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PROGRESSIVE HORTICULTURE CONCLAVE 2024

Horticultural Technologies for Self-Reliant India

Organised By

ASPEE College of Horticulture, Navsari Agricultural University | Indian Society for Horticultural Research & Development, Uttarakhand

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NAVSARI AGRICULTURAL UNIVERSITY

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COMPILATION AND EDITING

Dr. Alka Singh
Dr. S K Dwivedi
Dr. Parag Pandit
Dr. Devraj
Dr. Avnish Pandey
Dr. Hardik Shah

Organised By

Indian Society for Horticultural Research & Development, Uttarakhand

ASPEE College of Horticulture
Navsari Agricultural University

Progressive Horticulture Conclave 2024

Horticultural Technologies for Self-Reliant India

18th January, 2024

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NAVSARI AGRICULTURAL UNIVERSITY

Dr. Z. P. Patel
Vice-Chancellor

MESSAGE

It is with immense pleasure and enthusiasm that we announce the forthcoming Progressive Horticulture Conclave on Horticultural Technologies for Self-Reliant India, hosted by ASPEE College of Horticulture, Navsari Agricultural University in collaboration with Indian Society for Horticultural Research & Development, Uttarakhand, India during 18-20 January, 2024. In the vibrant tapestry of India's economic landscape, the horticulture sector is a proud and prolific contributor. Generating approximately 320 million tons of products, it adds a remarkable 33% to the Gross Value Addition (GDA). Our diverse geographical features have been pivotal in nurturing the growth of this sector, leading towards prosperity in the country.

As we set our sights on achieving self-reliance, the conclave becomes a crucial platform to deliberate on the vital role of infrastructure, governance reforms, and, most importantly, cutting-edge technologies in catapulting our horticulture sector towards self-sustainability. In the quest for Atma Nirbhar Bharat, our focus extends beyond rhetoric to identify key areas, revolutionary technologies, and strategic policies essential for curbing horticultural imports, ultimately enhancing the income of our farmers.

The conclave serves as a beacon, shedding light on challenges and formulating actionable plans to ensure food security, create employment opportunities, and fortify the foundation of self-reliance. Dr. Alka Singh, the Organizing Secretary and Dean of ASPEE College of Horticulture and Forestry, NAU and Dr. S. K. Dwivedi, PHC Coordinator and Scientist 'G' & Director, DRDO have taken a commendable initiative to orchestrate this transformative workshop, showcasing their dedication to the growth and prosperity of the horticulture sector.

To celebrate this auspicious occasion, a souvenir adorned with insightful articles is poised to be unveiled, capturing the essence of collective wisdom and expertise. To the entire organizing team and participants, I extend my heartfelt best wishes, envisioning a grand success for PHC 2024. Let this conclave be a catalyst for innovation, collaboration, and a flourishing future for Indian horticulture.

Navsari
January 10, 2024

(Z. P. Patel)

NAVSARI AGRICULTURAL UNIVERSITY

Dr. T. R. Ahlawat
Director of Research &
Dean PG Studies,
NAU, Navsari

MESSAGE

I am pleased to acquaint myself with the forthcoming Progressive Horticulture Conclave on Horticultural Technologies for Self-Reliant India, diligently organized by ASPEE College of Horticulture, Navsari Agricultural University in collaboration with Indian Society for Horticultural Research & Development, Uttarakhand, India during 18-20 January 2024. The Progressive Horticulture Conclave (PHC) represents an inclusive platform catering to diverse horticulture stakeholders, including researchers, educators, extension agencies, scholars, farmers, industry leaders, policymakers, among others. This multidisciplinary approach is poised to facilitate a comprehensive review and updates across the spectrum of horticultural endeavors.

This conclave transcends mere event status; it signifies a progressive stride towards cultivating awareness among the younger demographic about the pivotal role of horticulture in addressing socio-economic imperatives, particularly in terms of employment and nutritional security. In consonance with this objective, an ancillary exhibition themed 'Horticulture for Health and Happiness' has been judiciously curated, serving as an engaging adjunct for the students.

Beyond being a convergence of intellectual faculties, this conclave assumes the character of a nexus wherein academicians, policymakers, town planners, and environmentalists converge. The collective aim is to formulate an actionable agenda conducive to the preservation of environmental wealth alongside the assurance of nutritional security. I extend my earnest greetings and felicitations to the assiduous organizers, erudite participants, industrious farmers, and aspiring students.

In anticipation of scholarly deliberations and the emergence of consequential recommendations, I proffer my best wishes for the unmitigated success of this conclave. May it serve as an intellectual crucible, fostering transformative discourse and contributing meaningfully to the realization of a sustainable, self-reliant future for the horticultural landscape in India.

Navsari
January 10, 2024

(T. R. Ahlawat)

Prof. R. K. Pathak
President, PH-ISHRD

MESSAGE

It gives me immense pleasure that the Indian Society for Horticultural Research and Development and ASPEE College of Horticulture, Navsari Agricultural University, Navsari is organizing the 3rd Progressive Horticulture Conclave on Horticulture Technologies for a Self-Reliant India during 18-24 January 2024 at Navsari Agricultural University, Navsari, Gujarat.

Horticulture has been recognized as the mainstay of the Indian economy as early as the eighth five year plan. Ever since a sizeable budget has been allocated to developing this sector to give an impetus to Indian Agriculture globally. Having attained food security, India is fast developing as a nutritionally secure nation with this contribution of our scientists. Today India is the second largest producer of fruits and vegetables in the world producing 107.24 and 204.84 million metric tonnes, respectively which contributes approximately 33% of the Gross Value Addition. There is increasing acceptance of horticulture produce from the country at international level. This has occurred due to concurrent developments in the areas i.e. state-of-the-art in cold chain infrastructure and quality assurance measures. Apart from large investments pumped in by the private sector, the public sector has also taken the initiative for setting up several Centers for Perishable Cargoes and integrated post-harvest handling facilities in the country. Capacity-building initiatives at the farmers, processors and exporters levels have also contributed towards this effort.

I am sure that the galaxy of eminent scientists who will gather from across the country will be able to suggest a roadmap for building a self-reliant India in the Horticulture sector through the use of the various technologies available in the country.

I wish the organizers a successful Conclave and the participants' fruitful deliberations during the Conclave.

(R. K. Pathak)

Dr. S. K. Dwivedi
PHC Coordinator
Scientist 'G' & Director
Director of Personnel, DRDO

MESSAGE

Horticulture has been recognized as the mainstay of the Indian economy as early as the eighth five year plan. Having attained food security, India is fast developing as a nutritionally secure nation with this contribution of our scientists. Today India is the second largest producer of fruits and vegetables in the world producing 107.24 and 204.84 million MT, respectively which contributes approximately 33% of the Gross Value Addition. FAO (2021) lists India as the largest producer of ginger and okra among vegetables and second in the production of Potatoes, Onions, Cauliflowers, Brinjal, Cabbages, etc. Among fruits, India leads the world in production of Bananas (26.45%), Mangoes (including mangosteens and guavas) (43.80%) and Papayas (39.30%). The Horticulture production surplus has been diverted to the processing sector to reduce wastage which stands at 4.6-15.9% for the fruits and vegetables. Scientists have been able to develop processing technologies to create products which have national and international acceptance *vis a vis* the quality standards. Processing levels in F&V currently stand at close to 2%. Opportunity to invest in initiatives that help reduce wastage levels include adequate infrastructure (cold chain, processing infrastructure), R&D for processed food & packaging, innovative on-farm preservation systems and skill development. Horticulture scientists working within the different organizations of the Government of India, and particularly in the ICAR, have done their utmost in taking up the challenges in the Horticulture sector and churning out cutting edge technologies for the various components which are suited to the agro-climatic conditions of India and yet can compete globally. Despite such efforts, a large number of commodities like seed and planting materials, processed products, machinery and equipment, packaging materials, horticulture inputs etc., are still being imported in sizeable quantities. This increases our dependence on others besides putting a burden on the exchequer. Horticulture is a labor-intensive sector with immense employment opportunities, especially for the people of rural regions who form an integral part of the Horticulture ecosystem and are critical for a self-reliant India. In the backdrop of making India self-reliant (*Atma Nirbhar*), the task of achieving self-reliance and self-sustainability in the horticulture sector depends not only on infrastructure and governance reforms but on suitable technologies/ varieties/ inputs suitably supported by strategies and policies policies which could assist in decreasing horti-imports and increasing farmers' income.

It is befitting that third Progressive Horticulture Conclave: Horticultural Technologies for Self-Reliant India, is being organized by Indian Society for Horticultural Research & Development, Uttarakhand, India and ASPEE College of Horticulture, Navsari Agricultural University at NAU, Navsari during 18-20 January 2024. I feel that the three day deliberations could help in dissemination of ideas for the development of a successful and self-reliant India and shall help in charting a roadmap which may be forwarded to suitable agencies in the form of a proceedings. I wish all the participants a healthy academic discourse in the PHC 2024 and the organisers a successful Conclave.

(S. K. Dwivedi)

Dr. Alka Singh
Organising Secretary
Dean and Principal,
ASPEE College of Horticulture,
Navsari Agricultural University
Navsari.

MESSAGE

It is with immense pleasure that we extend our warm and cordial invitation to all the delegates and stakeholders for the Progressive Horticulture Conclave 2024. This prestigious event is a collaborative effort between the ASPEE College of Horticulture at Navsari Agricultural University, Navsari and Indian Society for Horticultural Research and Development, Uttarakhand, India during 18-20, January 2024, at the scenic Navsari Agricultural University campus, Navsari.

As we embark on this journey, the conclave seeks to delve deep into the very essence of horticulture, providing a pivotal platform for the exchange of groundbreaking ideas, cutting-edge research findings and transformative technologies. Our overarching goal is to drive India towards self-reliance in horticulture, aligning with the nation's vision for a sustainable and prosperous future.

The heart of the conclave lies in the exploration of advanced horticultural technologies that are instrumental in fostering the growth and sustainability of this indispensable sector. Our collective focus will be on fostering innovation and adopting practices that not only elevate the field of horticulture but also contribute significantly to the overarching goals of environmental sustainability and agricultural self-sufficiency.

This conclave will promise a truly enriching and rewarding experience for all participants, featuring a diverse lineup of esteemed speakers, experts and thought leaders in the field of horticulture. Their insights and experiences will undoubtedly shed light on the latest trends, challenges and opportunities in the domain, fostering a collaborative environment for knowledge exchange in the horticulture field.

I would like to express my sincere gratitude for the invaluable support provided by my esteemed team members, Dr. Devraj, Dr. Avnish Pandey, Dr. Parag Pandit, and Dr. Hardik Shah from ACH, as well as the invaluable guidance offered by Dr. S.K. Dwivedi, PHC Coordinator, and the dedicated PG students involved in the compilation of this endeavor. I would also like to extend my heartfelt appreciation to all the committee conveners, namely Dr. C.G. Intwala, Dr. D.R. Bhanderi, Dr. V.K. Parmar, Dr. Narendra Singh, Dr. K.D. Desai, Dr. S.L. Chawla, Dr. Anand Kaswala, Dr. Alpesh Leua, Dr. R.V. Tank, Dr. B.M. Tandel, and Dr. Chirag Naik, as well as the other committee members, for their unwavering support. Together, we will engage in thoughtful deliberations, exploring strategies and solutions that empower the horticultural community. Our collective efforts aim to be a driving force in realizing the vision of a self-reliant India, where the horticulture sector plays a pivotal role in the nation's economic and agricultural prosperity.

We eagerly anticipate your presence at the Progressive Horticulture Conclave 2024, confident that your participation will contribute to the success of this momentous event. Let us come together to sow the seeds of innovation, nurture the growth of horticulture, and reap the fruits of a sustainable and self-reliant future.

(Alka Singh)

NAVSARI AGRICULTURAL UNIVERSITY

PROGRESSIVE HORTICULTURECONCLAVE (PHC) 2024
Horticultural Technologies for Self-Reliant India

Organized by:
ASPEE COLLEGE OF HORTICULTURE,
NAVSARI AGRICULTURAL UNIVERSITY
Navsari- 396 450, Gujarat
and
Indian Society of Horticultural Research & Development (ISHRD)
Uttarakhand, India
18-20 January 2024

NAVSARI AGRICULTURAL UNIVERSITY

Session I: Panel Discussion on Thesis Research, Teaching and Scholars' Issues

Session II: Panel Discussion on Research and Projects Issues Strategies

Session III: Future Crops and Varietal Development for Self Reliance

Session VII: Effective Post Harvest Management and Processing

Session VIII: New Tools and Techniques for Future Horticulture

Session III

Future Crops and Varietal Development for Self Reliance

Ex situ conservation oftemperate berrycrops at ICAR-NBPGR

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India is bestowed with different climatic conditions conducive for the production of wide range of fruit crops. The vast genetic diversity of temperate fruits occurs in the North Western Himalayan region, the North Eastern Himalayas and the Nilgiri hill area. IndianHimalayas harbour rich diversity of native temperatefruitsincluding berry crops such as *Rubus, Ribes, Vitis, Morus, Actinidia* etc.in the wild. These fruits are rich in various phytochemicals with antioxidant and anti-inflammatory properties. Temperate berries are rich in antioxidants, vitamins and are good for health. These crops are vegetatively propagated and e*x situ* conservation of germplasm is important for crop improvement. Therefore, the germplasm of berry crops,augmented from wild or introduced from another county (exotic) are mainly conserved in the field genebanks of ICAR-NBPGR. Besides, germplasm of strawberry, blueberry, blackberry and mulberry are being conserved under *in vitro* conditions at the state of art facility at*In Vitro* Genebank at ICAR-NBPGR, New Delhi. For long-term conservation, vitrification-based cryo-techniques were used to cryopreserve the*invitro*-grown shoot tips. Some of the *in vitro*conserved accessions were found promising when evaluated for their performance in the field. The present paper describes the present status and future prospects of berry crops in India.

Underutilized horticultural crops of North East India and their exploitation potential

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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 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 becausc of thcir locational advantagc. Thc rcgion has a grcat 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 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.

Underutilized fruit crops of hot semi-arid region: issues and challenges-a review

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The Indian semi-arid regions are characterized by extreme temperature, erratic rainfall, poor soil and water quality, which ultimately limit the productivity. However, these conditions can favourably be utilized to enhance the productivity through advanced fruit technological interventions, resulting in more income by utilizing solar and wind energy, human work force, and developing infrastructural facilities which greatly favour in doubling the income of farmers. There is a plenty of scope for quantum jump in fruit production in semi-arid areas. The regions have strength to produce high quality bael, lasoda, khirni, karonda, jamun, chironji, tamarind, wood apple, custard apple, fig, phalsa, mulberry, manila tamarind, timru, mahua and palmyra palm (Saroj *et al.* 2018; Singh and Singh 2012). The existing low productivity could be enhanced by following improved new sustainable technologies and inputs with or without irrigation. The amelioration of the extreme conditions is also considered vital for life support to the inhabitants. The recent awareness regarding the potential of these ecologically fragile lands for production of quality produce has not only opened up avenues for providing sustainability in livelihood and nutritional security but at the same time for bringing new areas also to increase fruit production. The area expansion and yield potential of semi-arid fruit crops has increased manifolds because of development of new varieties and advancement in agro-techniques and processing techniques for development of value-added products.

Breeding strategies to mitigate the HLB disease in citrus

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Citrus production worldwide is threatened by a serious disease, Huanglongbing (HLB) or citrus greening disease, associated with the phloem-limited bacterium, *Candidatus* Liberibacter asiaticus (*C*Las), which is transmitted through the psyllid insect vector, *Diaphorina citri*. The disease vector can transmit it to a very long distance. On average, the dis ease can cause 30–100% in yield losses depending upon the severity of the disease. It takes 2-5 years for a tree to become unproductive from the first appearance of the symptoms, and the total life span of the tree is reduced to 7-10 years. HLB has been established itself in more than 40 countries. There is currently no cure for HLB, and it is generally accepted that the only way to keep *Citrus* as a viable crop, is by planting tolerant cultivars, obtained by either traditional breeding or by modern gene manipulation. Although some *Citrus* cultivars seem to be less prone than others to succumb to HLB, no true resistance to the pathogen is known in the genus. In this direction, seven tetrazygs (UFR -1, UFR-2, UFR-3, UFR-4, UFR-5, UFR-6 and UFR-17) and many hybrid rootstocks (SuperSour series and US series) have been developed showing tolerance to some extent against HLB. However, being the problem of scion varieties, there is need to develop the resistant/tolerant scion varieties to mitigate the impact of the devastating disease (HLB). The Australian finger lime (*Citrus australasica*) is tolerant to HLB. This species can be utilized to develop HLB tolerant citrus cultivars through conventional breeding and biotechnological approaches. The candidate genes have been identified, responsible to produce Cys-rich secretory proteins and Pathogenesis-related 1 (PR1-like) proteins that are highly upregulated in infected finger lime relative to noninfected and infected 'Valencia' sweet orange. Additionally, the anatomical analysis of phloem and stem tissues in finger lime and 'Valencia' suggested better regeneration of phloem tissues in finger lime in response to HLB infection. Analysis of callose formation following infection revealed a significant difference in the

production of callose plugs between the stem phloem of CaLas+'Valencia' sweet orange and finger lime. Understanding the mechanism of resistance will help the scientific community to design strategies to protect trees from CaLas infection and assist citrus breeders in developing durable HLB tolerant citrus varieties. Recently, it was observed that some *P. trifoliata* hybrids were not showing typical symptoms of HLB despite being infected, thus creating renewed interest in further evaluating the traits of the many hybrids combining *Citrus* and *P. trifoliata* in citrus scion breeding programme. Initial hybrids of *Citrus* × *P. trifoliata* typically produce fruits with unacceptable flavour, but more advanced hybrids (2nd to 3rd generation) with greater proportions of *Citrus* in their pedigrees have various degrees of off-flavour and taste. So, selecting advanced hybrids using *Citrus*× *P. trifoliata* having flavour close to citrus may be the potential strategy against HLB for sustainable citrus industry. Simultaneously, there is need to include the high throughput phenotyping for speeding up the breeding progress to develop HLB tolerant scion varieties.

