions. In this mode, ICAR-AICRP on Horticulture (fruit)s aimed to empower the National Research Centres (NRCs) on banana, grapes and litchi and the Central Citrus Research Institute (CCRI) for better coordination and scientific output of the respective mandate crops, besides effective utilization of resources. Accordingly, the project is operational at 50 centres (at present, there are 30 SAU-based centres, 14 ICAR-Institute-based centres, 4 CAU-based centres and one at a private centre in Pune and one under the Government of Arunachal Pradesh). Crop regulation techniques by using various chemicals and pruning methods have helped farmers produce more during off-season and helped in extending the fruiting period, thereby providing an opportunity for farm profitability. The centres of ICAR-AICRP on Horticulture (fruit)s in different hotspots of mandate crops have provided a

forewarning on the occurrence of insect-pests and diseases with suitable management techniques through effective extension strategies that resulted in managing the biotic stresses efficiently. In addition, extending the assessment of PHLs to other mandate crops in major hotspots and demonstration of promising technologies on Horticulture (fruit) crops in tribal are other focused areas of this project.

◆◆◆◆◆◆

Session-10

Horticulture Teaching and Students' Thesis Research

Effect of NPK through drip fertigation on vegetative growth and flowering attributes of Gladiolus cv. White Prosperity under taraiconditions of Uttarakhand

Yograj Kushwaha, B. D. Bhuj, Ranjan K. Srivastava, V.P. Singh, Satish Chand
Department of Horticulture, College of Agriculture, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar.

ABSTRACT

The present investigationwas carried out at Model Floriculture Centre, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar,District-Udham Singh Nagar, Uttarakhand, during November, 2019 to May, 2020. Investigation was laid out in randomized block design (RBD) with five treatment and four replicationsto study the "Effect of NPK through drip fertigation on vegetative growth and flowering attributes of Gladiolus cv. White Prosperity under *tarai* region of Uttarakhand". Observations were recorded on various attributes of vegetative growth, flowering and corms attributes. At 60 days the maximum plant height (70.04 cm) was obtained in T_1 while the maximum leaves number/plant (8.54) was exhibited by T_3. Width of leaves and girt at the base was depicted higher in T_4. Regarding flowering characters, the treatments T_3responded best result especially in commercial traits like spike length (121.63 cm), number of floret/spike (13.67) and rachis length (56.53 cm). In respect of corms characters there were a positive response by the application of various organic manures. The maximum number of corm/plant (1.25) was recorded in T_2while maximum weight of single corm (43.30 g) was found in T_1, On the basis of present findings it may be concluded that there was a positive impact of the application different levels of fertigationon vegetative growth, flowering and corms characters as well as to sustain the soil fertility by the residual presence of nitrogen, phosphorus, potassium, organic carbon and maintenance of normal pH and electrical conductivity of the soil.

◆◆◆◆◆◆

Effect of irrigation water quality on salinity tolerant and susceptible ornamental tree species in semi-arid region of Bathinda, Punjab

Kamal Kishor Nagar[1], R. K. Dubey[1], Simrat Singh[1], Parminder Singh[2], Ravi Deepika[2], Ulli Murli Krishna[2] and K. S. Sekhon[3]
Department of Floriculture & Landscaping, Punjab Agricultural University, Ludhiana 141 004, India
Regional Research Station, Bathinda, Punjab Agricultural University, Ludhiana 141 004, India

ABSTRACT

On the basis of morpho-physiological, biochemical and anatomical parameters during the 1st and 2nd year of the experiment, plants were classified as salt tolerant and susceptible. From these plants highly salt tolerant (*Callistemon lanceolatus*, *Pongamia pinnata, Acacia auriculiformis*and *Cassia Fistula*) and salt susceptible tree species (*Putranjivaroxburghii*and*Milletiaovalifolia*) were be planted at PAU regional research station, Bathinda. The field experiments were conducted in a randomized block design with 12 treatments replicated three times. The treatments were comprised of two irrigation water quality (saline water and canal water) and six ornamental tree species. pH and EC of the soil was increased as the irrigated with Saline water (pH 8.99, EC 3.65 dS/m) and Canal water (pH 8.1, EC 0.46 dS/m). Among different tree species, highest mean value of all parameters in salt tolerant tree species were found when the plants were irrigated with canal water up to the estimated salinity of 0.46 dS/m. The maximum increase in plant height (26.9%), plant spread (27.4%) was observed in *C. fistula,* Number of branches per plant (39.0%), stem girth (30.6%) in *A. auriculiformis*andsurvival

percentage (100%) in *C. fistula, C. lanceolatus* and *P.* pinnata compared with saline water irrigated tree species.

Keywords: -Saline water, Canal water and Ornamental tree species.

◆◆◆◆◆◆

Response of preharvest sprays of calcium and putrescine on postharvest quality of peach during storage

Shubham Jagga, Shweta Uniyal and D. C. Dimri
Department of Horticulture, College of Agriculture
G. B. Pant University of Agriculture & Technology, Pantnagar-263145, Uttarakhand, India

ABSTRACT

Peach fruit is generally characterized by high perishability and a relatively short storage potential, as fruits quickly pass from ideal maturity to over ripening phase that in turn cause substantial losses in the quality, including firmness and are, thus, responsible for the shorter postharvest shelf life of the fruit. For many years synthetic chemicals were used to control fruit ripening and decay but the public concerns about chemical residues and the harmful effects of these chemicals on human health and environment encouraged research to find safe alternative chemicals which can maintain the marketable quality throughout prolonged storage period of fruits. Hence, the present investigation was undertaken to study the effect of preharvest sprays of calcium, putrescine and their combination on extending shelf life and improving quality attributes of low chill peaches under *tarai* region of Uttarakhand.

The experiment was laid out in Factorial CRD with two factors comprising of twelve treatments (Control , Calcium Nitrate @ 0.5% , Calcium Nitrate @ 1.0%, Putrescine @ 100 ppm, Putrescine @ 200 ppm, Putrescine @ 300 ppm, Calcium Nitrate @ 0.5% + Putrescine @ 100 ppm, Calcium Nitrate @ 0.5% + Putrescine @ 200 ppm, Calcium Nitrate @ 0.5% + Putrescine @ 300 ppm, Calcium Nitrate @ 1.0% + Putrescine @ 100 ppm, Calcium Nitrate @ 1.0% + Putrescine @ 200 ppm and Calcium Nitrate @ 1.0% + Putrescine @ 300 ppm) and 6 storage intervals (0, 6, 12, 18, 24 and 30 days). The fruits after harvesting were stored in a refrigerator for further studies and the observations in respect to different physic-chemical parameters were recorded. The findings of the present investigation revealed that spray of calcium nitrate @ 1.0% + putrescine @ 100 ppm followed by calcium nitrate @ 1.0% + putrescine @ 200 ppm improves the quality and storability of peach cv. Pratap. The combined treatment of putrescine and calcium enhances firmness, total soluble solids and total sugars and had a reducing effect on weight loss, shrinkage and fruit decay percentage.

◆◆◆◆◆◆

Morphological and molecular Characterization of local mango (*Mangifera indica* L.) germplasm

Sanjay Kumar Dr. R.A. Kaushik

ABSTRACT

The present investigation was conducted at experimental orchard of AICRP on Fruits at Agricultural Research Station, Banswara, Department of Horticulture & Department of MBBT, RCA, MPUAT, Udaipur, during January, 2018 to August, 2018 to characterize local mango (*Mangifera indica* L.*)* germplasm at morphological and molecular level. The experiment was was carried out as completely randomized design with

fourteen local mango (*Mangifera indica* L.*)* germplasm with three replications. On the basis of fruit morphological and biochemical characters IC No. 589756 was found to be over all best germplasm with respect to fruit length, fruit width, fruit weight, pulp weight, TSS/Acid ratio, pH and low acidity followed by IC No. 589746 exhibiting maximum pulp per cent and highest TSS accompined with lowest stone weight and stone per cent as compared to other germplam under study. The dendrogram and cluster analyses revealed that the local mango germplasm for chloroplast marker *psb*A-*trn*H and *trn*CD F'- R'depicted the relationship among the germplasm and clearly divided them into two main clusters at a similarity coefficient 0.035 and 0.15, respectively. The first cluster includes only 1 germplasm at similarity and cluster – II contain 13 germplasm.

◆◆◆◆◆◆

Effect of Nano-Dap on Growth, Yield and Nutrient use Efficiency in Cabbage

Suchibrata Chamuah, Sailen Gogoi, Samiron Dutta & Diplip Barman
College of Agriculture, Assam Agricultural University, Jorhat- 785013, Assam

ABSTRACT

The present investigation entitled 'Effect of nano-DAP on growth, yield and nutrient use efficiency in cabbage' was conducted at the Experimental Farm, Department of Horticulture, A.A.U., Jorhat during 2021-2022. The experiment was laid out in Randomised Block Design with thirteen treatments and three replications. The growth and yield characters showed significant differences among the treatments. The maximum plant growth parameters, head weight, total yield and NPK uptake were recorded in T_3. Application of nano-DAP as seedling root-dip treatment and foliar spray was found to be effective for plant growth and head yield of cabbage. Among the nano-treatments, better vegetative growth parameters were obtained in T_7 while heavier heads (0.92 kg) and higher total yield (317.38 q/ha) was recorded in T_9 which also registered maximum P uptake (10.23 kg/ha) by plants. The highest N (65.4 kg/ha) & K (103.63 kg/ha) uptake was recorded in T_{11}. T_9 was evaluated to be the most remunerative option with a Benefit: Cost ratio of 3.44 although a higher yield (317.38 q/ha) was obtained in T_{11}. Recommended dose of 130:80:80 kg NPK/ha (T_3) resulted in the maximum head yield (348.60 q/ha) and B: C ratio (3.64). Thus, the use of nano-DAP may be a good alternative to minimise use of the conventional inorganic fertilizers thus reducing the cost on inputs, transportation & storage cost, mitigation of ground water pollution while sustaining the quality and quantity of produce.