Proteomics tools to understand stress tolerance mechanism of seabuckthorn and its nano-technological potential for translational research

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Recent global climate change has prompted researchers worldwide to extensively examine the stress hardy crops for understanding their hardiness potential. Seabuckthorn (*Hippophae*), a high-altitude Himalayan bio-resource grows in extreme (temperatures) climatic conditions and hence be a good system to understand stress tolerance mechanism, and is expected to be a storehouse of multiple stress tolerant genes/proteins. Although, some transcriptomics information is available for seabuckthorn but its proteomics is not much explored at global level. There are three species of seabuckthorn which grows at different altitudes with different morphological adaptations. Our group is using proteomics tools to understand and dissect the cold/freeze tolerance of seabuckthorn. High-altitude Trans-Himalayan (*H. rhamnoides, H. tibetana*) and lower altitude adapted Sikkim (*H.salicifolia*) germplasm were used for these investigations. Procedures were optimised to extract protein from apoplast,leaf and berry of seabuckthorn, Gel and LCMS/MS based proteome analysis was conducted with all three species Nano LCMS/MS analysis allowed identification of 4870 proteins clustered into 1035 protein groups. Gene ontology and KEGG analysis showed differential regulation of proteins associated with metabolic processes, stress signalling, defense responses, redox regulation, protein remodelling, and secondary metabolite or fatty acid biosynthesis. A clear trade-off between growth and stress tolerance phenomenon was observed, High-altitude adapted Trans-Himalayan populations repress their growth and divert energy for stress responses to survive extreme climatic conditions while the Sikkim populations at lower elevations invest in allocate resource for growth-promoting pathways. Besides, gold nanoparticles with high dye degrading potential were synthesised using berry and leaf extracts, these can be used to decontaminate toxic dyes and industrial water.

Underutilized Temperate Fruit Species in Western Himalayan States of Uttarakhand, Himachal Pradesh and J&K– Case Study of Kiwi Fruit Production Towards Harnessing Nutraceutical Values and Enhancement of Rural Livelihoods

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The identification of new species, their characterization, conservation and sustainable utilization is the key to improving 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. Different agro ecological /phytogeographical regions of Western Himalayan Regions hold rich diversity in both the cultivated, underutilized and the wild temperate horticultural crops. Due to this a wide range of natural population has been built up both at species and genotypic level in the region. In the present context of climate change, the diversification of temperate fruit with various underutilized horticultural crops is one of the possible solutions to this major challenge as their cultivation can bridge the gap between increasing demands and supply of food.

Potential indigenous fruits for the future

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Indigenous subtropical fruits because of their hardy nature of tree, high production potential in degraded lands and high nutraceutical value have immense potential for commercialization in India in the years to come. During last 50 years, most of the horticultural development efforts have been confined to the improvement and commercialization of major fruit crops like mango, banana, apple, guava, citrus, papaya, litchi, grapes, etc. Work done on under-utilized subtropical fruits in the country especially during last two decades has opened up new vistas of horticultural growth in general and arid and semi-arid regions in particular for enhancing small farmers' profitability and also the nutritional security. The crops like aonla (*Emblica officinalis* Gaertn), bael (*Aegle marmelos* Correa, jamun (*Syzygium cumini* Skeels), custard apple (*Annona squamosa* L.), khirni (*Manilkara hexandra* (Roxb) Dubard), carambola (*Averrhoa carambola* L.), mulberry (*Morus* spp), barhal (*Artocarpus lakoocha* Roxb), karonda (*Carissa carandas* L), tamarind (*Tamarindus indica* L.), chironji (*Buchanania lanzan* Spreng), wood apple (*Limonia acidissima* L.), jackfruit (*Artocarpus heterophyllus* L.) and paniyala (*Flacourtia jangomoas* (Lour.) Raeusch) have a lot of diversity in hot spot areas and offer immense potential of identifying superior genotypes for commercialization. The present paper deals with the identification of superior types in these crops through survey in hot spot areas and characterization and evaluation and prospects of their utilization for enhancing profitability and nutritional security of small land holders. It also deals with the latest efforts made in the development of superior genotypes of such potential indigenous fruits in the country. Aonla cultivars like Kanchan, Krishna, NA-7, NA-10, Lakshmi-52, Goma Aishwarya have gained popularity while CISH B-1, CISH B-2, Pant Aparna, Pant Sujata, Pant Shivani, Pant Urvashi, NB-5, NB-7, NB-9, NB-16, NB-17, Goma Yashi, Thar Divya and Thar Neelkanth of bael have spread in many new areas and contributed to enhanced profitability. Paras, Konkan Bahdoli, Thar Kranti, Goma Priyanka, CISH J-37 and CISH J-42 (seedless) have been developed in jamun for commercialization. Arka Sahan and Balanagar custard apples are being adopted in various degraded areas. Thar Priya and Thar Rituraj identified in chironji and khirni, respectively have become a new hope for plateau of central and western India. Pant Manohar, Pant Sudarshan, Pant Suvarna, Maroon coloured, White Pink Blush and Thar Kamal in karonda and Konkan Prolific, Singapore/Ceylon Jack, Hybrid Jack, Burliar-1, PLR-1 (Palur-1), PPI-1(Pechiparai-1) in jackfruit are some of the promising cultivars developed for commercialization. New superior genotypes of jack fruit from Uttar Pradesh and adjoining areas have also been identified. The crops like mulberry, barhal, wood apple, khirni, chironji, carambola, paniyala have exhibited tremendous variability in fruit traits for selection and commercialization of new cultivars. As paniyala is confined only in certain areas of Gorakhpur and Kushinagar, efforts are on to obtain the GI status for the important fruit to save it for future generations, The expected economic returns from the crops like custard apple, bael, jamun, chironji, khirni, carambola, jackfruit, etc are very high when marketed properly.

Chironji: A potential nut crop for the future in south Gujarat region

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Chironji or Charoli, (*Buchanania lanzan* Spreng.) is excellent tree growing under forest conditions as an under exploited fruit and gives monitory reward to the tribal community of the country and seems to be boon for them. It is medicinally important tropical tree species and a significant source of livelihood for local tribal, it holds good proportions of antioxidants, essential nutrients and bioactive molecules. The kernel is highly nutritious and rich in protein (25.0 - 30.0%) and yields sweet oil, which can be used to substitute olive and almond oil. Due to direct harvesting of economically important parts of tree from natural habitat, genetic resources of *B. lanzan* are facing severe threat of extinction and need immediate conservation efforts. A survey was conducted in Dang, Tapi and Narmada districts of Gujarat with the objectives to select the suitable genotypes with desirable horticultural traits for further multiplication and domestication at farmer's field. Seeds from superior genotypes in terms of nut weight (0.25g), better nut recovery (50%) and regular bearing habit; were collected and used for raising seedling.

Healthy seedlings were planted at 5m spacing during 2016, at AES, Paria and evaluated for growth and yield characters. At present five trees out of 40 are in bearing with considerable nut yield. Better yielding trees can further multiply vegetatively for commercial cultivation in future.

Keywords: *Buchanania lanzan*, Chironji, Genotype, Horticultural traits, nut yield, nut recovery.

Development of hybrids for fruit yield and disease resistance in Okra [*Abelmoschus esculentus* (L.) Moench]

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Okra [*Abelmoschus esculentus* (L.) Moench], is an important vegetable crop grown throughout the tropical and sub-tropical regions and also in the warmer parts of the temperate region.Among the biotic stresses affecting okra, the virus causing yellow vein mosaic disease, is the most serious disease causing severe threat to its production resulting in yield losses ranging from 50 to 94% depending on the stage of crop growth at the time of infection. An investigation was carried out to find out standard heterosis, combining ability of the parents and hybrids as well as behaviour of disease resistance particularly YVMV in okra at Vegetable Research Farm, Regional Horticultural Research Station, Navsari Agricultural University, Navsari, Gujarat, India under three consecutive environments *viz.,* January 2nd week-2021 (E1), February 2nd week-2021 (E2) and March 2nd week-2021 (E3).

The analysis of variance for individual environment as well as for pooled over environments revealed that considerable genetic variation present among the parents and hybrids for all the traits. In the present investigation, significant and positive standard heterosis as well as *SCA* effects for pod yield per plant was obtained in NOL-18-2 x Arka Anamika (in E1) and crosses NOL-18-7 × Arka Anamika and NOL-18-5 × GAO-5 (both in E2 and E3). An overall view of all the top yielding crosses with respect to pod yield contributing traits revealed that the higher pod yield was mainly due to average pod weight and average number of pods per plant. The analysis of variance for combining ability revealed that *SCA* variance was higher than *GCA* variance for most of the traits indicated that non-additive gene effect was more prominent for these characters. With respect to the crosses showing higher heterosis viz., NOL-18-2 × Arka Anamika (in

E1) and crosses NOL-18-7 × Arka Anamika and NOL-18-5 × GAO-5 exhibited resistant reaction against okra YVMV disease in all three consecutive years. This might be due to the resistant sources used for breeding programme *viz*. Arka Anamika and GAO-5. Those parents and hybrids showing moderately resistant/tolerance reaction to YVMV disease can be used in further breeding programmes to develop varieties/hybrids or can be used as source of resistance.

Key words: Heterosis, Combining ability, Disease resistance, Okra

Evaluation of Tall x Tall coconut hybrids under South Gujarat condition

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The field experiment entitled "Evaluation of Tall x Tall coconut hybrids under South Gujarat condition" was laid out under RBD with four replications and five different treatments (hybrids) *viz.,* BENT x ADOT; LCT x ADOT; ECT x LCT; WCT x TPT and ADOT x ECT having spacing of 7.5m x 7.5m during the year 2013-14 at Regional Horticultural Research Station, ASPEE College of Horticulture, Navsari Agricultural University, Navsari (Gujarat). The results obtained on growth and yield performances as well as insect-pest incidence of Tall x Tall hybrids are revealed that, significantly minimum stem/trunk height (3.28 m) with maximum total numbers of leaves on the crown (30.75 numbers), leaf scare in 1 m length of trunk (14.33 numbers), inflorescence production per annum (10.25 numbers), number of female flowers (242.50), fruit setting (25.30 %) and nut yield per palms per year (61.25 nuts) as well as minimum age at first flowering (39 months) was noted in treatment BENT x ADOT (T_1) whereas, maximum stem girth of palm (153.25 cm) and leaf length (539.25 cm) with petiole length (151.00 cm) were recorded in LCT x ADOT (T_2) and ADOT x ECT (T_5) treatment, respectively. In case of fruit with copra characteristics, significantly maximum fruit weight (1096.50 g) and kernel thickness (1.15 cm) was recorded in treatment WCT x TPT (T_4). Maximum husked fruit weight (555.75 g), weight of husk (473.25 g), kernel weight (262.75 g), copra content (138.50 g/nut), copra yield (8.50 kg/palm) and tender nut water (418.75 ml) with minimum per cent husk weight (46.05 %) were recorded in treatment BENT x ADOT (T_1). Regarding to reaction of biotic stresses, BENT x ADOT (T_1) T x T hybrid observed minimum per cent of incidence with respect to insect-pest as compared to rest of hybrids.

Key words: Biotic,coconut, hybrids, growth and yield.

Performance evaluation of jamun (*Syzygium cuminii* Skeels) varieties in semi-arid conditions of central Gujarat

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Jamun is highly adapted to diverse environmental conditions and widely distributed in India up to an altitude of 1600 m. The presences of anthocyanins, fibers and ellagitannins which are present in the pulp are important in reducing the oxidative stress-induced diseases. Because of its hardy nature and various uses, it has great potential for commercial exploitation in wastelands and dry-land horticulture. As a result it is gaining popularity among farmers all over the country particularly in rain-fed areas. Several old nondescript

varieties are under cultivation in this region but evaluation and recommendation regarding their suitability for this region has not been done. In this regard present work was carried out to know the plant growth and yield performance of jamun varieties grown in different parts of the country.

Plant growth, fruit yield and quality attributes of different varieties of jamun were evaluated during the year 2023. Plant height was observed the highest in CISHJ-37 followed by Goma Priyanka whereas plant spread in both the directions was found higher CISHJ-37. However, lower plant height and spread were recorded in CISHJ-42 while higher stem girth was recorded in CISHJ-37. Goma Priyanka recorded the highest fruit weight (18.45 g), yield/plant (38.50 kg), TSS (16.05 ^{0}Brix) and total sugar (10.40%) followed by CISHJ-37 while CISHJ-42 recorded lower fruit weight (8.78 g), yield/plant (10.55 kg), pulp weight (8.11 g), and higher pulp percentage (92.68%). However, Konkan Bahdoli recorded the minimum pulp percentage (80.13%), TSS (14.44 ^{0}Brix), acidity (0.39 %), ascorbic acid (41.20 mg/100g) and total sugar (9.50%). %). Based on the present findings, jamun varieties like Goma Priyanka and CISHJ-37 (Jamwant) were found better in terms yield and quality parameters in this region.

Keywords: Jamun, variety, fruit quality, yield

Pollen ultra-structure and storage studies in grape (*V. vinifera* L.) cv. Early Perlette Selection and Pusa Navrang

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The grape improvement program in the North Indian region focuses on specific goals, with an emphasis on early maturity. Early Perlette Selection (EPS) and Pusa Navrang (PN) are identified as potential male parents due to their early flowering periods. EPS flowers from March 11 to March 22, while PN's flowering period is from March 18 to April 2. Efficient pollen storage is essential for hybridizing with late-blooming female parents. This study aimed to explore the pollen morphology and storage of EPS and PN. SEM analysis revealed both genotypes exhibited a prolate pollen shapewith foveolate perforated exine ornamentation. EPS had a colpus length and width of 24.754 µm and 0.506 µm, respectively, while PN had a colpus length of 22.668 µm and colpus width of 0.809 µm. Pollen storage experiments at various temperatures (room temperature, 4°C, -20°C, and -196°C) for up to one month revealed that room temperature storage was viable for 3 days for EPS and 1 day for PN. *In vitro* pollen germination studies suggested that the most effective storage methods were at -20°C and -196°C, with higher pollen germination rates. However, successful storage for up to one month was achieved at 4°C. Effective storage at -20°C and -196°C offers extended viability, while 4°C remains a viable option for shorter storage periods of up to one month. The study provides insights into the pollen storage of EPS and PN and allowing researchers flexibility in choosing storage periods based on breeding objectives.

Key words: Grape improvement, Pollen structure, Pollen germination, Pollen storage.

Varietal Improvement through Genetic Selection Indices in Okra [*Abelmoschus esculentus* (L.) Moench]

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A total of 26 okra genotypes were evaluated to study genetic variability, heritability and genetic advance

as percentage of mean for quantitative traits of okra. The present investigation was carried out in randomized block design with three replications during the *kharif*, 2022 at Vegetable Research Farm, Maharajpur, Department of Horticulture, JNKVV, Jabalpur (M.P.). Analysis of variance imparted the significant diversity for all the studied characters. The phenotypic coefficient of variation was recorded higher than the genotypic coefficient of variation for all the studied characters. The maximum PCV and GCV were recorded for internodal length, fruit diameter, fruit weight and number of primary branches per plant revealed that there is ample scope for the yield improvement by the altering genetic makeup of okra. High heritability associated with high genetic advance as percent of mean observed for the characters like fruit yield per plant, number of primary branches per plant, fruit diameter, fruit weight and internodal length demonstrated that they are regulated by the action of additive genes and could be successfully strengthened through simple selection.

"Evaluation of Garden Pea (*Pisum sativum* L.) Varieties for Growth and Flowering Attributes Under Malwa Region of Madhya Pradesh"

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An experiment was conducted to evaluate the garden pea (*Pisum sativum* L.) varieties for growth and flowering attributes under Malwa region of Madhya Pradesh. The experiment was laid out in a RBD with three replications and used different varieties of pea *viz.* V_1 (Arka Ajit), V_2 (Arka Apoorva), V_3 (Arka Kartik), V_4 (Arka Priya), V_5 (Arkel), V_6 (Azad Pea-3), V_7 (Kashi Ageti), V_8 (Kashi Mukti), V_9 (Kashi Nandini), V_{10} (Kashi Samarth), V_{11} (Kashi Samridhi), V_{12} (Kashi Shakti), V_{13} (Kashi Uday), V_{14} (Matar Ageta-6), V_{15} (Mater Ageta- 7), V_{16} (Palam Priya), V_{17} (Palam Sumool), V_{18} (Palam Triloki), V_{19} (PSM-3), V_{20} (Punjab-89), V_{21} (Pusa Pragati), V_{22} (Pusa Shree) with 22 different varieties. Result revealed that in the genotypes differed significantly with respect to different growth and flowering parameter. Growth attributes *viz*., plant height, number of primary branches per plant, number of leaves per plant and number of node of first flowering. Variation in these attributes among the varieties is mainly due to genetic nature of varieties. Variety Arka Kartik was recorded maximum plant height (24.93, 49.27 and 78.40 cm), variety Kashi Shakti was recorded in highest number of primary branches per plant (1.73, 4.60 and 6.53) and highest number of leaves per plant (29.47, 52.33 and 55.47) at 30, 45 and 60 days after sowing over other varieties studied, variety Kashi Shakti had the highest number of node of first flowering (10.93). Flowering attributes *viz*., day to first flower appearance, day of 50% flowering and day of first picking. The result revealed that variety Pusa Shree had the noted minimum day first flower appearance (31.00 days), day of 50% flowering (41.03 days) and day of first picking (55.36 days).

Keywords: Pea **(*Pisum sativum* L.),** varieties, growth attributes, flowering attributes, number, plant height, flowering.

Rootstock-Induced Responses in Sweet Orange Scion *cv.* Pusa Sharad to NaCl Stress: Insights into Morphological and Photosystem Alterations

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There is a dearth of investigations on rootstock effects regarding how exposure to salinity stress enhances the tolerance of the scion cultivar in citrus. The impact of sodium chloride on sweet orange *cv*. Pusa

Sharad (PS) grafted on eleven different rootstocks *i.e.*, Jatti khatti (JK), X–639 (X9), CRH–12 (C12), NRCC–1 (N1), NRCC–2 (N2), NRCC–3 (N3), NRCC–4 (N4), NRCC–5 (N5), Troyer citrange (TC), CRH–47 (C47), and Cleopatra mandarin (CM) were evaluated at the nursery unit of Division of (F&HT), ICAR–IARI, New Delhi, from 2020 to April 2022. Upto 42 days, prior to onset of salt injury symptoms irrigation water containing 30 and 60 mM of sodium chloride (NaCl) was applied to scion/rootstock combinations in comparison to control (without NaCl). Under salinity stress, the PS scion grafted onto CM, X9, C47, N1, and N3 rootstocks exhibited the least reduction in the scion height, leaf area ratio, root to shoot ratio, total chlorophyll content, total carotenoid content, transpiration rate, photosynthesis rate, internal CO_2 concentration and stomatal conductance as compared to PS scions grafted onto JK, C12, N2, N4, N5, and TC rootstocks under 60 mM NaCl stress. PS scions grafted onto CM, C47, X9, N1, and N3 demonstrated greater NaCl tolerance compared to those grafted onto JK, C12, N2, N4, N5, and TC and hence recommended for areas having salinity level upto 60 mM. The outcome of the result suggest that specific rootstock can enhance salt-tolerance potential by increasing pigment content and strengthening the photosystem.

Keywords: Gas exchange parameters, NaCl, Salt damage index, Scion-rootstock combination

Genetic diversity of underutilized fruits in India for future development and environmental sustainability

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India is the center of origin for many fruit tree species, most of which are not commercially cultivated but provide a significant source of livelihood support for many rural and tribal communities. The tribal inhabitants of Western Ghats, Maharashtra, and North Eastern States of India were traditionally reliant on non-timber forest products and favoured local fruit species like tamarind (*Tamarindus indica*), jackfruit (*Artocarpus heterophyllus*), Indian gooseberry (*Emblica officinalis*), ber (*Zizyphus mauritiana*L.), etc., instead of arable food crops apart from mango and cashew, for establishing agri-horti for their livelihoods. Innumerable wild species of *Citrus, Musa, Pyrus*, and *Malus* was also prevalent in the North Eastern regions. Conversely, most of these species are in a state of neglect, while a trivial number of them are under cultivation in their native tracts by local communities for specific household uses only. These species were immensely constructive by surviving harsh agro-climatic conditions and can be established on degraded lands, which are presently being underutilized either due to poor soil fertility or moisture scarcity. Due to unsustainable market pressures and rapid urbanization, the majority of these species have come to near extinction. A holistic approach is hence proposed which includes both in-situ and ex-situ conservation strategies, as well as re-governance of the market chain. Reinforcement of their domestication through standardization of cultivation practices, facilitation for the supply of planting material, and increasing the demands for the produce by exploring their uses, creation of awareness among consumers, and establishing a good distribution network are also crucial for attaining sustainability.

Pollination management in date palm via time management, storage and usage of inert material

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The date palm (*Phoenix dactylifera* L.) is one of the world's oldest cultivated fruit crops. Its significance arises from the nutritional content of its fruit as well as its therapeutic characteristics. As a dioecious crop, one of the most significant challenges in date palm agriculture is pollination management, as natural pollination is extremely limited and unsuitable for commercial development. Because it is a palm tree with unsynchronized flowering, the grower must pollinate the tree on a regular basis. To address the difficulty, three sets of experiments were carried out at the Date Palm Research Station, SDAU, Mundra, to determine the ideal time of pollination (number of days after spathe opening), in the circumstance of pollen scarcity, the use of inert materials was investigated, and in the case of early female flower opening, the use of saved pollen from the previous season was evaluated. Based on the findings, it was recommended that female flowers be pollinated within 2-3 days of spathe opening, the talc powder be used as an adulterant (up to 1: 19:: pollen: talc powder), and additionally pollen can be stored at -4°C in an airtight glass bottle for a year. A combination of all three experiments assists date palm growers in managing pollination requirements.

Exploration of Genomic divergence in *Trichosanthes dioca* for morphological and biochemical attributes.

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A research endeavour took place at the ICAR-Research Complex for Eastern Region, Ranchi, Jharkhand, aiming to evaluate the genomic diversity of pointed gourd genotypes regarding fruit yield and quality traits. The primary goal was to pinpoint superior genotypes for future breeding initiatives. The study involved 46 unique pointed gourd genotypes organized in a Randomized Block Design (RBD) with three replications.

The data collected underwent thorough statistical analyses, encompassing genetic variability, analysis of variance (ANOVA), correlation coefficients, path analysis, exploration of genetic divergence, and biochemical characterization. The ANOVA results unveiled noteworthy variations across all 46 pointed gourd genotypes concerning both fruit yield and quality traits. Key attributes, such as the number of fruits per plant, harvest frequency, pulp seed ratio, and total phenol content, displayed significant positive correlations with total fruit yield (t/ha) at both genetic and observable levels. Particularly noteworthy was the positive direct effect of pulp weight on total fruit yield (t/ha), indicated by a coefficient of 0.99. The study identified total fruit yield (t/ha) as the primary contributor to the observed genetic diversity. Linear transformation produced seven principal components explaining a cumulative variation of 78.27 percent. To establish genotypic clusters, Tocher's method was employed, resulting in the grouping of the 46 genotypes into twelve distinct clusters based on squared D^2 values.

The study highlighted significant variability among pointed gourd genotypes, suggesting ample opportunities for selection-based improvement. Selection based on characteristics such as the number of fruits per plant, pulp weight, and pulp seed ratio is expected to significantly enhance yield. Noteworthy

genotypes, such as Swarna Alaukik, HAP-79, HAP-70 (for yield-related attributes), and HAP-106 (for quality traits), emerged as promising candidates. These promising genotypes hold potential for future breeding initiatives and are recommended for cultivation in the Eastern Plateau and Hill Region. This strategic cultivation aims to enhance the nutritional well-being of the local population in that area.

Key words: Pointed gourd, Genetic diversity, Fruit quality, Yield, HAP-79 and HAP-106

Evaluation of *Phalaenopsis* orchid for growth and yield under net house condition

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The research was conducted at the Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat. The experiment was laid out under 75% black net house in completely randomized design with ten different *Phalaenopsis* varieties *viz*., Benidorm, Piacenza, Pusan, Nottingham, Hong Kong, Nantes, Morelia, Bucharest, Cambridge and Montpellier and experiment was replicated thrice. Observations were recorded on vegetative and floral attributes. Initial plant height was found maximum in var. Hong Kong while var. Montpellier recorded significantly maximum plant height at 3rdmonth whereas, var. Nottingham recorded the tallest plants at 6th, 9thand 12thmonth. In terms of leaves, maximum number of leaves was recorded at the time of planting and throughout experiment by var. Nottingham. The plant spread was found maximum in var. Nottingham at initial, 6th, 9thand 12thmonth while var. Benidorm recorded maximum plant spread after 3 months of planting. With respect to flowering parameters, significantly early spike emergence was noted in var. Morelia and same variety recorded minimum days for first floret opening. Significantly maximum floret length was noted in var. Bucharest while, var. Benidorm recorded significantly maximum floret diameter. Significantly maximum spike length and rachis length were noted in var. Benidorm and Nottingham, respectively. Variety Nottingham recorded significantly maximum flower longevity, var. Benidorm produced maximum number of flowers per spike (8.53) while maximum number of spikes per plant was recorded in var. Nottingham (1.80). Moreover, var. Nottingham scored highest aesthetic value of plant *i.e.* 8.47 on the basis of 10-point hedonic scale and produced white coloured flowers followed by Cambridge (white) and Morelia (purple). Furthermore,characterization based on DUS guidelines was donefor 70 essential characters among which 45 were visually assessed, 19 were measured and 6 were both measured as well visually assessed, indicating their potential for varietal characterization and distinctiveness.

The response of various scion and rootstock grape (*Vitis spp*.) genotypes when exposed to artificially induced drought stress.

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Investigating grapevine responses to drought is crucial in viticulture, especially due to increasing water scarcity caused by climate changes and limitations in irrigation in wine-producing regions. This study,

conducted at the ICAR-Indian Agricultural Research Institute in New Delhi from 2021 to 2023, aimed to explore how seven grape scion and five rootstock genotypes reacted under well-watered (WW) and induced-drought (ID) conditions. Under the ID treatment, vine length notably decreased by 11.52% to 35.15% across most scion and rootstock genotypes. Notably, certain rootstocks such as *V. parviflora* (VP), 110R, and Male Hybrid (MH) exhibited better growth compared to scion varieties. Root length increased in response to ID, indicating the plant's adaptive response to seek moisture, especially evident in MH (40.86 cm), VP (39.84 cm), and Pusa Navrang (38.94 cm). Leaf count and average leaf area notably decreased under ID conditions, particularly in genotypes like Flame Seedless (28.50 & 19.07 cm^2, respectively). VP displayed the highest root: shoot ratio (0.79), while St. George showed a lower ratio (0.44) under drought stress. The ID treatment increased the chlorophyll a:b ratio, impacting chlorophyll degradation in various genotypes. There were significant variations in leaf iron (Fe) contents, crucial for chlorophyll function and formation.

Principal component analysis (PCA) underscored the influence of traits on genotypes, indicating VP, MH, and Pusa Navrang as top drought-tolerant genotypes among rootstocks and scion. Genotype clustering revealed distinct groupings of four clusters, while correlation analysis unveiled complex connections between traits, emphasizing the intricate way grapevines respond to water stress. This underscores the need for further research into strategies for enhancing drought resilience in grapevines.

Keywords: Well-watered, Drought-induced, Principal component analysis, Clustering.

Multivariate analysis for various agro-morphological traits of Brinjal (*Solanum melongena* L.)

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(*Solanum melongena* L) often known as brinjal, is a highly significant vegetable that is a member of the Solanaceae family and has chromosome number 2n=2x=24. It has key nutrients in it, the current study was conducted at the Department of Vegetable Science, College of Horticulture, Yelachenahalli, Mysuru district, Karnataka, using 29 genotypes and 17 different traits were observed with two replications and RCBD design used to set up the experiment. The results from the analysis of variance for characters indicated that there are highly significant differences among 29 genotypes, PCA contributed over 84.49% variation in studied traits viz,. PC1, PC2, PC3and PC4, PC5, PC6 exhibited 30.45%, 16.35%, 14.17%and9.75%, 8.24%, 5.53% respectively. The result of PCA analysis indicated the maximum PC score for the following genotypes., Dinka local, Green long, Green long cluster, White brinjal, Hebbettu Badane, Arka Harshitha for both yield and other morphological traits. And A heatmap analysis illustrated the genetic connections between eggplants. The diagonal, which runs from bright pink to dark pink, represents the ideal relationship between each addition and itself. The light green to yellow hues on the diagonal indicate genotype clusters that are tightly related to each other, whereas light green to dark green hues on the diagonal indicate genotypes that are not strongly related to each other or that are imperfect with themselves. Cluster analysis revealed that among the four clusters, most divergent clusters with distinct genotypes such as Udupi gulla, Dinka local, Musuku, Purple Light, Gomuka were unique in size and shape and also has significant role increase in yield so the genotypes from the diverse clusters having superior performance for desirable traits could be selected for as parents in hybridization.

Key words : Multivariate analysis, principal component analysis, Heat map clustering.

Variability Studies in Nut and Kernel Characters of Walnut (*Juglans regia* L.) germplasm of diverse origin

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The present investigations was carried out in the Laboratory of Division of Fruit Science, SKUAST-Kashmir, Shalimar Campus, Srinagar (Jammu and Kashmir) during 2022 with the collected samples of walnut grown at DARS, SKUAST-Kashmir, Budgam (J & K). Twenty five nuts from each sample were taken and all the nut and kernel parameters were studied. On the basis of studied parameters characters maximum nut weight (17.63 g), nut length (45.88 mm), nut width (34.02 mm), kernel weight (7.13 g), kernel width (26.19 mm) and kernel length (36.57 mm) was recorded in BWG-16 genotype whereas maximum kernel percentage (63.36 %) was observed in KWG-10 genotype. The nut yield among the studied genotypes varied from 46.50 kg/tree (BWG-36) to 87.50 kg/tree (AWG-08). Nut shape varied from round, broadly ovate, ovate, broad elliptic to elliptic whereas ease of kernel removing varies between very easy, easy, intermediate, difficult to very difficult. Kernel colour varies from very light, light, light amber, amber to brown. A great extent of variability was also noticed for all the studied parameters and among studied genotypes, BWG-16, KWG-10, BWG-36 and AWG-08 walnut genotypes produced nuts and kernels of superior quality which can be used as future variety to boost walnut cultivation in Kashmir valley.

Status and prospects of cultivation of Garcinia species in India

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Genus Garcinia is one of the important genera of fruiting plants belonging to the family Clusiaceae. It includes about 200 species found in tropical Asia and Africa. Thirty-five species of Garcinia are found in India. Out of these, 17 species are endemic. Of these, seven are endemic to the Western Ghats, six in the Andaman and Nicobar Islands, and four in the northeastern region of India. Several species of this genus have traditionally been used by the natives of Asia and Africa in their day-to-day lives. The trees provide spice, fruit, medicine, cooking butter, color, and polishing agents. The fruits of Garcinia species are used for edible purposes or medicinal purposes. In the 'Malabar' and 'Konkan' regions of India, the fruits are used in garnishing curries as a replacement for tamarind. In North Eastern India, the sun-dried slices of the fruits are used for culinary purposes. The fruits of the genus contain p-hydroxycitric acid, which has an inhibitory effect on lipogenesis and helps in controlling obesity in human beings. Garcinia possesses anti-cancer and antioxidant properties or can be used as biopreservatives. The commercially important species of this genus in India are mangosteen (Garcinia mangostana), Kokum (Garcinia indica), Malabar tamarind (Garcinia gummi-gutta), and yellow mangosteen (Garcinia xanthochymus). Garcinia grows extensively in a semi-wild state in the 'Konkan' region of Maharashtra, Goa, coastal areas of Karnataka and Kerala, evergreen forests of Assam, Khasi, Jantia hills, West Bengal, Odisha, and Gujarat. A lot of variability was observed in terms of vegetative, floral, fruiting, and biochemical characters, and some collections were made at different research centers. Two improved kokum varieties, namely Konkan Amruta and Konkan Hati, have been released by Dr. BSKKV, Dapoli. Few promising lines of Kokum have been identified by CHES (IIHR), Chettalli, and IIHR, Bengaluru. Few promising lines of G. gummi-gutta have been identified at NBPGRRS, Thrissur; IISR,

Calicut; and CHES, Chettalli. The variability in Mangosteen and yellow mangosteen is less as compared to other Garcinia species; however, some collections of mangosteen and yellow mangosteen have been made at CHES, Chettalli, and IIHR, Bangalore. The agro techniques for kokum and mangosteen have been standardized, and these are commercially grown in some parts of Maharashtra, Kerala, and Karnataka, but cultivation of Malabar tamarind, yellow mangosteen, and other species is limited to kitchen gardens. Most of the fruits are gathered from forests and sold in the market. Garcinia fruit, except mangosteen, is not used for table purposes. These fruits are processed to prepare several products such as kokum syrup, salted kokum syrup, rind flakes, dried rind powder, oil, seed butter, which are popular in the market. The seed oil is used to prepare a solid, stable hard butter which is used in cosmetics, bar soaps, and skin lotions. Several anti-obesity products of Garcinia, such as powder, concentrates, juice, tablets, are available in the market, and these are also exported. The area of Garcinia is rapidly growing in Maharashtra, Karnataka, Goa, Kerala, Tamil Nadu, and North Eastern States, etc., of the country. The seminars, workshops, field days, awareness programs, demonstrations, etc., conducted by BSSKVV, Dapoli, ICAR-IIHR, Bangalore, NBPGRRS, Thrissur, CCARI, Goa, etc., during the last two decades played a vital role in popularizing Garcinia in the country. Visualizing the demand and rising popularity of Garcinia in the pharmaceutical industry at domestic and international levels, there is a good scope for Garcinia cultivation in India. There is a need to provide suitable technological backup to fulfill the requirements of growers, the processing industry, and consumers.

Ex situ conservation of temperate berry crops at ICAR-NBPGR

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India is bestowed with different climatic conditions conducive for the production of wide range of fruit crops. The vast genetic diversity of temperate fruits occurs in the North Western Himalayan region, the North Eastern Himalayas and the Nilgiri hill area. Indian Himalayas harbour rich diversity of native temperate fruits including berry crops such as *Rubus, Ribes, Vitis, Morus, Actinidia* etc. in the wild. These fruits are rich in various phytochemicals with antioxidant and anti-inflammatory properties. Temperate berries are rich in antioxidants, vitamins and are good for health. These crops are vegetatively propagated and e*x situ* conservation of germplasm is important for crop improvement. Therefore, the germplasm of berry crops, augmented from wild or introduced from another county (exotic) are mainly conserved in the field genebanks of ICAR-NBPGR. Besides, germplasm of strawberry, blueberry, blackberry and mulberry are being conserved under *in vitro* conditions at the state of art facility at *In Vitro* Genebank at ICAR-NBPGR, New Delhi. For long-term conservation, vitrification-based cryo-techniques were used to cryopreserve the *invitro*-grown shoot tips. Some of the *in vitro* conserved accessions were found promising when evaluated for their performance in the field. The present paper describes the present status and future prospects of berry crops in India.

Topic-Spectral Characterization of Healthy and Malformed Panicles of Mango (Mangifera *indica* L.) Under Variable Photon Flux Density

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Malformation, a physiological disorder affecting mango growth and development is subjected to various environmental influences, contributing to diversity in susceptibility. The present investigation entitled "Spectral Characterization of Healthy and Malformed Panicles of Mango (Mangifera *indica* L.) Under Variable Photon Flux Density" was carried out at Fruit Research Station, Imaliya, in the Department of

Horticulture (Fruit science), College of Agriculture, JNKVV, Jabalpur, (M.P.) during 2022-23. The research was laid out in Asymmetrical Factorial Randomized Block Design (FRBD). Four trees from each variety were selected randomly with healthy and malformed panicle in each direction and replicated thrice. Total 32 panicles from each variety i.e., 96 panicles were tagged and characterised their spectral signatures in over 25 Indices with respect to varietal and directional influence.Spectral reflectance significantly discriminates malformed panicles in all directions. The highest spectral reflectance at visible wavelength was observed for healthy panicles in all directions except the North. Healthy panicles exhibited maximum spectral wavelength at near-infrared wavelength in the directions south, east and west. The spectral characterisation differentiated healthy and malformed panicles of mango using spectral reflectance data revealed the potential of hyperspectral remote sensing to discriminate them. All the indices derived from hyperspectral reflectance were very promising where SIPI, SPVI, NDVI, OSAVI, NPCI, VOG and VOG2 can be used to differentiate the malformed panicles from heathy once.

"Breeding for cold tolerance in ornamental crops"

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Abiotic stresses pose significant challenges to the floriculture sector, impacting flower growers globally. These stresses, including drought, salinity, heat, and cold stress, represent formidable constraints on crop growth and productivity. Cold stress, induced by low temperatures, is particularly detrimental, with chilling (temperature >0 °C to <10-15 °C) and freezing (temperature < 0 °C) conditions exacerbating the challenge. Addressing cold stress requires innovative breeding methods. Introduction and Selection, Wide distant hybridization, and Interspecific and intergeneric hybridization stand out as foundational strategies to enhance cold tolerance. Biotechnological methods, notably Genetic engineering, play a crucial role in this endeavor. Recent studies have seen a paradigm shift in breeding approaches. Genetic engineering, full genome profiling/sequencing, and mutational and transgenic plant analyses, along with transcriptome sequencing, have emerged as powerful tools. These techniques provide insights into gene expression levels and molecular mechanisms operating under cold stress, offering a nuanced understanding of the complex transcriptional processes. The integration of gene editing into ornamental crop breeding programs offers a transformative path forward. This approach not only improves cold resilience but also enhances overall productivity by overcoming the limitations of traditional breeding methods. The targeted and efficient nature of gene editing facilitates the creation of novel ornamental varieties with improved cold tolerance and aesthetic characteristics. As a stepping stone for future research, these advancements promise to shape the floriculture industry, fostering the development of resilient and visually appealing ornamental crops capable of thriving in diverse environmental conditions.