◆◆◆◆◆◆

Effect of Fertigation Levels on Growth and Yield of Okra

Madhuri Bhatt, Lalit Bhatt, Riya Pandey And Upendra K. Singh
G. B. Pant University of Agriculture and Technology, Pantnagar- 263145, Uttarakhand

ABSTRACT

A study was undertaken to investigate the response of okra to different doses of NPK applied through fertigation under *tarai* condition of Uttarakhand at Vegetable Research Centre of G.B Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar (Uttarakhand) during kharif season of 2022. The experiment was laid out in a randomized complete block design with seven treatments and three replications. Different levels of fertigation applied once in a week according to crop growth curve. Treatment consisting of five fertigation levels *viz.,* F_1: 120 percent of RDF, F_2: 100 per cent of RDF, F_3: 80 per cent of RDF, F_4: 60 per cent of RDF and F_5: 40 per cent and one fertigation scheduling which was given 5-20, 21-36, 37-52 and 53-68 days after sowing (DAS) respectively, along with one control (soil application of RDF with flooding). Present investigation revealed that performance of okra was significantly influenced by different drip fertigation levels

and scheduling. Among the different fertigation levels, fertigation at 120 per cent of RDF (T_1) is the best and most economical treatment recorded in terms of plant height, stem diameter, number of fruits per plant, average fruit yield per hectare and water use efficiency. Hence, fertigation in okra at 120 per cent of recommended dose @100:80:80 kg N, P_2O_5 and K_2O per ha through scheduling is the best and most economical for higher yield of okra.

◆◆◆◆◆◆

Morphological and molecular Characterization of local mango (*Mangifera indica* L.) germplasm

Sanjay Kumar Dr. R.A. Kaushik
(Research Scholar) (Major Advisor)

ABSTRACT

The present investigation was conducted at experimental orchard of AICRP on Fruits at Agricultural Research Station, Banswara, Department of Horticulture & Department of MBBT, RCA, MPUAT, Udaipur, during January, 2018 to August, 2018 to characterize local mango (Mangifera indica L.) germplasm at morphological and molecular level. The experiment was was carried out as completely randomized design with fourteen local mango (Mangifera indica L.) germplasm with three replications. On the basis of fruit morphological and biochemical characters IC No. 589756 was found to be over all best germplasm with respect to fruit length, fruit width, fruit weight, pulp weight, TSS/Acid ratio, pH and low acidity followed by IC No. 589746 exhibiting maximum pulp per cent and highest TSS accompined with lowest stone weight and stone per cent as compared to other germplam under study. The dendrogram and cluster analyses revealed that the local mango germplasm for chloroplast marker psbA-trnH and trnCD F'- R'depicted the relationship among the germplasm and clearly divided them into two main clusters at a similarity coefficient 0.035 and 0.15, respectively. The first cluster includes only 1 germplasm at similarity and cluster – II contain 13 germplasm.

◆◆◆◆◆◆

Influence of varieties to foliar application of Zn and Fe for growth, yield and quality of okra

A. J. Patel, B. N. Satodiya, K. D. Rathod and P. K. Patel
Department of Horticulture, BACA, AAU, Anand

ABSTRACT

Introduction: Micronutrient disorder appears to be the most wide spread and frequent problem in crop production worldwide, resulting in severe losses in yield and nutritional values.Foliar spray of micronutrients (Zn and Fe) with chelating agent facilitates efficient consumption of nutrients straightly through leaves, the effect of which can show its importance soon.

Methods: The experiment on Influence of varieties to foliar application of Zn and Fe for growth, yield and quality of okra was conducted at Horticultural Research Farm, AAU, Gujarat, during the year 2020 and 2021 in factorial RBD with three replication and fourteen treatment combinations comprising two factors *i.e.*, varieties *viz.*, V_1: GAO 5 and V_2: GO 6 and Foliar application of Zn and Fe *viz.,* M_1: $FeSO_4$ @ 0.50 %, M_2: $ZnSO_4$ @ 0.50 %, M_3: Fe EDDHA @ 0.1 %, M_4:Fe EDDHA @ 0.2 %, M_5: Zn EDTA @ 0.1 %, M_6: Zn EDTA @ 0.2 % and M_7: Control. Experimental Result: Results indicated that among the varieties,GAO 5 recorded maximum leaf area at 60 DAS, dry weight of plant at 90 DAS, pod length, yield, fiber content, chlorophyll content, phenol

content of pod with minimum LMI. Among the foliar application of Zn and Fetreatment M_6recorded maximum leaf area, fresh and dry weight of plant, pod length, pod girth, pod weight, yield, fiber content, chlorophyll content, phenol content of pod with minimum LMI. Interaction effect of varieties and foliar application of Zn and Fe recorded maximum pod length, chlorophyll content of pod was recorded with V_1M_6.

Keywords: varieties, Zn EDTA, Fe EDDHA, foliar spray, okra

◆◆◆◆◆◆

Impact of Oil Field Effluent on Soil Health and Growth in Small Tea Farms of Dibrugarh District of Assam

Eimon Bhardwaj, Pubali Neog, Rashmi Kalita, Dr. Aditi Smith Gogoi,Diganta Kumar Bora, Dr. Rana Pratap Bhuyan, Dr. Nilay Borah
AAU, Jorhat, Assam, India, 785013

ABSTRACT

The impact of spillage in the tea plantations in nearby oil fields with probable effect on soil health and the growth of the tea crop was studied with the following objective to study the impact ofeffluent released from the oil fields on the physiology of tea crop and soil physicochemical parameters.Analysis of variance (ANOVA) for two factorial RBD was carried out using OPSTAT.The field study was carried out in Shalmari near the Tingkhong tea estate of Dibrugarh. The laboratory works were carried out in the Department of Tea Husbandry & Technology and the Department of Soil Science, Assam Agricultural University, Jorhat, Assam.Two tea-growing seasons *viz.* Rainflush and autumn flush were considered. Samples were collected at four distances. A total of 24 samples each was collected for both plant samples andsoil samples for both seasonsconcerning 4 distances and 3 replication.Plant parameters like water saturation deficit increased in crude oil affected the site while decreasing the relative turgidity and stomatal count, in the tea plants grown in the contaminated site. Bulk density, pH, organic carbon and available nutrients in the contaminated site of the soils contaminated site were increased. However, porosity, hydraulic conductivity and electrical conductivity were low in the contaminated area.The study reveals oil effluent spillage as a major factor for plant growth and soil quality deterioration and the impact was more pronounced in the vicinity of the drilling point adversely affecting plant and soil parameters.

◆◆◆◆◆◆

Interactions of cellular immunocytes in red pumpkin beetle, *Aulacophora foveicollis* (Coleoptera : Chrysomelidae) against entomopathogenic bacteria Bacillus thuringiensis

Diplina Yein
Assam Agricultural University, Jorhat, Assam

ABSTRACT

The study "Interactions of cellular immunocytes in red pumpkin beetle, *Aulacophora foveicollis* (Coleoptera: Chrysomelidae) against entomopathogenic bacteria *Bacillus thuringiensis*" was carried out in the Department of Entomology and in the Department of Plant Pathology, Assam Agricultural University, Jorhat during 2020-21. Applying biological means for insect control is of high need during present times and one of the important aspects to test the efficacy of any entomopathogen is by studying the interactions of the cellular innate defense of the pest against the pathogen. To examine the cellular immune responses in insects it is important to

identify the types and characteristics of haemocytes. In this study, the cellular immunocytes of red pumpkin beetle, *Aulacophora foveicollis* were studied. For identification of the haemocytes and determination of Differential haemocyte count (DHC), haemolymph smear preparation was carried out; while for determination of Total Haemocyte Count (THC) the Neubauer improved haemocytometer was used. The haemocytes were identified as prohaemocytes (PRs), plasmatocytes (PLs), granulocytes (GRs), coagulocytes (COs) and oenocytes (OEs). The total haemocyte count (THC) of the insect was found to range between 4100 – 5100 cells/mm^3 in healthy insects. The PRs were the smallest and the most abundant cells in the haemolymph with a DHC of 34.86 - 38.21% while the OEs were the largest and the least abundant cells with a DHC of 3.25-5.36%. The physiological reaction of the immunocytes of red pumpkin beetle (*Aulacophora foveicollis*) in response to entomopathogenic bacteria *Bacillus thuringiensis* was studied at different time intervals post treatment *i.e.* 0, 6, 12, 24, 36, 48, 72, 96, 120 HAT. It showed that THC of *Bt* treated insects were significantly decreased from 6 HAT and the lowest decrease in THC was observed at 120 HAT. The DHC count after *Bt* treatment showed that the PR count showed significant reduction from 24 HAT onwards. The PL and GR count was significantly increased from 6 HAT which depicts that they were the primarily involved in the immune functions. The CO count showed significant increase at 24, 36, 48, 72 and 96 HAT while the OE count showed a significant increase only at 120 HAT. The haemocytes showed morphological alterations like vacuolization, cytoplasmic extensions, formation of pseudopods and degranulation on treatment with *Bt.* And also the defence mechanisms, such as phagocytosis, encapsulation and nodulation were exhibited by *A. foveicollis* against *B. thuringiensis.* Despite the presence of defence responses the bacterial infection progressed and lead to death of the insect causing significant mortality from 7 DAT. Hence, it can be concluded that *Bacillus thuringiensis* can be considered as a potential component in the IPM against *Aulacophora foveicollis*.