Innovative Biotechnological Strategies for Addressing Challenges in Onion Cultivation

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Biotechnological tools like micropropagation, transgenic development, genomics, and molecular markers are pivotal for enhancing crop traits. However, onion's biennial nature, complex breeding, and unique traits pose challenges. The extended crop duration, cross-pollination, and large genome hinder traditional breeding.

Developing a in vivo method for haploid induction technology provides an opportunity to implement the double haploid technology and enables the transfer of traits such as male sterility in a single step. The combining of in vivo haploid induction technology with genome editing technology, aim to transfer traits in a single step across genotypes, thus reducing the time taken for trait transfer. Epigenetics i.e. modifications in DNA sequence viz., DNA methylation, chromatin modulation, imprinting, and siRNA induced changes can also alter gene expression and phenotype helps in traits improvement. These approaches aim to create variability for economically relevant traits while ensuring stability across generations.

Keywords: Onion, double haploid, epigenetics

Yield loss assessment due to early blight and common scab in cold arid region of Ladakh

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Ladakh, a cold arid region situated in the northern part of India is characterised by low annual precipitation (rainfall/snow), prolonged subzero temperature up to -30 ° C and low humidity. Owing to its different geographical and climatic conditions, vegetation is confined to 5-6 months. During winter, the region remains landlocked from the other parts of the world resulting in inconsistent availability of fresh vegetable. Potato is one of the main cash crops widely grown in the region. It is also a major crop consumed by the local populace as well as by the army deployed there as compared to other vegetables throughout the season. The crop is susceptible to many fungal, bacterial, nematode,and viral diseases which causes significant yield loss in the field.Incidences of several pathogens in potato causing several diseases have also been reported in Ladakh in earlier studies. These diseases pose a major threat to potato production raising a concern about biosecurity and food security in the region. Among these diseases, early blight is a fungal disease in potato caused by *Alternaria solani* which affects its foliage leading to leaf necrosis and premature defoliation. The disease is a major constraint in potato productivity as it greatly affects its yield. Common scab is a bacterial disease caused by *Streptomyces scabies*. The disease cause lesions on the tuber surface and significantly affect its appearance, thereby greatly reducing its marketable yield. In view of the above, a survey was carried out in 5 major potato producing villages in Ladakh. The study estimatedyield loss due to early blight in Nang and Saspol villages and at DIHAR, Leh Ladakh, and yield loss /marketability loss due to common scab in Saboo, Stakmo and Gangles villages of Ladakh for the year 2019 and 2020. The results indicated an average yield loss of 30 % in Nang, 23 % in Saspol, and 25 % at DIHAR Leh due to early blight. For common scab,an average yield loss of 22 % in Saboo village, 35 % in Stakmo village and 4 % yield loss in Gangles village in Ladakh was observed.The effect of these diseases on crop yield /marketable yield is acause of major concern especially in cold arid region of Ladakh, where human population relies heavily on crop diversity for their daily livelihood. This study provides fundamental data on yield loss caused by early blight and common scab of potato, offeringinsights for effective disease management.

Keywords: Ladakh, potato, early blight, common scab, yield loss

Development of sex linked markers in Palmyra palm (*Borassus flabillifer*)for early stage identification of sex specific planting stock.

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Palmyrah is a dioecious palm with the great majority of its economic products such as sweet sap from the inflorescence, palm sugar, brush fibre and wood are obtained irrespective of whether the palms are male or female. The palms are slow-growing perennials and have no distinguishing features to identify the sex until flowering. The palm commences flowering only after 12 to 15 years of maturity. On account of the dioecious nature and long juvenile period, farmers have hesitated in planting this multipurpose tree. Breeding and crop improvement would be highly facilitated if sex could be determined at the seedling stage itself. This would help farmers while selecting the seedlings and maintain an optimum sex ratio at plantation. Molecular markers can be utilized to diagnose and select a genotype based on linked DNA markers, long before the phenotype is apparent. This is particularly important in Palmyra palm, which has a long juvenile period. So in the present project effort made for the identification sex linked marker which would facilitate the farmers of Gujarat to identify female plant at seedling age. Genomic DNA extracted from the male and female palms subjected to PCR. An amplification of 620 bp approx. band specific to male palmyra palm was obtained. Whereas, in female it was not amplified at all. The male specific amplicon was subjected to cloning in to TA vector and total two primer pairs for male specific SCAR markers have been identified. Among them scar Marker-1 NAUmaleTADSCAR_Borassus_MT090644_25_26 has efficiently amplified the male specific 620 bp band, whereas, it was absent in female. Present finding will be beneficial to the tribal farmers for maintaining the ratio of male and female palm in their orchards.

Enhancing GABA levels in Tomatoes: Using CRISPER-Cas9 Genome Editing Technology

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GABA-enriched tomatoes are a result of genetic modification using CRISPR-Cas9 technology to enhance their nutritional profile. The ɣ-aminobutyric acid (GABA) is a non-proteinogenic amino acid, which is widely found in bacteria, animals, and plants. Several studies in humans and experimental animals have shown that the administration of exogenous GABA is effective in lowering the blood pressure of hypertensive patients but not of normotensive ones. These genetically modified tomatoes are engineered to have higher levels of GABA, potentially offering consumers a more nutritious and health-promoting option. GABA functions as a neurotransmitter in humans, aiding in regulating brain activity and promoting relaxation by blocking certain signals in the brain. When incorporated into tomatoes, increased GABA levels could potentially enhance the fruit's nutritional value and offer added health benefits. The use of CRISPR-Cas9 technology allows for precise genetic modifications, targeting specific genes responsible for GABA production in tomatoes without introducing genes from other species. This technology enables scientists to manipulate the plant's DNA more efficiently and with greater accuracy compared to traditional breeding methods. GABA tomatoes could potentially offer consumers a novel way to access increased levels of GABA in their diets naturally. However, it's essential to note that the introduction of genetically modified organisms (GMOs) into the food supply often raises discussions about safety, regulation, and ethical considerations, which remain important aspects of this technology's development and acceptance in agriculture and food production. Genome-edited food made with CRISPR–Cas9 technology is being sold on the open market for

the first time. Since September, the Sicilian Rouge tomatoes, which are genetically edited to contain high amounts of γ-aminobutyric acid (GABA), have been sold directly to consumers in Japan by Tokyo-based Sanatech Seed. The company claims oral intake of GABA can help support lower blood pressure and promote relaxation.

Keywords: CRISPER, Tomato's, GABA, Blood pressure, and Cas-9

Year around Flowering Strategy for *Jasminum sambac* L.

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The present research work entitled „Year around flowering strategy for *Jasminum sambac* L" was carried out at Floriculture Research Farm, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. It was conducted using various treatments including foliar application of stimulants like $FeSO_4$ (0.5 %), $ZnSO_4$ (0.5 %) and *Panchgavya* (1%) along with the tip pruning in the month of June. Among the vegetative parameters (viz., plant height and leaf area) there was no significant difference was observed among various treatments. Whereas, in case of the flower quality (viz., flower bud diameter, flower size fully open, flower bud size and weight of 100 flower buds) and yield parameters were significantly influenced by treatment T_7 – $FeSO_4$ (0.5%) + $ZnSO_4$ (0.5%) twice after pruning + tip pruning in June + $FeSO_4$ (0.5%) + $ZnSO_4$ (0.5%) twice after tip pruning.

Genetic Evaluation of Genotypes of Leaf Lettuce for Yield and Quality traits in Solan District of Himachal Pradesh

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Lettuce is one of the major leafy vegetables used in salads, soups and occasionally lightly cooked. Lettuce leaves exude milk like sap when cut hence, its name has been derived from the latin word *lactuca* meaning 'milk'.The well being advancing properties of lettuce have been credited to minerals, nutrients like B_9, C and E and polyphenols like carotenoids, phenolic acids and flavnoids. Its high substance of phytonutrients is combined with low dietary fats which make lettuce an alluring low calorie food. Because of developing chain of the travel industry in Himachal Pradesh, leaf lettuce cultivation has been increasing at a higher pace. There is an earnest need to examine the inconstancy in lettuce to recognize explicit genotype specifically for Solan district of Himachal Pradesh. The success of every breeding programme depends upon the extent of genetic variability in the germplasm and the association of quantitative traits with yield and amongst themselves. The present investigation was carried out on twenty two diverse genotypes of leaf lettuce including standard check cultivar Solan Kriti. The experiment was laid out in a Randomised Complete Block Design (RCBD) with three replications at the Experimental Farm of KVK, Kandaghat to ascertain the mean performance, extent of variability, correlation and path coefficient analysis in leaf lettuce for yield and other horticultural traits among the genotypes. The observations were recorded on days to marketable maturity, fresh leaf weight, leaf length, leaf breadth, plant height, plant spread, leaf area, dry leaf weight, yield per plant, calcium content, β carotene content, iron content and 1000 seed weight. Various other morphological parameters were also evaluated viz., leaf taste, leaf shape, leaf colour, leaf texture and leaf blistering. The results concluded that genotypes viz., KGT-1, KGT-5, Lettuce C1, LS-2 Selection-3 and Lettuce Gentilina performed better in terms of yield and other horticultural traits as compared to check genotype i.e Solan Kriti. Maximum Iron content and β-carotene content was also recorded in genotype, KGT-1. Therefore, these genotype offer an ample scope for the release in the mid hill conditions of Himachal Pradesh after rigorous multilocational testing.

Morphological characterization of grape genotypes from Himachal Pradesh

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For the 1st time, an exhaustive survey for collection, documentation, geotagging and characterization of grape genotypes was conducted in Kinnaur and Solan districts of Himachal Pradesh. The surveys were conducted in the areas spread between 30.840908 to 31.764121 °N (latitudes); 77.062697 to 78.593155 °E (longitudes); and 1188 to 2822 msl (altitudes) to collect 163 grape genotypes.For morphological characterization, 24 OIV descriptors were used to develop an ampelographic database of collected genotypes from Himachal Pradesh. Among them 17 were qualitative descriptors and 7 were quantitative descriptors.The first five axes of the PCA plot explained 56.67% of the total morphological variation in the population. Phylogenic analysis separated all genotypes into two major clusters A and B having 65 and 98 genotypes, respectively. Both these clusters included genotypes from Kinnaur and Solan districts indicating that, there was no association of genetic diversity with geographic distribution and there might have been exchange of planting material among farmers of these two districts. Biochemical analysis was also conducted in 53 grape genotypes for 9 biochemical parameters. Anthocyanin, phenols and tannins were observed to be more in wild genotypes followed by genotypes having coloured berry skin and flesh. Biochemical evaluations of different genotypes from different elevations indicated low to significant +ve correlations between elevation, TSS, TA, carbohydrates, reducing sugars and phenols.

Guava (*Psidium guajava* L.) improvement for pulp colour

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Fruit colour not only increases the consumer acceptance but it also increases the nutritive value and processing value. Guava (*Psidium guajava* L.) being the third richest source of vitamin C, also contains fibre, and other minerals like Ca, Fe etc. This super fruit is available in different pulp colour, most commonly white and pink/red. But, other pulp colours like yellow and purple are also available. The guava improvement work for pulp colour involved hybridization between guava parents having white, pink, red, purple pulp colour. This resulted in F_1population having different types and/or shades of pulp colour. The study has shown that pulp colour is under polygene control. It also resulted in the knowledge about responsible pigment for different pulp colours. 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.

Key words: Anthocyanins, guava, lycopene, pigment, pulp colour.

Nutritional profiling of mango cultivars for the processing industries

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Mango is known to be an excellent source of dietary fiber, vitamin C, ß-carotene and phenolic compounds, and many studies have been conducted on the potential nutritional and health-effects of mangoes. Mango pulp has been reported to have antilithiatic and free radical scavenging properties, which reduce lipid peroxidation and enhance antioxidant enzymes against isoproterenol. Mango peel extracts have been reported to show strong antioxidant activity. There are also reports about the antioxidant activity of mango flesh and seed. Hence, varieties of mango should be investigated for feasibility of use. In this study, different fruit parts, namely peel, pulp and seed kernel of fully ripe mango were chosen.A study on "Phytochemical screening and determination of antioxidant activity of different mango cultivars" was laid out in CRDcomprising of four varieties as treatments *viz*. Kesar, Totapuri, Rajapuri and Langra during the year 2021-2022 at ACH, NAU, Navsari. The treatments were repeated for five times. The result revealed that total polyphenol content (mg/100 g FW) reported maximum in pulp and peel of Langra and kernel of Rajapuri. Total flavonoid (mg rutin equivalent (QR Equiv)/g FW) and Ascorbic acid (mg/100 mL) observed maximum in pulp and peel of Langra and kernel of Kesar. DPPH scavenging activity (%) and Ferric-reducing capability (µg/g) and ABTS scavenging activity (%)in Langra pulp, peel and kernel. The Langra variety found to have more antioxidant capacity among the selected cultivars. The study can encourage the mango industry to not only use mango pulp but peel and kernel also.

Correlation studies between yield and its component traits in amaranthus genotypes

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For amaranthus to be considered to fulfil the consumer needs it should be high yielding for its both useful forms *viz*., leaf and grains. Bypassing the ambiguity of separate selection for grain and green genotypes, the remedy is to have the high yielding dual purpose lines. So, understanding of relation between yield and component traits is prerequisite. Eighteen diverse amaranthus genotypes collected across various sources were evaluated for correlation between yield (grain and leaf) and their component traits. Association of grain yield with plant height(cm), number of nodes/plant, inter-nodal length(cm), days to 50% flowering, inflorescence length(cm), inflorescence weight(gm) and days to grain harvest, and leaf yield with that of plant height(cm), stem thickness(mm), number of leaves/plant, leaf weight/plant(gm), stem weight/plant(gm), leaf: stem and days to vegetative maturity were elucidated. Results spotlighted that leaf yield per plant had positive and significant correlation with stem weight/plant, leaf: stem, plant height and days to vegetative maturity. Grain yield had positive significant correlation with inflorescence weight, inter-nodal length and non-significant negative correlation with the inflorescence length, days to harvest and days to 50% flowering. Concluding, selection of amaranthus genotypes for improvement of dual purpose lines should concentrate on direct selection of genotypes with good stem weight/plant, leaf: stem, plant height and days to vegetative maturity for increased leaf yield and for grain yield the selection pressure should be towards inflorescence weight and inter-nodal length, and also negative selection should be put forth on inflorescence length, days to harvest and days to 50% cent flowering.

Tamarind : A hidden treasure of underutilized fruits for tribal community of India

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Tamarindus indica is a multipurpose tree of which almost every part finds at least some use either nutritional or medicinal. It contains invert sugar, citric acid, oleic acid, linoleic acid, volatile oils, pipecolic acid, lupeol, orientin, vitamin B_3, vitamin C, vitexin, phenylalanine, leucine, potassium, campesterol, β-amyrin, β-sitosterol, tannins, saponins and glycosides. Fruit pulp is used for seasoningas a food component, to flavor confections, curries and sauces and it is also used as a main component in making of juice and beverage. The major industrial product of tamarind seed is the tamarind kernel powder which is an important sizing material used in the textile, paper and jute industries. Seed is also the raw material used in the manufacture of polysaccharide (jellose) and adhesive and tannin. Tamarind leaves and flowers can be eaten as vegetables and are prepared in a variety of dishes. They are used to make curries, salads, stews and soups in many countries, especially in times of scarcity. Tamarind wood also used for manufacturing of handles and agricultural tools (Kadlang*et al*., 2016**).** Traditionally, tamarind plant use as a source of drug form ancient time. In medicine, it is used as abdominal pain, diarrhoea, laxative, vomiting, diabetes, infertility, cold, fever, leprosy, malaria, bronchitis, appetizing and healing *etc*. (Shaikh *et al*., 2017). These effects are probably due to the presence of polyphenols as n-Hexacosane, eicosanoic acid, b-sitosterol, octacosanylferulate, 21-oxobehenic acid and pinitol and phenolic antioxidants for proanthocyanidins (Menezes *et al*., 2016). Various bioactive compounds present in the fruit, its various parts, as roots, wood, bark and leaves, possess nutritional and pharmaceutical properties.

Keywords: Underutilized fruit, Nutritional value, Fruit pulp, polysaccharide and Soups.

Phenotypic stability analysis in brinjal (***Solanum*** *melongena* L.)

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Eggplant (*Solanum melongena* L), also known as aubergine or brinjal, is a member of the family Solanaceae. It is one of the few cultivated solanaceous species originating from the old world and an important vegetable in central, southern and south-east Asia, and in a number of African countries. Exploitation of hybrid vigour is complex genetical phenomenon depending on balance of additive and dominance gene action in parental line. In breeding programme, it is necessary to screen and develop stable genotypes which perform more or less uniform under varying environmental conditions. Thus, knowledge of Genotype x Environmental interactions helps the breeder to select high yielding and more adaptable varieties or hybrids. The present investigation was carried out for stability analysis utilizing eight parents including check and twenty eight hybrids were developed through half diallel mating design. Total thirty six genotypes were evaluated in Randomized Block Design with three replications at three different locations *viz*., College Farm, N. M. College of Agriculture, NAU, Navsari (L1), Hill Millet Research Station, Waghai (L2) and Wheat Research Station, Bardoli (L3) during the year *Rabi* 2021-22. Observations were recorded for fifteen different characters related to yield, quality and pest-disease incidence for this study. Analysis of variance over the locations exhibited the significance of genotype × environment interaction against pooled error for all the characters except fruit length, fruit weight, fruit diameter and fruit yield per plant which revealed that

genotypes interacted differently with environmental variations and provide an opportunity for selecting stable genotypes. None of the genotype exhibited average stability for all the traits under study. Stability analysis revealed that parent GJB 3 was average stable for branches per plant, while the hybrids, NB-20-4 × NB-20-9 and NB-20-1 × NB-20-9 were average stable for flowers per plant and total phenol content, respectively.

Key words: Stability, Half diallel, Fruit yield, Brinjal

Combining ability studies for fruit yield and its attributing traits over locations in brinjal (*Solanum melongena* L.)