◆◆◆◆◆◆

Effect of antioxidants and plant bio-regulators on leaf chlorophyll and mineral content of apricot (*Prunus armeniaca* L.) cv. New Castle

Neha Thakur[1], Gopal Singh[2], Dharma Paul Sharma[3] and Uday Sharma[4]
Dr. YS Parmar University of Horticulture & Forestry, Nauni, Solan (H.P.) 173230

ABSTRACT

A field experiment was conducted during 2019-2020 to investigatethe effect of antioxidants and plant bio-regulators on leaf chlorophyll and mineral content of apricot cultivar New Castle. The experiment was laid out in Randomized Block Design consisting of nine treatments replicated thrice. The antioxidants and plant bio-regulators were applied at pink bud stage and repeated at pit hardening stage through foliar application. The antioxidants and plant bio-regulators treatments were T_1: Ascorbic acid 1000 ppm, T_2: Ascorbic acid 2000 ppm, T_3: Citric acid 1000 ppm, T_4: Citric acid 2000 ppm, T_5:Benzyladenine 50 ppm, T_6: Benzyladenine 100 ppm, T_7: Gibberellic acid 25 ppm, T_8: Gibberellic acid 50 ppm and T_9: control (water spray). The results revealed that among various treatments significantly highest plant height, trunk girth, annual shoot growth, leaf area and leaf N, K, Fe, Cu, Zn and Mn contents were found in treatment T_8(gibberellic acid 50 ppm). However, maximum total leaf chlorophyll content and leaf P, Ca and Mg contents were recorded under treatment T_2(ascorbic acid 2000 ppm). It was concluded that GA_3 at 50 ppm had most pronounced effect. However, antioxidants mainly 2000 ppm of ascorbic acid was equally effective to gibberellic acid at 50 ppm. Since, antioxidants are organic compounds and are more readily acceptable than synthetic chemicals, these compounds can be considered as good alternative to chemicals in fruit production.

◆◆◆◆◆◆

Standardization of method for preparation of osmotically dried instant guava slices

Priyanka[1] and Anil Kumar Verma[2]
[1]PhD Research scholar, Dr Y.S. Parmar University of Horticulture & Forestry Nauni, Solan, HP
[2] Associate Professor, Dr Y.S. Parmar University of Horticulture & Forestry Nauni, Solan, HP
Department of Food Science and Technology, Dr. YSP UHF, Nauni, Solan H.P. 173230

ABSTRACT

Method for utilization of guava fruit cultivars viz, *Lalit* and *Shweta* for the preparation of osmo-dehydrated fruit slices was standardized. The guava fruits with peel and without peel of each cultivar were cut into 4 mm, 6mm and 8mm thick slices were dipped in 5 different soaking solution (0, 0.1% KMS, 0.2% KMS, 0.1% KMS+0.5% $CaCl_2$, 0.2% KMS+0.5% $CaCl_2$) for 15 minutes and dried in dehydrator at 55±5°C to a constant moisture content. Among different pre-treatments, fruit types and slice thickness the use of 0.2% KMS+0.5% $CaCl_2$, unpeeled guava and 6mm slice thickness were found most suitable with respect to moisture loss, weight loss, drying time and sensory characteristics for development of osmo-dried fruit slices. Then slices selected were kept in 50°B, 60°B and 70°B osmotic solutions for 24 hours and dried in cabinet drier at 55±5°C. The fruit slices packed in aluminium pouches showed marginal changes in various and sensory attributes but remained self- stable for 90 days of storage. The value of different attributes of osmo-dehydrated slices in aluminium pouches after 90 days of storage were 53.89-78.86 °B TSS, 0.10-0.59 per cent titratable acidity, 129.36-134.99 mg/100g ascorbic acid, 33.72-43.74 % reducing sugars, 39.86-51.82 % total sugars and 18.44-22.23 % moisture content with no microbial growth. Therefore, it is concluded that guava slices with peel having thickness 6 mm, pretreated with 0.2% KMS and 0.5% $CaCl_2$ of guava cultivars *Lalit* and *Shweta* dipped in 70^0 B sugar syrup can successfully be used for preparation of osmo- dehydrated guava slices.

◆◆◆◆◆◆

Physical and biochemical screening of brinjal genotypes against root knot nematode for use in tomato grafting

Pooja Pahal[1], Indu Arora[1],Vinod K. Batra[1],Anil Kumar[2]andKalpana Yadav[1]
[1]Dept. of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004
[2]Dept. of Nematology, CCS Haryana Agricultural University, Hisar-125004

ABSTRACT

Root-knot nematodes (RKNs) are the major problem in tropical and subtropical climatic zones causing significant damage, especially in protected structures. Root knot nematodes *(Meloidogyne incognita*) infecting particularly vegetable crops are one of the most wide spread pathogens limiting world agricultural productivity. In order to identify resistant cultivars and rootstocks forgrafting of tomato and to recommend suitable eggplant cultivars for grafting to farmers for both protected and open field cultivation, there is a need to screen existing eggplant genotypes against nema to de resistance. In this study, brinjal genotypes were screened for nematode resistance as rootstocks for tomato grafting to overcome the problem of root knot nematode in open field and protected cultivation. 23 genotypes of brinjal were screened in Screen house of Nematology, CCSHAU, Hisar in pots having sterilized soil and inoculated with 1J2/g soil with *Meloidogyne incognita* after 10 days of transplanting. G-19 and G-20 genotypes were found highly resistant with RKI of 1.00, G-6 and G-8 were found resistant with RKI of 2.00 and 2.66 and G-5 and G-14 were found highly susceptible with RKI of 5.00 and rest of genotypes were moderately resistant. Phenol test was performed for few screened genotypes which were found either

highly resistant , moderately resistant and highly susceptible among the 23 genotypes. In genotypes, G-19 and G-20 showed high phenol content (0.22-0.28 mg/g), while G-6 and G-8 were resistant with a phenol content of (0.17-0.20 mg/g) and G-5, G-10, G-14 and G-22 were susceptible genotypes with lower phenol content (0.13-0.16 mg/g). It was concluded that higher phenol content in roots of resistant genotypes is responsible for nematicidal activity and therefore rootstocks offer nematode resistance to grafted plants.

◆◆◆◆◆◆

Standardization of floral preservatives for storage and vase life enhancement of Gladiolus grandiflorus var. Nova Lux

Sheeba Belwal, B.D. Bhuj, Ranjan Srivastava, N.C Shahiand Satish Chand
G.B. Pant University of Agriculture & Technology, Pantnagar-263 145 Uttarakhand

ABSTRACT

An experiment was carried out during 2018-19 at ModelFloriculture Centre and Department of Horticulture at G.B. Pant University of Agriculture and Technology, Pantnagar Uttarakhand. The objective of the investigation was to study the effects of various floral preservatives on storage as well as vase life of *Gladiolus grandiflorus* var. Nova Lux which followed a completely randomized design in laboratory conditions. The experiment had thirteen treatment combinations of sucrose, 8 Hydroxy quinoline citrate (8-HQC) and $AgNO_3$. Three replications were given per treatment which intrinsically followed 3 further replications. The influence of floral preservatives showed statistically significant results for various floral characters such as floret diameter, longevity, spike length, preservative uptake, floret opening percentage, blooming period etc. over the control. For storage life, the optimum treatment combination recorded as per the data analyzed is found to be of T_2 (sucrose 3%) of 15.44 days over the control showing 10.29 days. For vase life, the optimum treatment combination recorded as per the data analyzed is found to be of T_8 (8-HQC 300 ppm, sucrose 6%) of 11.11 days over the control T_1 showing vase life duration of 8.46 days.

◆◆◆◆◆◆

Effect of NPK on growth, yield and quality attributes of Broccoli (*Brassica oleracea* var. italica)

Priyanka and Lalit Bhatt
Department of Vegetable Science, G. B. Pant University of Agriculture and Technology
Pantnagar, U. S. Nagar. 263 145 (Uttarakhand)

ABSTRACT

The present investigation was undertaken to check the effect of NPK fertigation in Broccoli at Vegetable Research Center of G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) during October to February for two consecutive years *i.e.* 2021-22 and 2022-23. The experiment was laid out in two factorial randomize block design with 8 treatments and three replications where planting was done at a spacing of 50 cm x 60 cm per plot under open condition. There were 8 treatments 100% recommended dose of NPK, 100% recommended dose of PK, 100% recommended dose of NK, 100% recommended dose of NP, 100% recommended dose of K, 100% recommended dose of P, 100% recommended dose of N and absolute control in various combination.

The result of the study revealed that performance of broccoli was significantly influenced by under drip fertigation and it's scheduling as compared to flood irrigation. Plant growth was found best with the application

of 100% recommended dose of NPK, NK, NP and N under drip irrigation. 100% recommended dose of NPK was found best with respect to higher yield, root parameters, maturity parameters, quality, nutrients content & nutrients uptake by plant.