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Among the vegetables, brinjal (*Solanum melongena* L.) is important *solanaceous* vegetable crop in many countries, particularly India, Japan, Indonesia, China, Bulgaria, Italy, France, USA and several African countries. Consumers of south Gujarat region prefer purple, round-oval shape, spineless, medium size fruits and long cylindrical large size fruits depending upon its use. The local varieties like "Surati Ravaiya" (round oval) and "Bilimora Bharatha" (long cylindrical) suffer from low yield and susceptibility to diseases and pests. The local genotype and "Bilimora Bharatha" specially used for a food recipe which is popular in South Gujarat region called as "Bharatha". So, our basic idea is to develop hybrids/ varieties resemble to "Bharatha type" with good yield as well as quality also. Knowledge of combining ability is essential for selection of desirable parents for hybridization and identification of promising hybrids through general combining ability and specific combining ability studies, respectively. Information regarding combining ability and types of gene action determines the transmission of various economically relevant quantitative traits which helps to operate the breeding techniques for genetic improvement of such traits. The present investigation was undertaken using eight diverse parents were crossed in a half diallel fashion to obtain 28 hybrids to appraisal of combing ability in brinjal. Analysis of variance for combining ability revealed highly significant differences for mean square of GCA and SCA for all studied characters except days to 50 % flowering indicating that both additive and non additive gene action were important for inheritance of these characters. The ratio of $\sigma 2$ gca/$\sigma 2$ sca was lower than unity for all the traits except days to 50 % flowering indicate the pre dominant role of non additive gene action. The GCA effect showed that the parents viz., NB-20-7 and GJB 3 observed as good general combiner for fruit yield per plant while for the SCA effect, hybrids viz., NB-20- 3 × NB-20-8 at Navsari (L1), NB-20-3 × GJB 3 at Waghai (L2) and NB-20-4 × NB-20-9 at Bardoli (L3) act as good specific combiner for fruit yield per plant.

Keywords: Combing ability, GCA, SCA, Half diallel, Fruit yield

Estimation of standard heterosis for fruit yield and its component traits over locations in brinjal (*Solanum melongena*L.)

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Brinjal (*Solanum melongena* L., 2n = 2x = 24) belong to family solanaceae; prominent and widely known vegetable crop in India. As we know that brinjal continues to be a choice of breeders for exploitation of heterosis due to hardy nature of crop, large size of flowers and large number of seeds per cross. Consumers of south Gujarat region prefer purple, round-oval shape, spineless, medium size fruits and long cylindrical large

size fruits depending upon its use. The local varieties like "Surati Ravaiya" (round oval) and "Bilimora Bharatha" (long cylindrical) suffer from low yield and susceptibility to diseases and pests. The local genotype and "Bilimora Bharatha" specially used for a food recipe which is popular in South Gujarat region called as "Bharatha". So, our basic idea is to develop hybrids/ varieties resemble to "Bharatha type" with good yield as well as quality also. The present investigation was carried out to estimate standard heterosis utilizing eight parents including check and twenty eight hybrids were developed through half diallel mating design. Total thirty six genotypes were evaluated in Randomized Block Design with three replications at three different locations during the year Rabi 2021-22. Observations were recorded for fifteen different characters related to yield, quality and pest-disease incidence for this study. The range of standard heterosis for fruit yield per plant was -14.77 to 26.14 %at Navsari (L1), -24.18 % to 23.08 % at Waghai (L2) and -22.73 to 14.77 % at Bardoli (L3).None of the hybrid exhibited positive and significant standard heterosis over all locations. Among total twenty eight hybrids; some top hybrids viz., NB-20-7 × GJB 3 and NB-20-4 ×GJB3atNavsari(L1),NB-20-1×NB-20-7andNB-20-3×GJB3atWaghai(L2),NB-20-7× GJB3,NB-20-4×NB-20-9atBardoli(L3)exhibited positive and significant standard heterosis for fruit yield per plant with yield contributing traits.

Keywords: Heterosis, Half diallel, Fruit yield, Environment, Brinjal

Study of inheritance pattern of Yellow Vein Mosaic Virus (YVMV) resistance in okra

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Okra [*Abelmoschusesculentus*(L.) Moench], is an important vegetable crop grown throughout the tropical and sub-tropical regions and also in the warmer parts of the temperate region, but largely in Asian and African countries. It is a very common vegetable in India and popular among all classes of people. Commercial cultivation of okra is threatened in the tropics and subtropics due to biotic stresses *viz.,* Yellow Vein Mosaic Virus and Enation Leaf Curl virus. Among which; yellow vein mosaic virus (YVMV) disease loss the fruit yield drastically in okra in tropical and sub-tropical regions. The inheritance pattern of YVMV disease tolerance is very confusing. Therefore, an experiment was under taken in rainy season of 2022 to estimate the gene action involved in inheritance of resistance to Yellow Vein Mosaic Virus (YVMV) disease in okra. Based on screening of 24 advanced breeding lines, two resistant (NOL 17-05 and NOL 19-08) and two susceptible (NOL 21-56 and NOL 21-84) lines were identified for this study. The inheritance pattern of okra was studied using six generations (P_1, P_2, F_1, F_2, BC_1 and BC_2) of four selected crosses (NOL 17-05 x NOL 21-56; NOL 17-05 x NOL 21-84; NOL 19-08 x NOL 21-84 and NOL 19-08 x NOL 21-84). Qualitative genetic analysis was done in segregating generations for all the four crosses under study indicate the genetic control of YVMV resistance in both parental lines governed by single dominant genes.The significance of scaling test and joint scaling test also revealed the presence of digenic gene interaction for days to first appearance of YVMV which involved both additive and non-additive gene action. Thus, the present study confirmed the role of genetic architecture of the parents for resistance reaction.

Key words: Okra, YVMV, ELCV

Demonstration of released coconut varieties under South Gujarat condition

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The field experiment entitled "Demonstration of released coconut varieties under South Gujarat

condition" was planted during the year 2013-14 with spacing of 7.5m x 7.5m as an un-replicated trial having ten different release varieties and hybrids i.e. Konkan Bhatye Coconut Hybrid-1, Kera Keralam, Kera Baster, Kalpa Raksha, Kalpa Dhenu, Kalpa Mitra, Kalpa Pratibha, Gautami Ganga, Kalyani Coconut-1, KalpaSamrudhiat Regional Horticultural Research Station, ASPEE College of Horticulture, Navsari Agricultural University, Navsari (Gujarat). The results obtained on growth and yield performances as well as insect-pest incidence of released varieties/hybrids are revealed that, maximum stem/trunk height (5.26 m), annual leaf production (11.00 numbers), total numbers of leaves on crown (33.67 numbers), inflorescence per annum (11.00 numbers), maximum number of female flowers (240.00), fruit setting (29.48 %) with nut yield/palm/year (70.67 nuts) were noted in KalpaDhenu. Moreover, the maximum stem girth (163.33 cm) and leaf length (514.67 cm) with petiole length (129.00 cm) was measured in Kalyani coconut-1 and KalpaPratibha, respectively. Looking to the flowering characters, KalpaSamrudhi flowered at the age of 40th month after planting. Regarding fruit and copra characteristics, heaviest nut (1525.00 g), husked fruit weight (771.00 g) kernel thickness (1.20 cm), copra content (186.67 g) and copra yield (10.46 kg/palm) was recorded maximum in KalpaPratibha, Gautami Ganga, Kalyani Coconut-1, Kera Baster, KalpaMitra and KeraKeralam, respectively. The maximum weight of husk (210.00 g) with minimum per cent husk weight (23.37 %) was recorded in KalpaPratibha and KalpaDhanu, respectively. In relation to reaction of biotic stresses, 2-3.30%, 6-7% and 14-20% palms of all genotypes are infected by rhinoceros beetle, BHC and eriophyid mite, respectively. Moreover, minimum incidence (4.60 %) and intensity (5.25 %) of RSW was observed in KalpaDhenu as compared to rest of varieties/hybrids.

Key words: Biotic, coconut, hybrids, growth and yield.

Counting on crossovers: Controlled recombination for crop improvement

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Plant breeders rely on natural recombination of genetic information during COs to generate novel and favorable haplotypes. A minimum of one CO for each chromosome pair, termed the obligate CO, is required for proper segregation, and three COs are rarely exceeded per meiosis. Manipulation of pro- and anti-CO factors, and the use of site-directed nucleases and epigenetic modifiers, is novel and increasingly applicable approaches for manipulating the recombination or CO frequency and distribution. These approaches collectively referred as 'controlled recombination'. Controlled recombination has potential to reduce the cost and time of high-resolution mapping to identify genes of interest. Likewise, it may facilitate reintroduction of genetic variance at sites of selective sweeps and introgression of diverse alleles from wild crop relatives for varietal development. So, the mechanisms underlying recombination and CO patterns in plants are the concept to understand in context to manipulate crossover frequency and distribution and utilize it for the crop improvement.

Key Words: chromosome, haplotypes, segregation

Genetic dversity of ber (*Ziziphus mauritiana* lamk.) germplasm under eastern region of Uttar Pradesh

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Ber (*Ziziphus mauritiana* Lamk.) is an important fruit tree species that is widely grown in the eastern region of Uttar Pradesh, India. This study aimed to assess the genetic diversity of the germplasm in this region based on fruit weight, fruit length, and total soluble solids (TSS) content. A total of 40 ber accessions were collected from different locations and analyzed for fruit weight, fruit length, and TSS content. The morphological parameter leaf shape of different genotypes of ber show variation mainly Cordate, Oval, Obovate and Elliptic shape. The quantitative parameters such as fruit weight (5.18 g to 16.27 g), fruit length (2.33 cm to 4.13 cm) and biochemical parameter TSS (8.67 ^{0}Brix to 20.17^{0}Brix). The high level of variation observed in fruit weight, fruit length, and TSS content among the ber accessions suggests the presence of diverse genetic resources that can be utilized for breeding and improvement programs. The findings of this study provide valuable information for the selection of diverse parents for breeding programs aimed at improving fruit quality traits in ber. These promising genotypes can be recommended for commercial multiplication, growing at farmer's fields for further evaluation and crop improvement.

Genetic diversity studies for various traits in strawberry (*Fragaria* × *ananassa* Duch.)

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The research based on diversity studies for various morphological and horticultural traits was aimed at estimating variability, correlation, path analysis and divergence analysis of seventeen strawberry cultivars under mid hill conditions of Himachal Pradesh. Cultivars chosen for study were Brighton, Meeherancher, Nabila, Belrubi, Royal Round, Douglas, CH-40, VL-13, Chandler, San Andreas, Etna, Winter Dawn, Dana, Sweet Charlie, Camarosa, Selva and Fern. The experiment was conducted using Randomized Complete Block Design. Considerable variation in vegetative, flowering, fruiting and biochemical traits was observed. Regarding various fruiting and quality parameters, maximum number of flowers in an inflorescence was obtained in the cultivar Royal Round (10.67) and minimum days to fruit maturity from flowering was recorded in the cultivar Dana (52.83 days). Maximum fruit length, fruit width and average fruit weight was obtained Nabila (46.92 mm, 35.75 mm and 25.71 g respectively). Highest TSS (10.90 ºB), ascorbic acid content (19.21 mg/100g), TSS/acid ratio (33.57) and lowest titratable acidity (0.34%) was achieved in the cultivar Nabila. High heritability with high genetic gainwas observed for yield per plant, average berry weight and number of runners per plant. Significant and positive correlation of yield was majorly obtained with average berry weight (0.982), fruit width (0.741) and days to runner formation after planting (0.725). The path coefficient analysis reflected direct and positive effect of average berry weight (0.968) on yield per

plant. Divergence analysis based on Mahalanobis D^2 statistics revealed maximum inter-cluster distance between Cluster III and Cluster IV and maximum intra-cluster distance in the Cluster III.

Water Chestnut (*Trapa natans* var. *bispinosa* Roxb.) Cultivation as a Cultural and Biodiversity Asset

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Water chestnut (*Trapa natans* var. *bispinosa* Roxb.), an annual aquatic plant native to Eurasia and Africa, thrives in fresh water wetlands, ponds, rivers, and lakes. Commonly known as Singhara or Paniphal in India, it has a rich history of traditional cultivation by Dalit communities. Despite its extensive cultivation, the absence of improved varieties and reliance on local indigenous types raise concerns about the disregard modernization of water chestnut cultivation practices in India. Water chestnut cultivation in India has ancient origins, hinted at in historical texts, and is believed to have originated in the Indian subcontinent. The Dalit communities have played a crucial role in preserving indigenous varieties through traditional cultivation, enriching the cultural and historical tapestry of water chestnut farming in India. Water chestnut holds significance in traditional medicine, with mentions in Ayurveda and the Unani system. Ayurvedic applications include treating dysuria, acting as a diuretic, and addressing postpartum hemorrhages. The Unani system employs it for various health issues, such as sexual weakness, dysentery, and dental caries. Water chestnut bears religious importance in Indian culture, especially during fasting. During water chestnut cultivation, aquatic organisms like fish reside beneath the roots, utilizing them as a source of food. In wetland areas, migratory birds come for breeding and the water chestnut plant functions as a natural habitat. Its environmental value lies in natural bio-remediation, fixing substantial amounts of nitrogen and phosphorus. The plants globally consumed fresh nuts contribute to soil fertility enhancement. Traditional cultivation involves meticulous steps, from nursery preparation to rosette transplanting and harvesting, all conducted using traditional methods. Despite its historical significance, the lack of modernization, emphasizing the need for improved varieties and cultivation techniques to meet growing demand and enhance farmer's profitability. Water chestnut stands as a culturally, medicinally, and economically significant aquatic plant in India.

Keywords: Traditional cultivation, Ayurvedic, Environmental Value, Indigenous.

Survey, collection and evaluation of elite genotypes of Devanahalli Pummelo (*Citrus Grandis* L.)

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Pummelo is the largest citrus fruit that belongs to the Rutaceae family and it is grown in backyard gardens all over India. Among the Pummelo, Devanahalli pummelo has a unique taste which is a blend of sweet and sour, hence got a GI tag in the year 2009.However, the 'Devanahalli Pomelo' variety was on the

verge of extinction because of urbanisation. To identify and conserve the elite genotypes of pummelo in that region a survey was conducted in 2021-22. A total of 40 genotypes were identified and among them, six genotypes were selected for conservation and crop improvement *viz*., DVP-4, DBS-1, DNR-1, DAK-1, DSR-2, and RHREC-2. The organoleptic evaluation showedthat DVP-4 was the most preferred to other genotypes.It was observed that it has a significantly higher maximum pulp weight (884.95) and lowest rind thickness (0.60cm) than other genotypes. DBS-1 genotype had the highest number of fruits per tree (480), each weighing nearly 1 kg, accompanied by a moderate total sugar content of 5.81%. DNR-1 genotype also showed the maximum overall acceptability score (8.37) for organoleptic qualities. DAK-1 has a higheramount of phenols, flavonoids and TAA (total antioxidant activity). DSR-2 genotype had the highest pulp weight at 1069.67 g, the highest Total Soluble Solids (TSS) at 11.04 ºB, and the number of segments at 17.00. Lastly, RHREC-2 distinguished itself with its attractive pear-shaped fruits and pinkish pulp. All the studied pummelo genotypes showed unique traits that enhance their appearance and utility.

Wild relatives for varietal development in fruit crops

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Wild relatives refer to those species of cultivated ones which are not under domestication and are having unique traits that are not been exploited much and have descended from its foremost original ancestor. There are around 175 wild relatives known in fruit and nut crops. These species are core sources of genes which gives resistance against both biotic stresses like diseases (*Mangifera laurina*against anthracnose in mango) and pests (*Vitisrupestris* against Phylloxera in grape) and abiotic stresses like extreme cold (*Vitisriparia*), wilt (*Psidiumfriedrichsthalianum*), salinity (*Citrus limonia*), drought (*Ziziphusrotundifolia*), flood (*Mangifera decandra*) *etc.,* and induces precocity, good vigour, growth and adaptability and also unique quality attributes (*Mangifera odorata*- high TSS and aroma)in different fruit crops which improves the consumer preference which in turn contribute to nutritional and majorly food security and ultimately increasing farmers income. These characters can be incorporated into cultivated ones through various breeding approaches. Hence, wild relatives of the cultivated crops are the potential sources for varietal development in fruit crops, a promising approach to develop more diverse, resilient and nutritious fruit crops for future.

Keywords: Breeding, Fruit crops, Quality traits, Resistance, Wild species

RNA Interference: A Revolutionary Approach for Genetic Manipulation in Fruit Crops for Horticultural Advancement

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The rapid evolution of RNA interference (RNAi) technology has emerged as a groundbreaking method for precise genetic manipulation in fruit crops, fostering advancements in horticulture. The utilization of RNAi in fruit crop modification involves the targeted silencing of specific genes through the introduction of micro RNAs and short interfering RNAs (siRNAs).This approach enables the downregulation of key genes associated with traits such as colour, ripening, flavor, shelf life, and resistance to pests and diseases. This has significant implications for reducing the dependence on chemical pesticides, thereby contributing to the promotion of eco-friendly horticultural practices. In conclusion, RNA interference stands as a revolutionary approach in the realm of genetic manipulation for fruit crops, offering unprecedented precision and versatility. As research continues to unravel the full potential of RNAi, its integration into horticultural practices holds promise for sustainable and resilient fruit crop production, contributing to global food security and agricultural sustainability.

Keywords: RNA interference (RNAi), downregulation, genetic manipulation, resistance, precision and horticulture.

Evaluation of different genotypes and cultivars Of gaillardia on growth and yield under Saurashtra region

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The present investigation entitled "Evaluation of different genotypes and cultivars of gaillardia under Saurashtra region" was conducted at Instructional Farm, Department of Floriculture, College of Horticulture, J.A.U., Junagadh. The treatments comprised with 12 different genotypes and cultivar of gaillardia with three replications. The mean data showed significant variation among genotypes and cultivars with respect to plant height at peak flowering time. Significantly, maximum plant height (89.00, 81.00 and 85.00 cm) was recorded in genotype Ludhiana Selection – 1. Significantly, highest plant spread (50.67 cm N-S) was observed in Gaillardia Mix during first year. But during second year and pooled it was noted in SarpanGaillardia Grand Mix (55.06 and 52.85 cm N-S). Similarly, maximum plant spread E-W (71.87 cm) was noted in Sarpan Gaillardia Grand Mix during first year, but PG-1 recorded (73.31 and 71.93 cm N-S) during second and pooled. Whereas, maximum number of branches per plant (21.13, 21.16 and 21.14) was recorded in Gaillardia Mix but maximum stem diameter (10.28, 10.46 and 10.37 mm) was in PG -1 during both the years and pooled. Similarly, maximum fresh weight of plant after final harvest (2382.12, 2422.95 and 2402.53 g) was noted in Sarpan Yellow but dry weight of plant (637.11, 637.66 and 637.39 g) was registered in Gaillardia Mix during both the years as well as in pooled. Maximum flower yield per plant (2334.86, 2430.02 and 2382.44 g), highest flower yield per plot (46.62, 48.55 and 47.58 kg) and Maximum flower yield

per hectare (86.33, 89.90 and 88.11 t/ha) were observed in cultivar Sarpan Yellow during both the years as well as in pooled data. Significantly highest number of flowers per plant (268.73, 287.61 and 278.17) was recorded in cultivar Gaillardia Mix during both the years as well as in pooled. While, highest flower weight (9.44, 9.51 and 9.48 g) was obtained in cultivar Gaillardia Double Mix during both the years as well as in pooled data.