◆◆◆◆◆◆

Effect of zinc application on yield and zinc uptake in potato (Solanum tuberosum L.)

Riya Pandey, Lalit Bhatt, Priyanka Rawat, Ankita Belwal
G.B. Pant University of Agriculture and Technology, Pantnagar- 263145,Uttarakhand

ABSTRACTS

An investigation on zinc application on yield and zinc uptake in potato (*Solanum tuberosum* L.) was carried out at Vegetable Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar (Uttarakhand) during r*abi* season of 2021-2022. The experiment was laid out in a randomized complete block design with twelve treatments and four replications. Among the treatments, T_6 (foliar application of zinc sulphate @ 2 g/l at 25 and 50 days after planting) was found best with respect to total number of tubers per hill (11.48), tuber yield (33.49 t/ha), zinc content in tuber (47.58), zinc content in haulm (100.02 ppm), total zinc uptake (8.12 kg/ha). Beside this, to assess the profitability of treatments cost of cultivation, net profit and benefit: cost ratio was also worked out. The net profit and benefit: cost ratio was observed as ¹ 369364.02 and 2.26 respectively. Based on overall performance, it can be concluded that foliar application of zinc @ 2g/l at 25 and 50 days after planting along with recommended dose of fertilizer was observed best. The findings of investigation revealed that the performance of potato crop was significantly influenced by zinc application.

◆◆◆◆◆◆

Effect of planting dates on growth and flowering of African and French Marigold cultivars under low hills of HP

Sudhanshu Verma, Dr Priyanka Thakur, Dr Sita Ram Dhiman, Yogendra Adhikari, Ali Haidar Shah and Manish Kumar
Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Himachal Pradesh

ABSTRACT

The present investigation titled as "Effect of planting dates on growth and flowering of African and French Marigold cultivars under low hills of HP" carried out at Floriculture Farm of Regional Horticultural Research and Training Station, Dhaulakuan, during October 2021 – July 2022. The experiment was laidout in Randomized Complete Block Design (Factorial), consisting of six planting dates (*viz.* 15th October, 15th November, 15th December, 15th January, 15th February and 15th March) and four cultivars (two African marigold cultivars *viz.* 'Punjab Gainda No. 1' and 'Pusa Basanti Gainda' and two French marigold cultivars *viz.* 'Pusa Arpita' and 'Red Brocade'). Marigold cv. 'Pusa Arpita' planted on 15th March showed best results in regard of vegetative parameters *viz.* plant height (109.63 cm), plant spread (64.29 cm) and number of primary branches per plant (20.00). Among the floral characters, African marigold cv. 'Punjab Gainda No. 1' planted on 15th March produced the greatest number of flowers (79.73), heaviest flowers (8.75 g) and highest flower yield per plot (4708.84 g). French marigold cv. 'Red Brocade' planted on 15th October recorded maximum number of flowers per plant (86.20), while cv. 'Pusa Arpita' planted on 15th November recorded maximum flower weight (5.00 g) and diameter (3.75 cm). However, maximum flower yield per plot was observed in cv. 'Red Brocade' planted on 15th January (3436.91 g). From the investigation, it was concluded that African marigold cv. 'Punjab Gainda No. 1'

planted on 15th March and French marigold cv. 'Red Brocade' planted on 15th October was most superior to the other cultivars and planting dates.

◆◆◆◆◆◆

Correlation among Component Characters in Leafy Mustard (*Brassica juncea* var. rugosa)

[1]Priyanka, [2]Dr. Anita Singh, [3]Vinay Kumar
[1,3] School of Agriculture,Graphic Era Hill University
G.B. Pant University of Agriculture and Technology Pantnagar-263 145, Uttarakhand

ABSTRACT

Leafy Mustard (*Brassica juncea var. rugosa*) is a popular green vegetable grown in plains and hills of Northern India. The present investigation carried out with 31 germplasm during November–February 2018–2019 at Vegetable Research Center (VRC) G. B. Pant university of Agriculture and Technology, Pantnagar, U.S. Nagar (Uttarakhand). Analysis of coefficient of variation showed significant differences among the genotypes for all the traits. The phenotype coefficient of variation recorded highest in green leaves yield per plant (g) was PLM-16 (350.00g) and phenotype coefficient of variation recorded highest in green leaves yield (kg/ha) was PLM-15 (400kg/ha). Lowest GCV and PCV value was recorded in days to last leaf harvest. Highest value of heritability was reported for green leaf yield/plot (99.90%). Highest genetic advance was obtained in leaf area (169.99) while highest genetic advance as % of mean was recorded in leaf area (31.37%). We can state that above genotypes were promising and can be utilized for further improvement programme in leafy mustard.

◆◆◆◆◆◆

Effect of different packaging materials on quality and shelf life of Kinnow Mandarin (*Citrus reticulata Blanco*)

Rohit Kumar, Priya Awasthi and Subhash Chandra Singh and Vigya Mishra
Banda University of Agriculture and Technology, Banda (U.P.) - 210001
Corresponding author email id: rohitgautam958@gmail.com

ABSTRACT

The present investigation entitled "Effect of different packaging materials on quality and shelf life of Kinnow Mandarin (*Citrus reticulata* Blanco)"was conducted at Post Harvest Technology,College of Horticulture, BUAT, Banda (U.P.) during the academic year 2020-21. Packaging treatments include T_1 (Control), T_2 (Fruits packed in LDPE 25 micron), T_3 (Individual news paper wrapped fruits packed in LDPE 25 micron), T_4 (Fruits packed in brown paper bags), T_5 (Individual news paper wrapped fruit packed in brown paper bags), T_6 (Fruits packed in CFB boxes), T_7 (Individual news paper wrapped fruit packed in CFB boxes), T_8 (Fruits packed in perforated brown paper bags), T_9 (Fruits packed in perforated LDPE 25 micron). The physio-chemical and organoleptic evaluation of the fruits of each treatment was done upto 45 days and all the observations were recorded at every 15 days interval. The PLW (%) and Volume loss (%) were recorded lowest in T_6 during storage which was (0.099) and (0.226) respectively. Total soluble solids and total sugar contents had increasing trend during storage period and found highest (12.533) and (10.013) in T_1 and T_2 respectively at 45 days while ascorbic acid and titrable acidity had decreasing trend and mean value was found highest (12.277) and (0.820) in T_4 and T_8 respectively during storage . On the basic of microbial count by TPC and organoleptic evaluation nine point hedonic rating scale, it was concluded that kinnow fruits packed under CFB boxes scored highest

overall acceptability at 45 days of storage.

◆◆◆◆◆◆

Identification of Specific Proteins of Ralstonia solanacearum and their Evaluation for Immuno-detection

Shalini Bhatt[1], Ankur Agarwal[1], Merwyn P. Raj[1], Neha Faridi[1]
[1]Defence Institute of Bio-Energy Research, DRDO, Haldwani- 263139, Uttarakhand, India

ABSTRACT

Introduction: Bacterial wilt caused by *Ralstonia solanacearum* possess serious threat to a broad range of agriculturally important crop plants worldwide. So, quick and sensitive detection of the infection is the need of the present detection strategies so that infection could be detected at an early stage and crop loss could be minimized. During isolation of bacterial wilt pathogen, *R. solanacearum* from the suspected plant and soil samples, colonies of other soil-dwelling saprophytes often overgrow and resemble closely the colony morphology of the *R. solanacearum* cells. Screening every colony by PCR or DAS-ELISA would be a tedious, time-consuming as well as expensive task. Therefore, introduction of a rapid immuno based screening system to limit colonies for processing could aid in the screening and identification procedure. Henceforth, the effort was taken to evaluate the possible use of different target proteins, FliC, Rip4 and Prh, as an immune target for detecting *Ralstonia solanacearum* cells.

Methodology: Outer membrane and secretory proteins were identified and selected on the basis of their specificity as well as their key role in pathogenicity. BLAST analysis was done to find the specificity of the protein as well to check whether the protein is shared among different strains of the species.Total of 7- specific proteins [r-Flagellin (rFliC), r- Ralstonia injected protein 4 (rRip4), r-Pectin methyl esterase (rPme), r- Proline rich homeodomain (rPrh), r- Endogluconase (rEgl), Rsp 0777 and Rsc 3095] were identified as potential candidates for immune-detection. Then the recombinant forms of proteins FliC, Rip4, Prh, Pme and Egl were prepared. Thereafter, polyclonal antibodies were generated against recombinant FliC, Rip4 and Prh proteins. Further recombinant antibodies raised against the protein were used for detecting the target proteins in *R. solanacearum* cells as well as non-*R. solanacearum* cells by Western Blotting and DAS-ELISA. Additionally, anti- rFliC polyclonal antibodies coated latex reagent generated for screening *R. solanacearum* cells.

Results: Results presents successful cloning and expression of *fliC*, *rip4*, *prh*, *pme* and *egl* genes and their proteins respectively. Further, it was concluded that FliC and Rip4 protein can be used as a potential immuno-target for screening *R. solanacearum* cells using Western Blot and coated latex reagent.

Conclusion: Results indicate that antibodies against the FliC and Rip4 protein can be utilized for successful development of laboratory based tools for quick screening and identification of *R. solanacearum* cells. However, cross-reactivity with *R. pickettii* was detected, but it would not affect the motive of screening cells during preliminary isolation of the bacterial wilt pathogen from soil or infected plant tissues, where other saprophytic bacteria overgrow. Antibodies raised against the Flagellin protein coated over latex particles can be utilized for preliminary screening of the colonies obtained during the isolation of the bacterial wilt strains from the infected plant samples. Further, this proof of concept and the prototype has to be evaluated with bacterial wilt strains isolated across different hosts and geographical regions.

Horticulture Teaching and Students' Thesis Research

◆◆◆◆◆◆

Assessment of genetic diversity among single and double petalledtuberose (*Polianthes tuberosa* L.) varieties using Random Amplified Polymorphic DNA (RAPD) markers

Swapnil Bharti[1], Ranjan K. Srivastava[2] and Kanchan Karki[3]
[1] Ph.D., Scholar, [2]Professor, Department of Horticulture, College of Agriculture,
GBPUA. & T., Pantnagar, Uttarakhand, India
[3]Scientist B, Department of Molecular Biology and Genetic Engineering,
Uttarakhand Council of Biotechnology, Uttarakhand, India

ABSTRACT

Genetic diversity evaluation among twenty eight tuberose (*Polianthes tuberosa* L.) varieties were determined using RAPD technique at GPPUA&T, Pantnagar and UCB, Haldi, Patnagar.Fifteen RAPD markers belonging to Operon series were used for screening in search of polymorphism and all fifteen markers produced clear, consistent, reproducible and scorable bands. A total of 929 amplicons were amplified with 15 RAPD markers with an average of 61.93 amplicons per primer. With each primer, there were variations in the size range of the amplified products, which ranged from 300 bp to 1800 bp. The number of bands generated by each primer ranged from 6 (OPB 13) to 18 (OPC 13) with mean of 13 bands per primer. The RAPD profiles generated were further evaluated for studying the Jaccard's similarity coefficient. It is evident from the data that the Jaccard's similarity coefficients among all the twenty-eight varieties ranged between 0.499 to 0.875. The RAPD amplification data that were used to obtain similarity matrix were also used for generation of dendrogram using unweighted pair group method with arithmetic averages (UPGMA) method. Based on the dendrogram, all 28 genotypes could be distinctly divided into seven major clusters (I and VII) with 64.30 % Jaccard's similarity coefficient matrix and the genotype ArkaShringar was found to be most dissimilar from other genotypes. The study revealed that DNA based molecular marker is a powerful, less time consuming and cost-effective molecular technique for assessment of genetic diversity among different varieties and alsoprovides information useful not only for selection programfor further improvement, but also for the establishment of relationship among varieties worldwide.

Keywords: *Polianthes tuberosa L., RAPD, Genetic diversity, Jaccard's similarity*

◆◆◆◆◆◆

Effect of Pre-harvest application of chemicals and fruit bagging on yield and quality of mango cv. Amrapali

Kiran Kothiyal, A. K. Singh, K. P. Singh, Satish Chand, Pratibha and Ishu Kumari
Department of Horticulture, College of Agriculture, G.B. Pant University of Agriculture and Technology,
Pantnagar-263145 Uttarakhand

ABSTRACT

An experiment was conducted during the year 2020-2021 at Horticulture Research Centre, GBPUA&T, Pantnagar with a view to study the effect of pre-harvest application of eco-friendly chemicals and fruit bagging to enhance yield and quality on yield and quality characteristics. The experiment was laid out in randomized block design (RBD) with 12 treatments (T_1: Nimbecidine @ 0.4%, T_2: Kunapajala @ 10%, T_3: Starch @ 1%, T_4: Starch @ 2%, T_5: Mineral oil @ 0.5%, T_6: Mineral oil @ 1.0%, T_7: Starch @ 1 % + Mineral oil @ 0.5%, T_8: Sodium bicarbonate @ 1% + mineral oil @ 0.5%, T_9: Nutrients mixture (boric acid @ 0.2% + calcium nitrate @

0.2% + zinc sulphate @ 0.2%), T_{10}: Fruit bagging (ordinary brown paper), T_{11}: Fruit bagging (organic/ UV/ water resistant brown paper), T_{12}: Control) and the treatment were replicated thrice. The results of the study revealed that the treatment T_{11} (fruit bagging with organic/ UV/ water resistant brown paper bags) was found to be most effective for increasing the yield (14.58 kg plant^{-1}, 19.43 tonnes hectare^{-1}), fruit weight (298.23 g), width (7.29 cm), volume (310.17 ml), shelf life (15.05 days), TSS (20.95 ºB), total sugars (16.86%), reducing sugar (5.20%) and total carotenoids (5.86 mg/100g). The higher net return (737027.20 Rs/ha) was also observed with the treatment T_{11}. The higher fruit length (12.39 cm) was observed with the treatment T_8. However, it was observed that the treatment T_9 have found most effective for increasing the ascorbic acid (42.01mg 100g^{-1}) content in fruit. Thus it can be concluded that the fruit bagging with organic/ UV/ water resistant brown paper bag is most effective for increasing the yield, shelf life, quality and net return in late maturing mango cv. Amrapali.

Keywords: Mango, chemicals, bagging, quality, yield, shelf life.

The existing status and agribusiness potential of Acacia catechu based entrepreneurship in Una and Kangra Districts of Himachal Pradesh

Vaishali Thakur[1] and Krishan Kumar[2]
Dr. Y S Parmar University of Horticulture and Forestry, Nauni, Solan (H.P) 173230

ABSTRACT

The study assessed the existing status of *Acacia catechu* based entrepreneurship and the potential of kattha entrepreneurship in employment and income generation by administering questionnaires to 25 entrepreneurs (17 Kattha entrepreneurs in Una district and 8 Kattha entrepreneurs in Kangra District). The study also examined the problems faced by kattha entrepreneurs. Respondents were selected by using convenience sampling technique. Furthermore, descriptive statistics, arithmetic mean, total weighted score method and pie charts were used for data analysis. The results of field data analysis revealed that out of all the respondents 44 % entrepreneurs agreed that profits from kattha are encouraging which indicated that there is great potential of kattha production in income generation. The study also revealed that unavailability of skilled labour locally, costly raw material, various government policies, expansion of large scale industries, large capital requirement, distant markets and requirement of highly skilled labour are the number of problems faced by the kattha entrepreneurs. With these, it is recommended that proper management of cutch should be done at the production site and government should impose such policies that encourage local labour to be part of this kattha based entrepreneurship. Marketing facilities should be provided for small entrepreneurs as they lack infrastructural facilities and government should reduce the tax rate on the transportation of kattha.

◆◆◆◆◆◆

Genetic variability and character association studies for yield and quality traits in tomato (*Solanum lycopersicum* L.)

Sudesh, Lila Bora and D. S. Duhan
Department of Vegetable Science
CCSHAU, HISAR

ABSTRACT

The present experimental study was conducted to access the relative performance, genetic variability and nature of relationship among yield and its attributing traits through correlation and path analysis in selected set of tomato germplasm, consisting of thirty genotypes. The crop was sown under Randomized Block Design

(RBD) in three replications at Regional Research Station Karnal, CCS Haryana Agricultural University, during the *Autumn Winter* season of 2021-22. The observations were recorded for sixteen parameters pertaining to the morphological, fruit yield and quality traits in tomato. Statistics from analysis of variance showed susbstantial differences among the genotypes unveiling the plausible presence of significant genetic variability within the selected germplasm which could be positively exploited in crop improvement programmes.The cynosure of this investigation was yield per plant (kg) which observed moderate GCV (18.61), high PCV (22.60) and moderate heritability (67.82%) coupled with high genetic advance (31.58%). The genotypes EC-631457, EC-631357 and Pusa Early Dwarfwere found high overall yielders. The genotypes namely EC-631357, EC-631457 and EC-617064were found superior in terms of both overall yield and quality, whereas, Pusa Ruby, EC-615056, EC-631351, PHS and Selection 7 were found superior in terms of earliness as well as quality traits. The correlation coefficients exhibited a significantly positive association, at phenotypic levels, for yield per plant with average fruit weight, number of branches per plant, number of fruits per plant, equatorial diameter, polar diameter, number of locules and plant height at harvest.The findings from path analysis rendered that average fruit weight, number of fruits per plant, equatorial diameter, polar diameter, plant height at harvest and pericarp thickness are the most commendatory characters influencing the fruit yield per plant directly as well as indirectly.

◆◆◆◆◆◆

Influence of variable nitrogen levels andcutting frequencies on growth and yieldof vegetable Amaranth (*Amaranthus* spp.)

Mukesh Kumar[1] and Manoj Raghav[2]
Ph.D Research scholar, Dept. of Vegetable Science
Professor, Dept. of Vegetable Science
College of Agriculture, G.B. Pant University of Agriculture and Technology,
Pantnagar, Uttarakhand-263145

ABSTRACT

The present investigation was carried out at Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar, U. S. Nagar Uttarakhand,during summer season of year 2022-23in Randomized Block Design with three replications to assess the influence of variable nitrogen levelsand cutting frequencies on growth andyield of vegetable amaranth(*Amaranthus spp.*). The experiment comprised oftwelvetreatments in which nitrogen was applied@ 0, 30, 60 and 90 kg/ha^{-1}along with three plant spacing 45×15cm, 45×30cm and 45×45cm. 1/3rd of nitrogen was applied as basal dose and remaining dose of nitrogen was topdressed equally in two split doses. The results revealed that treatment T_4(N@90 kg/ha^{-1})was found superior for edible leaf yield. On the other hand, the cuttings taken at shorter intervals increased the regrowth, but very frequent cuttings reduced the total dry matter of the leaves. It was observed that cuttings taken at biweekly intervals increased the number of leaves, number of branches, fresh weight of the leaves and dry matter per plant. On the basis of field study, it can be concluded that treatment T_4 (N @90 kg/ha^{-1}) and cutting intervals of two week was found to be most effective in improving the growth and yield attributes ofvegetable amaranth in *Tarai* conditions.