Key words: *Gaillardia, Genotypes, Cultivars, Growth, Yield, Sarpan Yellow, PG-1, Gailardia Mix, Ludhiana sel.-1, SarpanGaillardia Grand Mix.*

Response of Varieties to Foliar Application of Zn and Fe for Yield and Quality Parameters of Okra

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Micronutrient disorder appears to be the most widespread and frequent problem in crop production worldwide, resulting in severe losses in yield and nutritional values. To overcome this problem study was conducted. The experiment was conducted in *kharif* during 2020 and 2021 in Factorial RBD with three replications and fourteen treatment combinations comprising two varieties i.e., V_1: GAO 5 and V_2: GO 6 and seven level of foliar application of Zn and Fe *viz.,* M_1: FeSO4 @ 0.50 %, M_2: ZnSO4 @ 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 (Water spray). Which were sprayed in four frequencies at 30, 40, 50 and 60 DAS. Variety GAO 5 recorded the maximum pods per plant (20.50), pod yield (258.89 g/plant and 13.91 t/ha), fibre content of pod (2.56%), chlorophyll content of pod (0.496 mg/100 g), phenol content of pod (0.112%), and the lowest amount of leaf membrane damage (32.72%). Foliar application of Zn EDTA @ 0.2% resulted in maximum days to last picking (96.93), number of pods per plant (21.35), pod weight (14.43 g), pod yield (269,44 g/plant and 14.64 t/ha), fibre content of pod (2.62%), chlorophyll content of pod (0.504 mg/100 g), phenol content of pod (0.119 %) and least amount of leaf membrane injury (26.92 %). Zn EDTA applied topically at 0.2% with variety GAO 5 produced the maximum pods per plant (24.22), with the highest chlorophyll content (0.509 mg/100 g).

Keywords: Varieties, Zn EDTA, foliar spray, yield, okra.

A Potential Crop for the Future Generations: Dragon Fruit

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Dragon fruit (*Hylocereuscostaricensis* L.) is an important fruit crop considered to be a super fruit because of its highly nutritious value which makes it a promising and remunerative crop. Dragon fruit is originated from Southern Mexico, The pacific coast of Guatemala, Costa Rica, and El Salvador. It belongs to the family Cactaceae. The very attractive colour and shape of it attracts the buyers all the time. It is a nutritious fruit with a variety of uses and is highly valued for its reported neutraceutical properties. Cultivation of dragon fruit is comparatively easier than any other fruit crops because of its highly adoptive nature under any adverse conditions. But still there are some problems that farmers are facing nowadays. One of the challenge

farmers are facing recently in the growth and development of dragon fruit plants is low productivity and low fertility of the land. So some steps are to be taken to improve the soil fertility as Well as the soil structure to get quality fruits. Providing organic fertilizers and organic materials help the process of nutrient absorption by plants. Organic farming of dragon fruit is sustainable efforts are made to increase the total economic value. Nutritionally very much aware of their health and are willing to try organic products for their ever increasing ailments specifically diabetes, cardio-vascular and other stress-related diseases being the most common. organically produced dragon fruit would be residue-free, toxic chemical-free healthy crop, an ideal fruit crop for a health-conscious person.

Genetic Diversity Study in Morpho-Biochemical Traits in tomato (*Solanum lycopersicum* L.)

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A research study was conducted at the research farm of the Department of Horticulture (Vegetable & Floriculture), BAU, Sabour, during the 2021-22 period, with the aim of investigating genetic diversity among twenty-two tomato genotypes. The analysis of variance demonstrated significant variations among the genotypes for all studied characteristics, indicating a substantial amount of genetic variability within the genotypes under consideration. This suggests a promising opportunity for incorporating these genotypes into breeding programs aimed at enhancing fruit yield and its associated traits. Based on mean performance, genotypes such as 2019/TOLCVRES-4 and 2019/TOLCVRES-8 were identified as superior for fruit yield and yield-contributing traits. Most traits exhibited high heritability and significant genetic advance as a percentage of the mean, with the exception of plant height, days to first fruit set, and days to first maturity. Correlation analysis revealed significant and positive correlations between fruit yield per plant and average fruit weight, fruit equatorial diameter, number of primary branches, and Beta carotene content (mg/100 g fruit weight). Path coefficient analysis highlighted that average fruit weight, number of fruits per plant, number of primary branches, and fruit equatorial diameter had a high direct positive effect on fruit yield. These traits are recommended as selection criteria in breeding programs, and their direct selection could lead to simultaneous improvements in fruit yield. Cluster analysis grouped the genotypes into eleven clusters, with cluster I containing the highest number of genotypes (07), followed by cluster II with 3 genotypes. The maximum inter-cluster distance was observed between clusters VI and XI (2019/TODVAR-2 and 2019/TOLCVRES-2), indicating wider genetic diversity. This diversity may be harnessed through inter-varietal hybridization programs for obtaining high-yielding recombinants. Titratable acidity, total soluble solids, ascorbic acid, and pericarp thickness contributed the most to genetic divergence. It is recommended to use diverse genotypes from these clusters, along with other desirable attributes, in tomato breeding programs to increase the chances of obtaining superior segregants for high fruit yield, yield-contributing traits, and quality characteristics.

Keywords: Tomato, Genetic Divergence, Fruit yield, 2019/TOLCVRES-4, 2019/TOLCVRES-8

Exploring Antioxidant Potential in Fruit Developmental Stages of Different Guava Genotypes: A Comparative Analysis

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Phytochemicals, such as antioxidants, have been of public interest due to their potential health-promoting benefits. In the present study, total phenolics, flavonoid, and antioxidant activity of guava genotypes during different fruit developmental stages-early, mid, and ripe (70 and 96, 110 DAA) were investigated. Thirty-one edible guava genotypes were examined in two winter seasons. Our results revealed a gradual decrease in total phenolics, total flavonoids, and antioxidant activity as guava fruit ripens. Specifically, phenols, flavonoids, and antioxidant content were significantly reduced in the mid (colour turning) stage, followed by the ripe stage, compared to the early stage. When comparing hybrids with parents, the highest phenolic content was observed in Pusa Aarushi during the early, mid, and ripe stages (471.3 mg/100g FW, 339.8 mg/100g FW, 292.5 mg/100g FW). Pusa Pratiksha exhibited the highest flavonoid content in the early stage, mid-stage, and ripe stage (916.5 mg/100g of FW, 752.05 mg/100g of FW, and 441.1 mg/100g of FW, respectively). Regarding antioxidant activity in hybrids, the highest content was found in the early stage for Pusa Aarushi (26.93 mg/100g of FW), in the mid-stage for genotype 2A (Pant Prabhat × Lalit) (33.87 mg/100g of FW), and in the ripe stage with the highest content observed at 13.98 mg/100g of FW. These findings highlight the importance of considering both genotype and developmental stages when assessing the phytochemical composition and antioxidant potential of guava, and this study contributes to valuable insights for future research on optimizing the harvesting stages of guava.

Insights into cytoplasmic male sterility system of cauliflower breeding in genomics era

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Ogura-type cytoplasmic male sterility (Ogu-CMS) has been widely used in the hybrid breeding of colevegtables. CMS is a male sterility system resulted from a genomic conflict between the mitochondrial and nuclear genomes. Ogu-CMS was first discovered in Japanese radish and is now widely applied in the breeding of Brassicaceae crops including snowball group of cauliflower (*Brassica oleracea* var. *botrytis* L.). Mitochondrial markers can be used to differentiate diverse mitotypes as well as cytoplasms in angiosperms. In India, during the last three decades, a large number of CMS-based breeding lines/material have been generated in cauliflowers by repeated backcrossing or somatic hybridization by exploiting various CMS sources. The CMS system in combination with doubled haploid system have been exploited for developing heterotic hybrids in cauliflower. The cytoplasmic effects on varying nuclear-genetic backgrounds render an array of floral abnormalities like reduction in flower size, fused flowers, splitted style with the exposed ovule, absence of nonfunctional stamens, and petaloid stamens. These floral malformations cause dysplasia of flower structure affecting female fertility with inefficient nectar production. The advances in sequencing techniques and biotechnological tools have accelerated the development and identiaftion of stable CMS lines across the plant species. The stable ideal CMS lines are instrumental in strengthening the hybrid seed industry and for economic prosperity.

Keywords: Cauliflower, Cytoplasmic Male Sterility, Doubled Haploid, Heterosis, Molecular Markers

Genetic Variability, heritability and genetic advance for Yield and Yield Attributes traits in Tomato (*Solanum lycopersicum* L.)

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The present research programme, Genetic variability, heritability and genetic advance for yield and yield attributes in tomato (*Solanumlycopersicum* L.), was carried out at Hill Millet Research Station, Waghai, The Dangs, NAU. *Rabi* season 2021-22. Fifty genotypes of tomato were evaluated in Randomized Block Design with three replications. The analysis of variance revealed highly significant variation among the genotypes for all the characters studied indicating considerable amount of variability among the genotypes. High GCV and PCV were observed for plant height, number of primary branches, pericarp thickness, number of locules per fruit, fruit firmness, average fruit weight, yield per plant, total yield, TSS, vitamin C, total sugar, beta-carotene and lycopene content. This indicates the existence of broad genetic base, which would be amenable for further selection.High heritability coupled with high genetic advance as per cent of mean was observed for plant height, number of primary branches, flowering, number of locules per fruit, fruit firmness, equatorial diameter, polar diameter, pericarp thickness, average fruit weight, number of fruits per plant, total yield, yield per plant, vitamin c, total sugar, beta-carotene and lycopene content and total soluble solids.

Future crop: Apple growing in warm climate in India can be game changer?

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Normally apple is grown in temperate regions of India and mostly the states include Jammu and Kashmir. From the last 4 years growers has faced the challenges in temperate apple like inadequate pollinizer proportion, reduction in natural population of pollinating agents, inadequate winter chilling, occurrence of spring frosts, hales & gales, nutrient deficiencies and climate change effect. In the past it was generally regarded as a crop of the temperate zones but is increasingly cultivated under subtropical and even tropical conditions (Luckwill 1984). The apple from temperate to tropical climate, this has been possible by suitable varieties, improved production technologies, potential areas of India for growing low chilling apple cultivars, winter chilling & heat unit accumulation, breaking rest period by chemical application and by both technological innovations and modifications to standard temperate zone practices. For optimum production, most apple varieties require cross-pollination from another variety that blooms at the same time and produces abundant, viable pollen. Many varieties are self-fruitful and have sterile pollen; others are partially self-fruitful (not all of their pollen is viable); a few are self-fruitful. Winter chilling requirements for most varieties are 500 to 1000 hr. below 45° F (7° C). To ensure successful apple production in mild winter zones, select

from the following varieties that need less than 300 hr. of chilling: Beverly Hills, Gordon, Tropical Beauty, Anna, Dorsett Golden, HRMN-99.

Keywords: Winter chilling, Heat unit accumulation, Self-fruitful, Sterile pollen

Research Article Variability, character association and path analysis for *Annona* yield and quality attributes

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The knowledge of genetic variability among the genotypes for yield and quality attributes is the utmost requirement for any crop improvement work. The eighteen *Annona* genotypes of two species were studied for five leaves and fruit morphological attributes and twenty-nine components related to growth, yield and fruit quality. The experiment was arranged in a randomized block design in two replicates. A vast variability among the genotypes was revealed as seen based on the significant difference from ANOVA for all the quantitative traits. For morphological traits, genotypes showed variations for leaf shape, base and apex also for fruit shape and segmentation. The high magnitude of heritability and genetic advance as per cent mean was noted for most of the traits indicated presence of fixable genes and least influence of environment for inheritance. The results of the association analysis presented significant and positive association of fruit yield with growth and fruit morphology and fruit quality attributes at both genotypic and phenotypic levels. A strong influence of fruit traits and fruit quality related traits on yield observed owing to their positive and significant direct effects. The pulp/seed ratio, fruit weight, fruit per plant, total soluble solids, sugar content could be emphasize to discriminate the various *Annona* genotypes so as to utilize them for future hybridization programme to generate desirable genotypes for yield and quality.

Keywords: *Annona*, character association, fruit quality, genetic variability, path analysis

Importance of underutilized vegetables

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Underutilized vegetable crops are those which are neither grown commercially on large scale nor traded widely. These crops are considered as valuable component to attain nutritional security because of their high content of vitamins, micronutrients and proteins. Most of underutilized vegetable crops are tolerant to harsh agro-climatic conditions. The possible reason for slow development and poor status of underutilized vegetable crops are lack of availability of planting material, lack of awareness on nutritional and medicinal importance and lack of information on production techniques. The government of India has been taking some steps to do research on underutilized crops under various schemes like MIDH (Mission for Integrated +Development of Horticulture), MEIS (Merchandize Export from India Scheme) and a national coordinated project has been also launched by Ministry of Agriculture. Basically, these underutilized vegetable crops have great potential for food security, income generation it makes Indian economy sounder.Climate change and increasing population pressure demands a high amount of food production to ensure food and nutritional security for the world. India is one of the mega-diverse or mega-biodiversity countries of the world, rich in biodiversity and consists of many plant species which are endemic in nature and many of them are not well known or documented properly and still lying unexplored or underexploited. India is consisting of number of

underutilised and neglected plants such as millets, tubers, leguminous plants, vegetable crops, fruits, edible flowers etc. Exploration of value-added products from neglected plant species and constraints in utilisation and marketing of neglected plants of India

Keywords: Food security, Nutritional security, Neglected crops, Underutilized plants, Wild food crops

Correlation studies between yield and its component traits in amaranthus genotypes

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For amaranthus to be considered to fulfil the consumer needs it should be high yielding for its both useful forms *viz*., leaf and grains. Bypassing the ambiguity of separate selection for grain and green genotypes, the remedy is to have the high yielding dual purpose lines. So, understanding of relation between yield and component traits is prerequisite. Eighteen diverse amaranthus genotypes collected across various sources were evaluated for correlation between yield (grain and leaf) and their component traits. Association of grain yield with plant height(cm), number of nodes/plant, inter-nodal length(cm), days to 50% flowering, inflorescence length(cm), inflorescence weight(gm) and days to grain harvest, and leaf yield with that of plant height(cm), stem thickness(mm), number of leaves/plant, leaf weight/plant(gm), stem weight/plant(gm), leaf: stem and days to vegetative maturity were elucidated. Results spotlighted that leaf yield per plant had positive and significant correlation with stem weight/plant, leaf: stem, plant height and days to vegetative maturity. Grain yield had positive significant correlation with inflorescence weight, inter-nodal length and non-significant negative correlation with the inflorescence length, days to harvest and days to 50% flowering. Concluding, selection of amaranthus genotypes for improvement of dual purpose lines should concentrate on direct selection of genotypes with good stem weight/plant, leaf: stem, plant height and days to vegetative maturity for increased leaf yield and for grain yield the selection pressure should be towards inflorescence weight and inter-nodal length, and also negative selection should be put forth on inflorescence length, days to harvest and days to 50% cent flowering.

"Performance of exotic mango cultivars under south gujarat agro-climatic conditions"

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The present investigation entitled "Performance of exotic mango cultivars under South Gujarat agro-climatic conditions" was conducted during 2018-19 at Agriculture Experimental Station, NAU, Paria.The observations were recorded on morphological parameters of plant (viz. plant height, plant spread, stem girth, panicle emergence and initiation of flowering, full bloom stage, plant canopy), physical parameters of fruit (viz. weight of fruit, specific gravity, fruit length, external skin color, flesh color, fruit set, fruit retention,

number of fruits per plant, yield per plant, pulp weight, pulp percent, organoleptic evaluation) and chemical parameters of fruit (viz. TSS, titrable acidity, ascorbic acid, reducing sugar, total sugar). Result of study revealed that the entire nine exotic cultivars can be grown successfully under South Gujarat agro-climatic conditions. Among these cultivar Apple found superior with respect to plant spread, fruit weight, fruit size, and yield. Whereas, on the basis of maximum fruit set, fruit retention, pulp percent, number of fruits per tree, TSS, ascorbic acid, reducing sugar, total sugar and overall acceptability cultivar Maya was found the best. Hence, it can be concluded that among these exotic cultivars, Maya is the superior cultivar due to better yield, quality and attractive appearance of fruits. Mango growers of this region may go for commercial plantation of this cultivar not only for export but for domestic market also.

Keywords: Cultivar, Maya, Apple, export, Morphological

Kiwano (Horned Melon): Incredible Benefits Vigour and Vitality

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The kiwano belongs to the Cucurbitaceae family. The alien likeexotic fruit has similarities with Passion fruit and Pomegranate in its texture. Its increasing popularity in the health arena is due to the multiple health benefits it possesses. It improves cognitive function, used as a recovery aid for heart stroke; kiwano melon slows the ageing process and even neutralizes the free radicals in the body. Due to the presence of essentialminerals, nutrients and organic compounds in the fruit, it got recognition by WHO, stating kiwano to be an important fruit in fighting againstmalnutrition and illness. The health benefits of the kiwano are in the nutrients it contains including Fe, K and vitamin C. It also has smaller amounts ofCa, Cu, P, Mg, Znand Na. The seeds contain oleic and linoleic acid. Linoleic acid is an omega fatty acid rich which is required for human health while oleic acid is help to reduce blood pressure. Some of anti-oxidants present inkiwano seeds are α-tocopherol as well as β-tocopherol. Its pulp contains the carotenoid, beta carotene. The beta carotene strengthens the body's defence mechanisms and sustains skin and eye health. It may also help to stop cancer simply by suppressing the growth of free-radicals.

Keywords: Fatty acids, Free radicals, Illness, Malnutrition, Minerals, Tocopherol.