Keywords: Amaranthus,cutting frequencies, nitrogen levels,

◆◆◆◆◆◆

Effect of antioxidants and plant bio-regulators on leaf chlorophyll and mineral content of apricot (*Prunus armeniaca* L.) cv. New Castle

Neha Thakur[1], Gopal Singh[2], Dharma Paul Sharma[3] and Uday Sharma[4]
Dr. YS Parmar University of Horticulture & Forestry, Nauni, Solan (H.P.) 173230

ABSTRACT

A field experiment was conducted during 2019-2020 to investigatethe effect of antioxidants and plant bio-regulators on leaf chlorophyll and mineral content of apricot cultivar New Castle. The experiment was laid out in Randomized Block Design consisting of nine treatments replicated thrice. The antioxidants and plant bio-regulators were applied at pink bud stage and repeated at pit hardening stage through foliar application. The antioxidants and plant bio-regulators treatments were T_1: Ascorbic acid 1000 ppm, T_2: Ascorbic acid 2000 ppm, T_3: Citric acid 1000 ppm, T_4: Citric acid 2000 ppm, T_5:Benzyladenine 50 ppm, T_6: Benzyladenine 100 ppm, T_7: Gibberellic acid 25 ppm, T_8: Gibberellic acid 50 ppm and T_9: control (water spray). The results revealed that among various treatments significantly highest plant height, trunk girth, annual shoot growth, leaf area and leaf N, K, Fe, Cu, Zn and Mn contents were found in treatment T_8(gibberellic acid 50 ppm). However, maximum total leaf chlorophyll content and leaf P, Ca and Mg contents were recorded under treatment T_2(ascorbic acid 2000 ppm). It was concluded that GA_3 at 50 ppm had most pronounced effect. However, antioxidants mainly 2000 ppm of ascorbic acid was equally effective to gibberellic acid at 50 ppm. Since, antioxidants are organic compounds and are more readily acceptable than synthetic chemicals, these compounds can be considered as good alternative to chemicals in fruit production.

◆◆◆◆◆◆

Effect of date of sowing and row spacing on growth, yield and quality of summer vegetable cowpea(Vigna unguiculata L.)

P. P. Solanki[1], J. R. Vadodaria[2]
[1]Department of Horticulture (Vegetable science), B.A. College of Agriculture,
Anand Agricultural University, Anand-388110
[2]Associate Professor, C. P. College of Agriculture,
S. D. Agricultural University, Dantiwada-385506

ABSTRACT

A field experiment, "Effect of date of sowing and row spacing on growth, yield and quality of summer vegetable cowpea (*Vigna unguiculata* L.)"was carried out during the summer season of 2020 at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Gujarat. The cowpea variety local was used for this experiment. The experiment was laid out in split plot design with three replications.experiment was comprised of two factors *viz.*, date of sowing as main plot with four date 10th February (d_1), 20th February (d_2), 1st March (d_3) and 10th March (d_4) and in sub plot with three row spacing 30 cm × 30 cm (s_1), 45 cm × 30 cm(s_2) and 60 cm × 30 cm (s_3). The result revealed that 20th February (d_2) recorded maximum plant height (58.91 cm) at 60 DAS, plant spread (E-W & N-S) (38.61 cm & 51.03 cm, respectively) at 60 DAS, number of branches per plant (6.17) at 60 DAS, number of cluster per plant (34.08), number of pickings (8.04), yield per plant (120.52 g), yield per plot (3.94 kg) and yield per hectare (80.82 q). Minimum days taken for initiation of flowering (54.97) and for first picking after sowing (64.91) were recorded with treatment d_4 (10th March). Whereas maximum days (113.29) taken for last picking after sowing was recorded with treatment d_1 (10th February). Among the row spacings, 45 cm × 30 cm (s_2) recorded maximum plant height (53.91 cm) at

60 DAS, yield per plot (4.03 kg) and yield per hectare (83.00 q). While, maximum plant spread (E-W & N-S) (35.10 cm & 46.62 cm, respectively), number of branches per plant (5.42) at 60 DAS, number of cluster per plant (34.62) and yield per plant (116.47 g) were noted with treatment of 60 cm × 30 cm spacing (s_3). With respect to economics in date of sowing maximum gross income (¹ 161640), net income (¹ 103103) and benefit cost ratio (2.76) recorded with 20th February as well as in row spacing maximum gross income (¹ 166000), net income (¹ 108263) and benefit cost ratio (2.87) recorded with 45 cm × 30 cm.

Keywords: Summer vegetable cowpea, Date of sowing, row spacing

◆◆◆◆◆◆

Salt damage index of sweet orange cv. Pusa Sharad on different citrus genotypes

Kripa Shankar, O. P Awasthi, A.K. Dubey andAwtar Singh
Division of Fruits and Horticultural technology,
ICAR-Indian Agricultural Research Institute, New Delhi, 110 012

ABSTRACT

The production of sweet orange (*Citrus sinensis* L.) in India has been witnessing a declining trend in the last five years. Some of the reasons attributed to this declining trend is associated with the biotic and abiotic stress. Among the abiotic stress accumulation of salts in the root zoneis the major challenge. Citrus is a salt susceptible crop for which screening of compatible rootstock against salinity is the need of hour. During 2020×2022 an investigation was undertaken to screen eleven different citrus genotypes to varying levels of salinity stress *i.e.*, Control, 30 mM and 60 mM in completely randomised design (CRD) factorial.Salt damage index to the grade scaleof 0-15was calculated depending on the overall plant condition and damage symptoms. Forty-two days after salt treatments, out of eleven citrus genotypes*Jatti Khatti*, CRH-12 and Troyer Citrangeshowed acute damage followed by high damage inNRCC-4, NRCC-5 whereas no visual symptom was observed in X-639, NRCC-1, NRCC-3, CRH-47 and Cleopatra mandarinat 60 mMsalt concentration. Among six genotypes CRH-12 and Troyer Citrange showed high damage followed by medium damage in *Jatti Khatti*, NRCC-2, NRCC-4, NRCC-5 at 30 mM saltconcentration. No visual damage observed in X-639, NRCC-1, NRCC-3, CRH-47 and Cleopatra mandarin at 30 and 60 mM of salt concentration.The findings of the study have lead to the identification of newer responsive rootstocks to salinity stress which could be utilized as alternative rootstocks for sweet orange cv. Pusa Sharad and other citrus cultivars/varieties in the saline prone areas.

◆◆◆◆◆◆

Heritability and Genetic Advance in Bitter gourd (*Momordica charantia* L.) Genotypes

Mondeddula Dhathri, D. K. Singh, SubhashreeSubhasmita, Ankita Belwal
Department of Vegetable Science
G.B. Pant University of Agriculture and Technology, Pantnagar-263 145, Uttarakhand

ABSTRACT

Bitter gourd (*Momordica charantia* L., 2n=2x=22) commonly known as balsam-pear is a tropical and subtropical vine of the family Cucurbitaceae widely grown in Asia and Africa for its edible fruit. Heritability gives idea about the range of inheritance of traits while genetic advance helps us to know about the genetic gain under screening. Twenty-eight genotypes including two check varieties Kashi Mayuri and Pant Karela-1 were evaluated

in randomized block design during March-July, 2022 at the Vegetable Research Centre, G. B. Pant University of Agriculture and Technology, Pantnagar to study the heritability and genetic advance for 19 different characters. Highest value of heritability was reported for number of fruits per plant followed by days to first female flower, fruit yield per hectare(q), fruit weight (g), number of nodes per vine, number of primary branches per vine, sex ratio, fruit yield per plant(kg), days to first fruit harvest, fruit length (cm). High heritability could be exploited through simple selection from this material and could be transmitted to the offspring to improve yield.High genetic advance as percentage of mean at 5 per cent was obtained for all characters under study indicating that these characters were governed by additive genes and selection will be worthwhile for exploiting these characters and their improvement.

◆◆◆◆◆◆

Estimation of Genetic Variability in Mid-Season Pea Genotypes

Rajni, Amit Vikram
Department of Vegetable Science, Dr. YSP UHF Nauni, Solan-173230

ABSTRACT

The present investigation was carried out at Research Farm of Department of Vegetable Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, (H.P) during *Rabi* season of 2019-20 with the objective of analizing the nature of variability in the germplasm and to study the correlation among various traits and its effects of these traits on yield for effective selection. The experiment was laid out in a Randomized Complete Block Design with three replications. Thirty genotypes along with one check variety *i.e.* Pb-89 were evaluated for testing the performance of each genotype for yield and other important horticultural traits. Significant differences among the genotypes were observed based on the analysis of variance. A wide range of variability was recorded for all the characters. Genotypes UHF Pea - 42, UHF Pea - 63, check variety and UHF Pea - 68 were found superior over the other genotypes for yield and other horticultural traits. Wide genetic variability and high heritability coupled with high genetic gain were observed for number of pods per plant, seed yield per plant, plant height, pod length and green pod yield per plant. Correlation analysis unveiled that green pod yield per plant was positively and significantly correlated with seed index, green pod weight, seed yield per plant and other growth and yield attributing character at both genotypic and phenotypic levels.