Probing Water Chestnut Variability through Electrophoresis Analysis in Wetland Ecosystems

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Water chestnut (*Trapanatans* var. bispinosa Roxb.) is an integral component of wetland ecosystems, thriving in diverse aquatic environments. Wetlands are regions where hydric sub soil supports the growth and regeneration of vegetation that has adapted to grow in saturated/inundated and low-oxygen conditions. They serve as crucial ecosystems supporting biodiversity and regulating water quality, making them essential for sustaining water chestnut populations. A large population of farmers in India depends on water chestnut cultivation for their livelihoods yet even today there are no standard varieties. Morphological and stomatal

studies conducted reveal presence of large number of morphotypes within water chestnut populations cultivated in ponds and wetlands. However, it is not clear whether this is expressed even at the genotypic level. 20 morphotypes of water chestnut were collected from the farmers ponds and subjected to protein profiling using SDS-PAGE and showed distinct polymorphism in electrophoretic banding patterns, the initial screening the molecular weight of the 25 bands obtained ranged from 322 kDa to 18 kDa. . The present study highlights the variations present in the water chestnut germplasm collected from the different locations in Uttar Pradesh at the molecular level. A UPGMA dendrogram of the protein profile obtained using hierarchical genetic distance based clustering revealed two main clusters. This research illuminates the adaptive mechanisms of water chestnuts across diverse wetland habitats, highlighting the pressing need to preserve these ecosystems for sustainable cultivation and environmental equilibrium. The study explores the genetic diversity within water chestnut populations from wetlands, aiming to unravel crucial insights in the absence of distinct cultivars.

Keywords: Water chestnut, wetlands, genetic diversity, electrophoresis, ecosystem conservation

Performance of Brinjal (*Solanum melongena* L.) Genotypes in Red and Laterite Zone of West Bengal

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India is the primary centre of origin for brinjal having a wide range of genetic variation, but various local varieties/landraces are grown in West Bengal leading to its low productivity. So, recognition ofnew genotypes having good yield potential and quality are required to uplift the overall productivity of brinjal in Red and Laterite Zone of West Bengal. Hence the present study was undertaken to study the production performance to brinjal genotypes and identify suitable genotypes for this region.

The experiment was conducted with 35 genotypes laid out in Randomized Block Design (RBD) with three replications. The observation was recorded for plant hcight, numbcr of branchcs, days to 50 pcrccnt flowering, days to first harvest, fruit length, fruit width, average fruit weight, number of fruits per plant, total yield and dry matter. Pusa Purple Long was found as early type and suggested to utilize in breeding programme. UtkalAnushree and Brinjal Blue Star having highest number of fruits per plant and total yield can be suggested to the local growers of West Bengal.

Keywords: *Solanum melongena*, Red and Laterite zone, yield

Edit the fruit crops to improve the desired traits – CRISPR/Cas9

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Fruits are a gift from nature to humans. Fruits are a vital dietary supplement because they offer the vitamins, minerals, and fiber that humans need to stay healthy. The population of any nation adepends on the production of fruit crops for their economic well-being. The production and qualities of fruit crops are directly influenced by diverse agro-climatic conditions, biotic and abiotic factors, and their own genetic

character. In early decades, Conventional breeding methods are used to improve the traits of interest by manipulating the plants genetically to attain sustainability, but these methods take more time. Plant genetic engineering techniques provide to develop a new plant variety with desired traits by transfer of one or just a few genes of interest, between either closely or distantly related species. In genetic engineering, different genome editing technologies are present, but now the most popular technology, clustered regularly interspaced palindromic repeats (CRISPR/Cas9), which is a transgene-free genome editing technology, improves the commercialization potential of modified fruit crops. CRISPR-Cas9 is powerful tool gene knockout by insertion or deletion of nucleotides in the editing site of specific traits of the target gene for develop desired quantitative traits for plant architecture improvement, including a plant resistance to biotic and abiotic stress, the timing of fruit ripening and flowering and the growth characteristics of the plant. It is anticipated that CRISPR/Cas9 technology will improve food quality, production, and environmental sustainability in the future.

Keywords: Abiotic and biotic stress resistant, CRISPR/Cas9, fruit crops, quality traits

Genetic analysis of yield and its component traits in brinjal (*Solanum melongena* L.)

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A field experiment was carried out to perform genetic analysis of yield and its component traits in brinjal (*Solanummelongena* L.) using 10 parents, 45 hybrids (produced through half-diallel mating design) and commercial hybrid ABH-1 as a check in a Randomized Block Design with 3 replications at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. The data were recorded for 16 traits including days to first flowering, days to first picking, fruit weight, fruit yield, number of seeds per fruit, total phenol content, TSS and Anthocyanin etc. The analysis of variance for all the traits revealed significant variation for all the traits studied, indicating presence of considerable amount of genetic variability in the parental material tested. Parents vs. Hybrids comparison were found to be significant for total phenol content, TSS and anthocyanin content. Among parents, Punjab Barsati, Punjab Sadabahar and Arka Anand were recorded as the best performing parents for fruit yield per plant. IC 074224 x IIHR 635 (60.69), SuratiRavaiya Pink x ArkaNeelkanth (58.81) and IIHR 635 x ArkaNeelkanth (55.08) showed significant and desirable heterobeltiosis for fruit yield. Combining ability studies revealed non additive type of gene action involved in the expression of traits. IC 074224, Punjab Barsati and IC 11066-2 were good general combiners for fruit yield per plant. The ratio of gca variance/ sca variance were observed less than unity for all the characters which revealed the predominance of non-additive gene action. The overall analysis based on gca effect, sca effect, heterobeltiosis and standard heterosis revealed that parents IC 074224, IC 11066-2 and IIHR 635 and crosses IC 074224 x IC 11066-2, SuratiRavaiya (Pink) x ArkaNeelkanth and IIHR 635 x ArkaNeelkanth found promising for future breeding programme.

In-vitro techniques for multiplication using apical buds or nodules in cut roses (*Rosa species*)

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Propagation of cut roses (*Rosa species*) is being done very slowly by traditional methods. And not enough to meet demand. *In-vitro* techniques are dominating for the rapid multiplication and development of new clonal plants with desirable properties with the production of healthy and disease-free plants. On the other hand, various factors are required for successful *in-vitro* propagation of rose. Various stages of micro-propagation are used in the form of explant (apical buds or nodal) segments Wherein, various factors are required for successful in-vitro propagation of rose. In which, Surface sterilization was carried out with 70% ethyl alcohol and $HgCl_2$. Shoot growth rate and shoot index showed better performance on MS than on WPM medium. Thidiazuron (TDZ) in combination with 6-enzylaminopurine (BAP) induced a significantly higher number of shoots per explant than the most optimal BAP treatment alone. The highest level of shoot multiplication rate was recorded with the combination of BAP and TDZ. The type and concentration of auxin did not have a significant effect on shoot multiplication and shoot length. Among various cytokinin's, BAP was more effective than kinetin on shoot multiplication. There was no consistent response by both shoot multiplication rate and genotype to different concentrations on growth regulators. Two accessions were rooted on medium supplemented with and naphthalene acetic acid, respectively.

Keywords: *In-vitro* propagation; apical bud; cut rose

Session IV

Seeds, Planting and Nursey Materials

Genome editing in vegetable crops for stress tolerance and quality improvement: challenges and opportunities

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The horticulture scenario of our country is rapidly changing due to health consciousness, awareness and better purchasing power. Among horticultural crops, vegetables are the major contributor with around 60% to the total horticultural production in India. Presently, India stands the second in world vegetables production with a global share of about 13.6% by producing 209.14 million tonnes (mt) from 11.37 m ha area (https://mospi.gov.in/4-agricultural-statistics, 2021-22). The increase in production of horticultural crops by in last three decades is not only due to increase in area (102.04 % in horticulture and 75.42 % in vegetables) but due to development of high yielding varieties and technology led production system. Thus, in the last three decades, country's vegetable production has increased by more than 133.06 mt and the gross vegetable productivity has increased by nearly 80%. However, in terms of average productivity of vegetables, country still lags behind many countries which prompt to further advance our efforts to boost vegetables productivity vis-à-vis attaining greater levels of use efficiencies of finite land and water resources, particularly in the changing scenario due to the climate change. Vegetable crops are sensitive to various environmental stresses, which are promoting the spread of various pest and diseases causing the deterioration in yield. Being the major source of nutrition in diet, the magnitude of the losses caused by diseases in vegetable crops is a serious threat to nutritional security. Climate change may also alter the nutritional composition of these crops. This necessitates the focused breeding programmes to develop stress tolerant and nutritionally rich vegetable cultivars. Apart from molecular breeding, the recently developed novel strategies, such as genome editing, may be required to keep up with and address these challenges. At present, CRISPR/Cas9 is the most efficient and easy to use among the different genome editing tools available so far. This tool is very helpful in identification of more Cas variants and has several applications like gene knockout, RNA editing, base editing, gene activation, chromosome engineering, nucleic acid detection, chromatin imaging, etc. One of the most fascinating applications is base editing which enables the direct, irreversible conversion of a one nucleotide base to another at desired location in the genome. The use of CRISPR/Cas9 tool for developing virus resistance in plants has been successfully demonstrated. The same techniques can be utilized in different vegetable crops primarily by targeting the susceptibility genes in plants required for infection and survival of the pathogens. The knockout of *MLO* gene causing downy mildew resistance is one of the best examples. Similarly, resistance against RNA viruses has been developed in cucumber by targeting the eIF4E gene. The knockout of genes like MAPK3 and CCD8/MAX1 in tomato resulted resistance against *Botrytiscinerea* and *Phelipancheaegytiaca* respectively. *DMR6* mutant plants can be obtained using CRISPR/Cas9 to develop resistance against fungal and bacterial diseases in tomato. The stress tolerance in plants can be developed by targeting transcription factors or negative regulators of stress responsive pathways. The editing of *NPR1*, *MAPK3*, *LBD40* and *ARF4* genes resulted the development of drought tolerant in tomato. The targeted *Coilin* and *HyPRP1* gene used for development of salt tolerance trait in potato.

Keywords: Climate resilient, quality, genome editing, vegetables, gene

Comprehensive analysis of the *Atma Nirbhar* clean plant initiative: a focus on certification systems for clonally propagated fruit crops

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This paper presents a comprehensive exploration of the certification systems for clonally propagated fruit crops in the context of India's Atmanirbhar Clean Plant Program, aligning with a framework for structuring the research and development. The analysis begins by addressing fundamental knowledge gaps, probing into the repercussions of the absence of certified planting material on yield, fruit quality, and overall orchard health in India. Moving beyond foundational knowledge, the paper comprehensively analyzes the challenges within the production and supply chain, establishing a clear understanding of the economic impact of fruit plant graft transmissible pathogens. Drawing comparisons with international models, such as the National Clean Plant Network (NCPN), Superplant Scheme, and Fruit Propagation Certification Scheme (FPCS), we seek to comprehend the intricacies of the Indian scenario and identify key challenges and constraints. The application phase involves the formulation of hypotheses, predicting positive outcomes resulting from the implementation of the Atmanirbhar Clean Plant Program, a national certification system, standardized testing protocols, and a robust regulatory framework. This segment aims to apply theoretical constructs to practical scenarios, foreseeing the potential benefits in terms of enhanced productivity, improved fruit quality, and increased horticultural diversification, aligning with the national vision of self-reliance. To enrich the analysis, a comparative study evaluates India's certification approach against international models, synthesizing lessons from successful international programs and applying them to the unique challenges faced by India. Emphasis is placed on adaptability and contextual relevance within the framework of the Atmanirbhar initiative. The economic impact assessment constitutes a critical analysis of potential returns on investment for farmers adopting certified planting material within the Atmanirbhar framework. Furthermore, the economic repercussions of virus-induced diseases are compared to other horticultural challenges, proposing strategic measures for mitigation within the context of self-reliance. Synthesizing strategies for system improvement, the paper proposes enhancements to the existing accreditation and rating system for nurseries within the Atmanirbhar Clean Plant Program. Simultaneously, it outlines strategies to bridge the gap between the burgeoning demand for certified planting material and the current supply capacity in India, contributing to the national goal of agricultural self-reliance. This paper concludes with a nuanced understanding of the interconnectedness between certification measures and the overall health of the horticultural ecosystem within the framework of the Atmanirbhar Clean Plant Program. By addressing these multifaceted challenges, we contribute to the cultivation of a robust certification system that aligns with India's vision of self-reliance, benefiting farmers, consumers, and the broader agricultural sector.

VNR nursery's journey towards sustainable and high-quality planting material production in India

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The availability of high-quality planting material is pivotal for successful fruit crop cultivation, posing a considerable challenge due to current limitations. Both organized and unorganized nurseries meet the demand for planting material from farmers in India. However, the inadequate access to healthy and disease-free planting material results in a decline in fruit production, productivity, and quality. Existing nurseries in the country confront deficiencies in modern infrastructure, lacking proper greenhouse facilities, mist chambers, and efficient nursery tools and machinery. Additionally, the provided plant material often lacks a reliable pedigree, collectively hindering the overall effectiveness of fruit crop cultivation. Several constraints

contribute to these challenges, including the procurement of low-quality seeds, unavailability of standardized rootstocks, lack of improved tools, failure to adopt plant protection measures, absence of virus indexing, use of diseased scion woods, procurement through open quotations, and failure to maintain a healthy stock of elite varieties. Embracing recommended infrastructure, equipment, and practices is imperative for cultivating uncontaminated vegetation. VNR Nursery, established in 2012, initiated operations after creating a robust mother block with various fruit varieties and the necessary infrastructure for cultivating disease-free plants. During this period, VNR Nursery engaged with horticulture scientists and technologists at ICAR institutions, SAUs, and KVKs to acquire and implement expert recommendations for enhancing infrastructure and production capacity. By December 2023, VNR Nursery has produced around 8 million fruit plants, distributed across 325 districts in 24 states of India. Recognized for its expertise, VNR Nursery holds a 3-star accreditation from the National Horticulture Board (NHB) since 2019. Spanning 13 hectares, VNR Nursery's modern infrastructure includes a mother block of 65 hectares with over 76 varieties of 20 fruits, facilitating the annual production of more than 2.5 million clean planting materials. The journey underscores the critical need for high-quality planting material in fruit crop cultivation, revealing the pervasive challenges faced by nurseries and farmers in India. Addressing deficiencies in infrastructure and embracing recommended practices are essential steps toward cultivating uncontaminated planting material. The success story of VNR Nursery stands as a testament to the transformative impact that dedicated efforts and adherence to expert recommendations can have on the production of clean planting materials, ultimately contributing to the advancement of fruit cultivation and horticultural sustainability on a national scale.

Performance of seedballs of ornamental plants in different media mixtures under Punjab conditions

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Today's world is facing extreme changes in climate. Global warming is one of the factors of climate irregularities. It is caused by the imbalance of oxygen and carbon dioxide which is due to deforestation. The conventional methods to restore forests are not effective as per the need. Seedball technique can overcome the problems of conventional methods and can be adopted to restore forests. Therefore, the performance of seedballs of ornamental plant species in different media mixtures sown at different times under Punjab conditions was investigated.Seedballs of five differentornamental tree species (*Cassia fistula, Azadirachtaindica, Schleicheraoleosa, Pongamiapinnata and Putranjivaroxburghii*) were prepared using five different media mixture viz. M_1 [soil + clay (1:1 v/v)], M_2 [soil + FYM (1:1 v/v)], M_3 [soil + cocopeat (1:1 v/v)], M_4 [soil + cocopeat + clay (4:3:3 v/v)] and M_5 (seed priming with clay). Prepared seedballs were sown in different locations in the Punjab Agricultural University campus on three different sowing dates (15th July, 15thAugust and15thSeptember). The experiment was laid out in FRBD design with 75 treatments each having three replications. The treatment combination of *Azadirachtaindica*and soil + cocopeat sown on 15th July resulted in earlier germination (7.35 days) with maximum (90 %) germination percentage. The treatment of *Cassia fistula* along with soil + cocopeat sown on 15th August exhibited maximum plant height (40.35 cm), leaf area (75.28 cm^2) and survival percentage (50.67 %). However, with same media and sowing date, maximum number of leaves (18.43) were obtained in *Putranjivaroxburghii*. The maximum stem girth (29.01 mm) was observed in *Azadirachtaindica* in soil + cocopeat along with sowing date of 15th August which was at par with *Cassia fistula* in same media and sowing time. The media consisting of soil + cocopeat had the pH of 6.80 which is closest to the neutral pH. Along with neutral pH, other properties of cocopeat like water holding capacity, porosity etc. helped in better germination and establishment of the plants.

Keywords: Seedball, tree species, media, growth, sowing date, germination, survival, cocopeat

Grafting success and seedling growth of loquat scion affected by different rootstocks and grafting time

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The present investigations was carried out at Experimental Farm of Division of Fruit Science, SKUAST-Kashmir, Shalimar Campus, Srinagar (Jammu and Kashmir) during 2022 to find out best rootstock and grafting time for loquat scion. The experiment comprised four rootstocks (BA-29, Quince seedling, Loquat seedling and Kainth seedling) grafted with loquat scions at three grafting times (10th March, 20th March and 30th March) with cleft grafting, replicated thrice under Randomised Block Design. Observations recorded depicts that earliest bud burst (24th April) was recorded on loquat seedling grafted on 10th March whereas lowest number of days to bud burst (44 days) was observed with loquat seedling grafted on 20th March alongwith highest grafting success (86.66 %), scion girth (10.48 mm), plant height (47.73 cm) and number of branches (2.10). Maximum rootstock girth (11.95 mm) was measured in BA-29 grafted on 20th March. Highest and lowest stock-scion ratio was recorded in BA-29 grafted on 10th March and loquat seedling grafted on 20th March, respectively. Maximum survival plant was recorded on loquat seedling grated on 20th March (73.33 %). From the present study, it is concluded that loquat seedling grafted on 20th March performed best for most of studied vegetative parameters.

Effect of alteration of microclimate on yield and quality in guava planted at different spacings

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The study on effect of microclimate on yield and quality in guava was carried out to standardize the planting density with respect to solar radiation interception, canopy temperature and relative humidity by the plants to get higher production and improved quality was carried out in the Fruit Research Farm, Department of Fruit Science, Punjab Agricultural University, Ludhiana during 2021-22. The present investigation reveals that with an increase in plant density from 333 (6x5 m) to 833 (4x3 m) plants per hectare, the solar radiation interception and canopy temperature in the plant were found to be decreased during both the rainy and winter crop seasons. In comparison, the relative humidity in the canopy was found to be increased. In the rainy season crop (March to August), the solar radiation interception and canopy temperature were found to be maximum compared to the winter season crop (September to February). Whereas, the relative humidity was found vice versa. In the upper 1/3 part of the canopy, irrespective of plant spacing, solar radiation interception and canopy temperature was higher, followed by the middle and lower parts. While, relative humidity was highest in the lower part of the canopy. The Fruit weight, pulp weight, fruit yield, TSS and total sugars were highest in the orchard with 333 plants/ha (6x5 m) and least in 833 plants/ha (4x3 m). It may be concluded that guava planted at 5x5 m (400 trees/ ha) had a significantly higher yield per tree vis-à-vis improved fruit quality as compared to trees planted at recommended spacing i.e 6x5 m.

Keywords: Guava; Shweta; High-density planting; Spacing; Microclimate.