◆◆◆◆◆◆

The Yield and Economic Feasibility of Watermelon under Low Tunnel

Poonam[1], S.S. Lakhawat[1] and Subhita Kumawat[2]
[1]Department of Horticulture, Rajasthan College of Agriculture, MPUAT, Udaipur, Rajasthan
[2]Department of Agricultural Economics, Shri Karan Narendra Agriculture University, Jobner, Rajasthan

ABSTRACT

One of the Republic of Serbia's most commercially significant vegetable crops is watermelon. Due to its origin, watermelon has high requirements toward growing conditions and especially high requirements toward heat in all stages of growth and development. Open-field production on soil mulched with plastic mulch is the dominant agricultural practice. Normally the economics of protected cultivationdirectly depends upon the initial cost of fabrication of the protected structure, its running cost and the available market for highquality produce. Therefore, low-cost protected structures, which can generally be fabricated with low cost and therunning cost of such structures is also very low, just like naturally ventilated greenhouses, walk-in-tunnels and plastic low tunnels.These are highly suitable for off-season cultivation of cucurbits and are also highly economical for peri-

urban areas of northernplains of India. Since recently, areas under watermelon production in low plastic tunnels are increasing. The use of various covering materials such as polythene sheet, non-woven polypropylene and insect-net. The use low tunnels give significant results in the early production of almost all vegetable crops, but mostly in warm-season vegetables which are sensitive to low temperatures.

Keyword: Low tunnel, low temperature and watermelon.

◆◆◆◆◆◆

Session-11

Interface with Farmers and Industry

Consumer Behavior towards Aloe Vera products and consumption

Sachin Kumar and K K Raina
Department of Business Mnagement, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni-Solan (HP) -175001

ABSTRACT

Aloe Vera market is demand driven and 77 percent of consumers use aloe vera in various forms like beauty products, medicinal, sanitizers, Juice etc. About 65% consumers use products single time a day and more than 30% use two or more than two times a day. The pull of consumers is so strong towards top brands that the stores are forced to keep the brand of consumer's choice. Most of the consumers are aware about the quality standards of aloe vera and they just buy the brand name due to popularity of the brand and product itself as seen in advertisements. Most of the consumers get information about the product through advertisement and sales promotion. About 60% consumers use brands like Patanjali and Himalaya because they are the most popular brands in India and are available easily at any store. Decision maker in family regarding the purchase are elders and younger ones. 65% consumers choose brand and quality of the products over the price factor. Customers are not loyal to one brand and shifts easily to another brand according to their use and other factors such as quality, quantity, schemes, offers, gifts and price of the product. According to 90% consumers, price affects the sales of these products most. As, India is the largest market to capture, so marketers and aloe vera industry is facing cut throat competition from other brands also. So, industries should study the strategy of competitors and then build strategies to attract customers and capture market.

Keywords: Aloe vera, Consumers, Competetion, Strategies.

◆◆◆◆◆◆

Beekeeping in Uttarakhand: Emerging Agribusiness Opportunity in Post-Covid Era

Rashmi Joshi[1], H. S. Baweja[2] and Hemwati Nandan[3]
Deptt. of Hort. & Food Processing, Govt. Of Uttarakhand

ABSTRACT

Uttarakhand a North Western Himalayan state of India is famous for its beautiful hilly terrains and spiritual/religious significance. The biggest challenge in the state is that of migration as peoplehave been migrating to the plains from hills to avail the employment and other basic facilities like education, health etc. Recently a trend of reverse migration was observed, mainly after covid-19 pandemic. The government schemes in agriculture and allied fields such as general and off season crop production, exotic vegetable production, bee-keeping, mushroom cultivation etc. are helpful to the farmers for financial stability. The beekeeping has vast potential in the region for self-employment with many advantages.The promotion of beekeeping is essential for the conservation of biodiversity in the region. Government Bee-keeping Centre, Jeolikote is playing a vital role in creation of beekeepers to develop the beekeeping in Uttarakhand as an industry through extension, trainings and hand holding of budding beekeepers with basic facilities. The beekeeping provides the business opportunity for beekeepers from the sale of bee colonies, bee-productssuch as Honey, Royal jelly, Pollen, Propolis, Beeswax etc, pollination services to orchardist etc.This Centrehas now initiated the promotion of Api-tourism, as a new income generation activity in the rural areas of hills which will help in creating new jobs opportunities.

◆◆◆◆◆◆

Farmer's Perception and Participatory Selection of Vegetable Crops and Varieties in Tribal villages for Sustainable Livelihood in Bastar, Chhattisgarh

Vikas Ramteke, R. S. Netam, Narendra Kumar, H. K. Patra and Padmakshi Thakur
S. G. College of Agriculture and Research Station (Indira Gandhi Krishi Vishwavidyalaya),Kumharawand, Jagdalpur, Bastar, Chhattisgarh – 494001

ABSTRACT

The study aims to explore farmers perception and attitudes towards cultivation of different vegetables and preference of varieties during mid-late *kharif* in participatory mode under farmer's field. It also helps to select and determine factors influencing farmers' perception and adaptation to uptake low input vegetable farming and to investigate if this in turn supports sustainable development of farmer's livelihood in the tribal areas of Chhattisgarh. A total of 256 tribal farmers of three villages of Bastar District were randomly selected on current farming practices experience, in transforming to improved vegetable farming in *kharif* 2022. Information was collected using semi-structured questionnaires and focus group discussion from May to July 2022. Majority of farmers are engaged in single vegetable cultivation season with paddy cultivation. Results revealed that, brinjal, onion and okra was recorded at top rank due to high returns from these crops. Apart from these, farmers didn't rank garlic, cucumber, cabbage and cauliflower due to their limited knowledge about cultivation of these crops, risk of crop failure and heavy pest incidence. Aforesaid, lack of irrigation becomes the major problem of the village due to unavailability of borewells, tube wells, other sources. Various vegetables and their popular varieties available in the market were tested in the farmers *badi* (backyards) in participatory mode, suitable for mid to late *kharif* cultivation under rainfed upland situations. Sweet potato, cowpea and okra were found suitable for commercial cultivation with high monetary return per unit area.

Key words: Vegetables, *Kharif*, Farmer, Cultivation, Bastar

◆◆◆◆◆◆

The Floral Diversity and High Value Honey Production Potential in The Temperate Region of Uttarkashi District of Uttarakhand

Bhawna Bhattwal[1], MonikaVats Puroht[2], Hemwati Nandan[3], H. S. Baweja[4]
Govt Garden, Circuit House, Dehradun, Deptt. of Hort. & Food Processing, Gov. of Uttarakhand

ABSTRACT

The mountainous region of Uttarakhand is enriched with floral resources which are known for their unmatched medicinal properties. Many of these flowering plants in such vegetation serve as nectar and pollen sources for honey bees. The various bee products especially honey produced by these honey bees derive their nutritional and medicinal properties from floral resources. The study done in the temperate forest of Uttarakashi district revealed the occurrence of 63 such plants which are preferred by honey bees as bee forage and have been known for their medicinal value, some of these highly significant. The Manuka honey produced from Manuka plant in New Zealand is one of the most researched honeys and the antioxidant content makes it one of the costliest honey available commercially in the world. The honey derived from the nectar of the flora rich in antioxidants and other medicinal compounds in the Himalayan region has the potential of being valued as similar to or even higher than Manuka honey. Thus, the promotion of beekeeping activity using indigenous bee species *Apis cerana*not only provides a livelihood opportunity in the hilly region but also be can be a solution to enhance the income and reduce the migration from the region.

Keywords: floral resources, medicinal properties, honey, Himalayan region

◆◆◆◆◆◆

Moringa – As super herbal food and resource for Women Empowerment through Self Help Groups of Raipur District of Chhattisgarh

Rekha Singh and Jitendra Singh
Krishi Vigyan Kendra, Raipur (IGKV) Chhattisgarh .
Vegetable Science and Dean, CoH&RS, Rajnandgaon, C.G.

ABSTRACT

Moringa oleifera is a multi-purpose herbal plant used as human food and an alternative for medicinal purposes worldwide. It has been identified by researchers as a plant with numerous health benefits including nutritional and medicinal advantages. It contains essential amino acids, carotenoids in leaves and components with nutraceutical properties, supporting the idea of using this plant as a nutritional supplement or constituent in food preparation. As such prospective, moringa business is a goldmine for an entrepreneur. According to the Agropreneur, Moringa business is one of the best agribusinesses that are highly profitable with low investment cost as it gives a quick return in the same year of investment. In recent years SHGs have become a significant movement in India for revenue generation at village level with empowering women and eradicating poverty in the rural and urban areas. Looking to the nutritional benefits of moringa leafs and pods, Krishi Vigyan Kendra, Raipur conducted On Farm Trials (OFT) and field level Demonstrations (FLD) based on moringa processing, labelling and packaging solutions together with sustained capacity building, for empowering Women Self Help Group of District Raipur during 2020 -2021. Total 20 women from 11 SHG of Astha Mahila Gram Sangathan, village Biladi from Raipur District were selected for OFT/FLD. These groups were involved in community farming and have 4 acres of organic Moringa plantation. After training the products (moringa pickle and leaf powder) prepared by them were marketed. Prepared processed products are being sustainably sold by SHGs through various retail outlets and IGKV sale counter managed by KVK, Raipur. Findings of the present OFT/FLD shows that each member of the group earned an income ranging from Rs.2000 to Rs.3000 per month as an additional source of income apart from their regular source of income. In this study, it has been found that processing of moringa has high trainability, low investment and potential for sustainable income generation of women SHGs along with human health and nutrition.

Keywords: Moringa, Nutrition, Empowerment and SHGs.

◆◆◆◆◆◆

Interface for Farmers

Y.G. Desai
Department of fruit science, ASPEE college of Horticulture, Navsari Agricultural University,
Navsari 396 450, Gujarat, India

ABSTRACT

In current years, the emergence of smart phones has changed the world of mobile phones. Phone is not any longer just a communication tool, but also a main part of the people's lifestyle and communication. Many applications added unlimited fun for people's routine life. It is sure that the future of the network will be the mobile world. Now the Android system in the electronics market is becoming more liked, especially in the Smartphone world. Because of the open source, some of the development tools are free, so there is many of

functionality generated. Telecommunication, especially mobile phones have the prospective to provide sufficient solution to the existing information inequality in various sectors like agricultural field. Information and Communication Technology (ICT) in agriculture is a chief come out field mainly focuses on the increasing agricultural and rural development areas in India. Using innovation is a main dimension in the rural domain. The advancement of ICT can be utilized for providing timely and sufficient relevant information details and services to the farmers. We propose an android based mobile interface consisting some applications like weather updates, crop information, NGO services etc. It is an iconic interface system with the advancement of technology, application world of computer is revolting day by day.

Keyword: Mobile phone, Communication, Application, Android

◆◆◆◆◆◆

Local Organizing Committee of 'PHC-2023' held on Feb 3-5, 2023

1. Steering Committee

1. Prof. Manmohan Singh Chauhan, Vice-Chancellor – Patron
2. Dr. H.S. Baweja, Director Horticulture, Govt of Uttarakhand
3. Dr. A.K. Shukla, Registrar
4. Sri D.P. Singh , Director DIBER, DRDO Haldwani
5. Dr. N.S. Jadon, Dean Veterinary and Animal Sciences
6. Dr S.K. Kashyap, Dean Agriculture
7. Dr. K.P. Raverkar, Dean PGS
8. Dr. Alaknanda Ashok, Dean Technology
9. Dr. Sandeep Arora, Dean CBSH
10. Dr. Alka Goel, Dean Home Science
11. Dr. R.S.Jadon, Dean Agribusiness Management
12. Dr. Malobica Das Trakroo, Dean Fisheries
13. Dr. A.S. Nain, Director Experiment Station
14. Dr. A.K. Sharma, Director Extension Education
15. DR Brijesh Singh, DSW
16. Dr. S.K. Bansal, Director Communication
17. Sri. Ashish Bhatgain, Director Administration & Monitoring
18. Sri. Dhram Singh Bonal, Comptroller
19. Dr D.C. Dimri, Head Horticulture
20. Dr D.K. Singh, Head Vegetable Science
21. Dr. Ranjan Srivastava, Professor Horticulture, Organizing Secretary

Functions:

- To provide over all guidance for organization of the Conference

2. ABSTRACT Evaluation & Publication Committee

1. Dr. S.K. Guru, Professor & Head, Plant Physiology- Chairman
2. Dr Ratna Rai, Professor Horticulture
3. Dr Ranjan K. Srivastava, Professor Horticulture
4. Dr. Shweta Uniyal, Assistant Professor, Horticulture
5. Dr. S.K. Maurya, JRO, Vegetable Science

Functions:

- To evaluate the **ABSTRACT**s and compilation of Book of **ABSTRACT**s

3. Registration Committee

1. Dr. D.C. Dimri, Professor & Head, Horticulture – Chairman
2. Dr. Ratna Rai, Professor, Horticulture
3. Dr. Rashmi Panwar, Assistant Professor, Horticulture
4. Dr. Anju Pal, Assistant Professor, Horticulture
5. Dr. Lalit Bhatt, JRO, Vegetable Science
6. Dr. Omvati Verma, JRO, Agronomy

Functions:

- To make arrangement for registration

4. Decoration/Inaugural/Plenary Session/Technical session/Valedictory Session Committee

1. Dr. V.K. Rao, Professor, Horticulture- Chairman
2. Dr. B.D. Bhuj, Professor Floriculture & Landscaping
3. Dr. Navneet Pareek, Professor, Soil Science
4. Dr. Omveer Singh, Professor, Horticulture
5. Dr Satish Chand, SRO Horticulture
6. Dr. Alka Verma, JRO, Vegetable Science
7. Dr. Pratibha, Assistant Professor, Horticulture

Functions:

- To make arrangement for booking of conference hall and its decoration/committee rooms for different sessions for Training and Workshop
- To make arrangement for the sitting of guest, delegates, press and media persons.
- Preparation for inaugural address for chief guest and guests on Dias.
- To arrange LCD, Audio-Video facility All other facilities/items required for smooth conduction of different sessions.

5. Poster Session Committee

1. Dr Ramesh Chandra, Professor & Head, Soil Science-Chairman
2. Dr S.K. Sharma, Prof & Head, Food Sci & Tech
3. Dr Ajit Kumar, Professor Horticulture/ Floriculture
4. Dr Gurvinder Singh, SRO Agronomy
5. Dr Ajay Kr Srivastava, Asstt Prof Agronomy
6. Usha Bhatt, Asstt Professor Genetics and Plant Breeding

Functions:

- All arrangements pertaining to conducting poster session

6. Boarding, Lodging and Transportation Committee

1. Dr. Manoj Raghav, Professor Vegetable Science- Chairman
2. Dr V.P. Singh, Professor, Horticulture
3. Dr. Jayant Singh, OI/C, Transport Officer
4. Dr. Satish Chand, SRO, Horticulture
5. Dr. Mohan Singh, Officer Incharge Guest House
6. Dr Poonam Gautam, SRO Soil Science
7. Dr J.P. Purwar, SRO Entomology
8. Dr Rashmi Panwar, Asstt Professor, Horticulture

Functions:

- Booking of accommodation in University Guest Houses/Hotels.
- To make necessary arrangement for boarding & loading of guest/delegates.
- To make necessary arrangement for transportation, pick and drop of delegates.
- To provide transport facility to guest/delegates from place of their accommodation to the venue & vice-versa.

7. Food and Refreshment Arrangement Committee

1. Dr. D.C. Dimri, Professor, Horticulture- Chairman
2. Dr Dinesh Kr Singh, Professor & Head, Vegetable Science
3. Dr. P.N. Rai, Professor, Horticulture
4. Dr. B.D. Bhuj, Professor, Horticulture

5. Dr Dhirendra Singh, Professor Vegetable Science
6. Dr. Sanjay Kumar Srivastava, Professor, Ag Economics
7. Dr. S.B. Bhardwaj, JRO DES
8. Dr. Navin Singh, SRO, Horticulture

Functions:

- To make arrangement of quality food (breakfast, lunch, dinner, inaugural and session tea)
- To hire contractor for food arrangement including required tentage etc.

8. Finance and Fund mobilization Committee

1. DrS.K. Kashyap, Dean Agriculture - Chairman
2. Dr A.S. Nain, Director Research
3. Dr D.C. Dimri, Professor & Head, Horticulture
4. Dr D.K. Singh, Prof & Head Vegetable Sciene
5. Dr. Manoj Raghav, Professor, Vegetable Science
6. Dr. Ranjan Srivastava, Professor, Horticulture
7. Dr. J.C. Badola, Dy. Comptroller
8. Sri Satish Chandra, AO, Agriculture College

Functions:

- To generate funds to meet the expenses for various activities of Conference.

9. Press/Publicity/Videography/Photography Committee

1. Dr S.K. Bansal, Director, Communication - Chairman
2. Dr. A.K. Singh, Professor Horticulture
3. Dr Omveer Singh, Professor Horticulture
4. Dr Poonam Srivastava, SRO Entomology
5. Dr. Amardeep, Associate Professor, Communication
6. Dr. Ajit Kumar, Floriculturists

Functions:

- To make arrangement for the publicity of the event through display of banners
- To prepare draft for English and Hindi news arranging and their publication in News papers.
- To invite local media persons to cover the inaugural session of the event.
- To arrange videography, photography & AV Aids facility for inaugural & plenary session.

10. Invitation Committee

1. Dr. Salil Kr Tiwari, Professor & Head, Genetics and Plant Breeding- Chairman
2. Dr. Ajaya Srivastava, Professor, Soil Science
3. Dr B.D. Bhuj, Professor Floriculture & Landscaping
4. Dr. A.K. Singh, Professor, Horticulture
5. Dr. Rajesh Kumar, Associate Professor, Horticulture
6. Dr. Pratibha, Assistant Professor, Horticulture

Functions:

- To prepare the list of delegates and local Scholar
- Printing of invitation card for breakfast, lunch, dinner, inaugural tea, plenary session, tea etc. and their timely distribution.

11. Cultural Programme Committee

1. Dr Pramod Mall, Professor & Head, Entomology- Chairman

2. Dr Vipin Dhyani, Associate Professor Agronomy
3. Dr Manisha Rani, Asstt Professor Soil Science
4. Dr Rashmi Panwar, Asstt Professor
5. Dr Neetu Dobhal, Asstt Professor, Foods & Nutrition
5. Dr Ruchi Rani Gangwar, Asstt Professor Ag Economics

Functions:

- To organize the university song in the inaugural session
- To organize a cultural programme on May 29, 2019

ISBN: 978-93-91664-13-8