Characterisation of promising rootstocks among 20 maternal olour mango progenies on the basis of molecular, morphologial, physiological and biochemical parameters

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India is bestowed with wide variety of mango rootstocks having innate potential to invade adverse climatic conditions and problematic soils and its ability to influence on horticultural traits for yield and quality. PolyembryonicOlour mother taken as a maternal parent which is known very well for its salinity tolerance, when hybridised with other promising mango species results in hybrid/zygotic rootstocks with vital source of genetic variation along with favourable traits conferred by both the parents. The present investigation was conducted to distinguish zygotic saplings from nucellar progenies in a Randomized Block design (RBD) using 25 SSR markers followed by its morpho-physio-biochemical characterisation with 3 replications. The results showed that 14 zygotic progenies were there out of 20 maternal progenies (O-17-91 to O-17-110) with ESTD 10 found as the most useful marker followed by MiKVR98 and MiIIHR 2. The zygotic Olour hybrids identified were O-17-91, O-17-93, O-17-94, O-17-97, O-17-98, O-17-99, O-17-100, O-17-101, O-17-104, O-17-105, O-17-106, O-17-107, O-17-109 and O-17-110. The Genotype (O-17-99) exhibited maximum bark: wood ratio signifying its dwarf stature followed by O-17-107. Parameters such as specific leaf weight and photosynthetic rate was found maximum for the genotype O-17-93 indicating higher production & accumulation of photosynthates to leaves and translocation activity. Therefore it was found to be the vigorous rootstock. Enzymatic activities was also evaluated for the rootstocks out of which peroxidase and total phenols was found maximum for O-17-101, thereby proving its tolerance against abiotic stresses. Total phenolics level was also measured in the selected zygotic progenies, amongst which O-17-107 had shown its maximum presence followed by O-17-104. Total phenolic content in bark was found more than that in leaves and interestingly there was a direct relationship between dwarf stature of a rootstock with the total phenolic level in the bark of the rootstocks.

Impact of girdling on morpho-physiological potential of pear plants under high density plantation

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Girdling involves manipulation of the source-sink by making a bark incision of a particular thickness and the complete removal of the phloem circumscribing the trunk. The cut primarily restricts the movement of photosynthates from the upper portion of the trees to lower parts. Consequently, there is build up of carbohydrate above the girdled portion and the plantroots become deficit in photosynthates. This causes the root metabolism to slow down, which decreases the growth and development of both root and shoot. Keeping this mechanism in mind, an experiment was conducted at Punjab Agricultural University, Ludhiana to study the impact of girdling on Oriental pear cultivar 'YaLi' grafted on Kainth (*Pyruspashia*) rootstock. The plants were trained under high density on Espalier system. Trunk and sub-limb girdling was performed at the beginning of spring season. The results revealed that girdling significantly reduced the annual shoot length, number of shoots, leaf area and relative water content. However, an increase in leaf chlorophyll content, net photosynthesis and penetration of photosynthetic active radiations within the tree canopy was observed. Girdling had a positive impact on percent flowering, fruit set and yield/plant. It also improved the physico-chemical aspects of fruit in terms of fruit weight, length, width, total sugars, TSS, and ascorbic acid content. The fruits harvested from girdled trees also possessed high phenolics and antioxidants in comparison to ungirdled trees. Therefore, girdling could be used as an eco-friendly and cost effective alternative to manage tree canopy and improve fruit quality.

Standardization of growing media for off season cultivation of green garlic and Indian spinach

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The experiment was conducted to study the influence of different growing media and foliar application of Nitrogen on Garlic and Spinach. The experiment was laid out in Completely Randomized Design with factorial concept (FCRD) with three repetitions. Treatment combinations include six media levels viz., Cocopeat + vermicompost + Rice husk (4:1:1), Cocopeat + vermicompost + perlite (4:1:1), Cocopeat + vermicompost (4:1), Local black soil+ vermicompost (4:1), Sand and vermiculite + Rice husk (2:2) along with three doses of foliar appliacation of nitrogen viz., 50ppm, 100ppm, 150ppm. The experiment was laid out under naturally ventilated polyhouse and seeds shown in 55 cm x 36 cm x 10 cm trays during off season i.e June-July for three consecutive years (2019,2020 and 2021). The results revealed that growing media consisting of sand was found to be best media for cultivating green garlic in tray with regard to higher number of leaves and yield (3.06 g/plant & 302.79 g/tray) as well as higher pungency. Furthermore, nitrogen level comprising of foliar spray of N@150 mg/l every week produced maximum number of leaves and yield (2.77 g/plant and 274.56 g/tray) as well high quality with respect of pungency. Moreover, media consisting of sand was found to be best for cultivating of off-season spinach in tray with regard to higher number of leaves, plant height and yield (15.75 g/plant & 315.00 g/tray). While, nitrogen level comprising of foliar spray of N @150 mg/l every week producing maximum plant height, number of leaves, plant spread and yield (14.10 g/plant and 282.01 g/tray).

Key words: Garlic, Spinach, growing media, foliar application of Nitrogen and sand

Effect of dates of planting on growth and flowering yield in China aster [*Callistephus chinensis* (L.) Nees] cultivars under semi-arid conditions of Bundelkhand region of Uttar Pradesh.

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The field experiment in Bundelkhand, Uttar Pradesh, investigated the impact of planting dates and varieties on China aster (Callistephus chinensis). ArkaAadya and Phule Ganesh Violet emerged as the top-performing varieties. Planting during the 2nd week of November resulted in optimal outcomes for flower yield, quality, and seed production. ArkaAadya, planted during this period, exhibited superior characteristics such as maximum primary and secondary branches, leaves, dry plant weight, and flower yield. Phule Ganesh Violet excelled in plant height, flower diameter, individual flower weight, and flowering duration. Overall, planting in the 3rd week of November is recommended for maximizing flower yield, quality, and seed production. The study emphasizes the suitability of ArkaAadya and Phule Ganesh Violet for the semi-arid conditions of Bundelkhand.

Key words: China aster, varieties, planting dates, growth, flowering and yield

Effect of various planting dates on performance of China aster (*Callistephus chinensis* (L.) Nees.) varieties under south Gujarat agro climatic condition

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The experiment was laid out in split-plot design with four main plots of planting dates, *viz.*, P_1-15th October, P_2-1st November, P_3-16th November and P_4-1st December and six sub plots of varieties *viz.*, V_1-Phule Ganesh Pink, V_2-Phule Ganesh Purple, V_3-Phule Ganesh White, V_4-Phule Ganesh Violet, V_5-Arka Archana and V_6-Arka Kamini. The different planting dates and varieties were replicated four times. Among different planting dates, P_1 planting, i.e., October 15th gave the best results for all vegetative parameters, *viz.*, plant height, plant spread in East-West and North-South directions and number of primary branches at 60 and 90 days after transplanting. Regarding flowering and quality parameters, minimum days to first flower opening and 50 *percent* flowering were recorded in the P_4 planting, *i.e.,* in December. However, P_1 planting, i.e., October 15th also recorded the maximum duration of flowering, flower head diameter, stalk length, weight of 10 flowers and longevity of flowers, number of flowers per plant, flower yield per plant, per plot and per hectare. The same planting date was also found superior regarding post-harvest parameters, *viz*., shelf life, vase life, water uptake, fresh weight retention and quality. Among the different varieties, Phule Ganesh White (V_3) was found to be better regarding plant height at 60 and 90 DAT, duration of flowering, flower head diameter, stalk length, weight of 10 flowers, longevity of flowers, shelf life, vase life, fresh weight retention and flower quality score. While variety Phule Ganesh Violet (V_4) was found superior regarding plant spread in both East - West and North - South directions and the number of primary branches at 60 and 90 days after transplanting. However, variety Arka Archana (V_5) took the minimum number of days to first flower opening and 50 *percent* flower opening. This variety also recorded the maximum number of flowers per plant, flower yield per plant, yield per plot, yield per hectare and water uptake.

Key Words: China aster, planting dates and varieties

Technology for the vertical expansion of nursery by air layering in clonal rootstocks of temperate fruits.

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To utilize the available vertical space in the greenhouse and the vertical growth of plants, a technology vertical expansion through air-layering of the nursery has been developed. The multiplication of clonal rootstocks of apple including (M9, Pajam, T337, T339, MB-9, P-22, M-27, G-202, G-11, CIV-P21), Pear rootstock Quince A, Quince-C and Quince BA-29 and cherry rootstock colt was done by using this technique. Rootstocks having a diameter of (5 mm and above) at 30 cm (1.0 ft) above ground level were selected and wounding/incision was given by sharp knife/blade and rooting hormones IBA (2500 ppm) in apple and (3000 PPM) (Pear and Cherry) 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. Black-color polybags filled with a rooting medium have been fastened at the points where rooting needs to be initiated. A light substrate (Cocopeat) with 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 frequent intervals was done to keep the rooting media moist. Sufficient rooting has been recorded in all the rootstocks of Apple, Pear, and Cherry. 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 additional inputs. One more supplementary benefit of this technology is that under greenhouse conditions a plant attained a sufficient girth, above (5mm) and all the daughter plants are suitable for budding operation. The budding has been done to about 85% of plants with an almost 95% success rate. This technology not only produced the additional 2-4 plants but also the budded plants which added further advantage to this technology that budded plants with well-developed root systems are produced in one year of the nursery cycle. The technology has been replicated in farmer's fields and promising results have been recorded.

Keywords: Apple, Pear, Cherry, Clonal Rootstock, Air layering, Soilless.

Effect of different chemical and physical treatments on germination and seedling vigour of chironji (*Buchanania lanzan* Spreng.).

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In order to accomplish the objectives of the present study, the experiment "Effect of different chemical and physical treatments on germination and seedling vigour of chironji (*Buchanania lanzan* Spreng.)" was conducted 2020-21 at the Research Field Department of Fruit Science, College of Horticulture, Mandsaur (M. P.). Detail of treatments T_1 (Soaking in KNO3 solution 1.5 % for 24 hrs.), T_2 (Soaking in KNO_3 solution 2.5 % for 24 hrs.), T_3 (Soaking in H_2SO_4 5 % for 5 minutes), T_4 (Soaking in H_2SO_4 5 % for 10 minutes), T_5 (Soaking in GA_3 250 ppm for 24 hrs.), T_6 (Soaking in GA_3 500 ppm for 24 hrs.), T_7 (Mechanical scarification breaking of seed coat through hammering), T_8 (Hot water treatment 60ºC for 20 minutes), T_9 (Alternate wetting 36 hrs. and drying 24 hrs.), T_{10} (Alternate wetting 48 hrs. and drying 24 hrs.), T_{11} (Soaking in water for 4 days), T_{12} (Soaking in water in 6 days) and T_{13} (Normal sowing). Result revealed that minimum number of days (29.18 days) for seed germination, number of days for 50 per cent seed germination(36.02 days), maximum germination percentage after 30 days(2%), and germination index (0.94%) were observed in treatment T_7 (mechanical scarification breaking of seed coat through hammering) and treatment T_5 (soaking in GA_3 250 ppm for 24 hrs.) was recorded the maximum value of survival percentage (62.92%), seedling height (6.38 and 9.79 cm), number of leaves per plant (4.11 and 6.16), leaf area (16.75 and 24.07 cm^2), collar diameter (0.18 and 0.29 cm), root length (9.63 and 12.73 cm) at 60 and 90 DAS, respectively. Similarly maximum fresh shoot weight (7.18 g), fresh root weight (3.8 g), shoot and root ratio (0.93), dry shoot weight (4.66 g), dry root weight (1.86 g) and seedling vigour index (682.07) was also notice in treatment T_5 (soaking in GA_3 250 ppm for 24 hrs.) at 90 DAS.

Keywords: Chironji, germination index, seed, vigour, GA_3, scarification.

Effect of plant growth regulators and thiourea on seed germination and seedling growth of Jatti Khatti (Citrus jambhiri Lush.)

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The present investigation entitled *"Effect of plant growth regulators and thiourea on seed germination and seedling growth of JattiKhatti (Citrus jambhiri Lush.)"* was conducted at Fruit Nursery, Department of Fruit Science, College of Horticulture, Banda University of Agriculture & Technology, Banda 210001, (U.P.) during the year 2020-2021. The experiment was conducted in Completely randomized design with nine treatments, replication thrice. The seed germination experiment was conducted in laboratory (in Petri dish). However, the physical growth parameters and root parameters were taken in shade net house. The various concentration of plant growth regulators and thiourea viz., T_1 (Control), T_2 (GA_3 200 ppm), T_3 (GA_3 400 ppm), T_4 (IAA 30 ppm), T_5 (IAA 50 ppm), T_6 (Thiourea 500 ppm), T_7 (Thiourea 1000 ppm), T_8 (Kinetin 500 ppm) and T_9 (Kinetin 1000 ppm) were used to treat the seeds of JattiKhatti and further observations were taken for 30 days for seed germination parameters. The result indicated that minimum days taken to start seed germination in 8 days, maximum germination percentage 94.47%, earliness index 0.886 and also vigour index 511.760 in T_3 (GA_3 400 ppm) for 12 hours were recoded. However, the final observation was taken for 90 DAS for physical growth and root parameters. The results were indicated that maximum seedling height (15.400 cm), number of leaves (16.800), leaf area (7.003 cm_2), stem diameter (0.323 cm), fresh weight of shoot (0.398 g) and dry weight of shoot (0.186 g), length of primary root (8.820 cm), number of secondary root (11.523), fresh weight of root (0.158 g) and dry weight of root (0.075 g) were recorded in seed treated with T_3 (GA_3 400 ppm) for 12 hours. Therefore, it can be concluded that the GA_3 at 400 ppm was found best for seed germination, physical growth and root parameters.

Key words: Plant growth regulators, thiourea, seed germination, seedling growth.

Tryptophan: Enhancer of seed germination in Brinjal

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The aim of the study was to evaluate the influence of different L-tryptophan concentrations on several germination characters of Brinjal. Germination of seed is the first step toward a successful crop establishment. Seed priming is a non-distractive and cheap pre-sowing treatment that allows partial rehydration without leading to radical emergence. Priming with biostimulants can potentially support rapid uniform seed germination and ensuing growth. Biostimulant priming activates processes associated with the early phases of germination. Thus in this experiment, influence of tryptophan as biostimulant during germination and early seedling growth in brinjal was evaluated. Treatments were 11 concentration of tryptophan (0, 25, 50, 75, 100, 125, 150, 175, 200, 252, and 250 ppm $C_{11}H_{12}N_2O_2$) in three replicates. The results showed that different treatments of L-tryptophan had considerable effect on the mean germination time, germination percent, root length, root weight, shoot length, shoot weight, seedling height, **vigour Index I** and **vigour Index II** of brinjal. The highest germination percentage was obtained at 200 ppm L-tryptophan and the all growth characters were also increased. Result of this experiment is consistent with the hypothesis that L-tryptophan has a priming effect and can improve seed germination performance and seedling establishment.

Key words: Seed priming, Biostimulant, L-tryptophan, Germination characters

Effect of various concentrations of IBA and NAA on rooting and survival of hardwood cuttings of fig (*Ficus carica* L.) cv. Dinkar

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The Fig (*Ficuscarica* L.), one of the earliest fruits cultivated by humans, originated in the Middle East. The fig is a traditional tree that produces highly nutritious fruits, commonly consumed in both fresh and dried forms. Fig seeds, being non-viable, require propagation through air-layering, cutting, grafting, and tissue culture. Grafting and air layering, even though a good method of propagation but deteriorates mother plant, yielding fewer seedlings. Hardwood cutting allows for substantial propagation, maintaining true-to-type material, but is time-consuming, with 20–30% survival due to poor rooting, posing adoption challenges. Hence, we conducted this experiment using an RBD design and examined six different combinations of Indole-3-butyric acid (IBA) and 1-naphthaleneacetic acid (NAA). viz. T_1 (IBA 1000 ppm), T_2 (IBA 2000 ppm), T_3 (NAA 1000 ppm), T_4 (NAA 2000 ppm), T_5 (IBA 1000 ppm + NAA 1000 ppm) and T_6 (IBA 2000 ppm + NAA 2000 ppm), with control, on rooting parameters and survival of hardwood cuttings of fig cv. Dinkar. Treatment T_6 showed the best results, with the highest rooting percentage of 69.22%, the longest root length of 23.18 cm, the most roots per cutting (26), and root weights of 2.53 g (fresh) and 0.79 g (dry). Furthermore, it had an 87.35% survival percentage when examined 90 days after planting (DAP). In conclusion, applying a combination of 2000 ppm IBA and 2000 ppm NAA to fig hardwood cuttings under shade house is advisable for nursery growers and researchers, as it significantly enhances rooting success and overall cutting survival rates.

Keys words- Fig, IBA, NAA, rooting, hardwood cutting

Seed enhancement - to improve seed germination and crop stand.

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Seed enhancement is a treatment of seeds that improve seed germination and seedling growth under various soil conditions by altering seed vigour. In many crop species, seed germination and early seedling growth are the most sensitive stages to several biotic and abiotic stresses, such as low and high temperatures, soil crusting, shortage or excess of water, salinity, pathogenic diseases and insects, can reduce the rate of germination or completely inhibit seed germination and seedling emergence, thereby leading to reductions in plant growth and final crop yield. The adverse effects of stresses during initial stages of plant growth can be alleviated by various seed enhancement treatments including, seed priming, is a controlled hydration of seeds, treatment with bioactive chemicals (seed fortification) for improving the germination and vigour, treatment with microorganisms (biological treatment) that can protect against various soil born fungi and bacteria and increase plant growth, seed coatings or pellets that can improve seed shape for planting and seed hardening, method to alter the physiological and biochemical nature of seed in order to overcome. The practice of this quality enhancement treatment can enhance speed and uniformity of seed germination and result in improved seed and seedling performance under normal and stress condition.

Keywords: Seed germination, plant growth promotion, seed enhancement, seed priming.

Nursery management for raising off-season onion seedling

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Research and development in off season production is important to mitigate the gap between demand and supply of onion during November – March along with increasing farmer's profit. Earlier research indicated that off season production have been tried out on the following areas- (1) date of transplanting, (2) suitable variety, (3) seedling growing and (4) raising of crop through seeds or sets. Among the various dates transplanting on mid-August to September was found to be ideal for West Bengal and adjoining areas. The overall performance of *kharif*onion in red and laterite belt of West Bengal was highly satisfactory with average bulb yield of 171.1q/ha. It has been showed that N-53, Nasik Red, N-53, LR- 241 and Red Creole varieties performed better as off season production. However, cultivar Agrifound Dark Red, L-883 Bhima Super, Bhima Red, Bhima Raj, Bhima Dark Red, Bhima Shakti, Punjab Selection, Pusa Red, N2-4-1, PusaMadhavi, ArkaKalyan, and ArkaLalima for *Kharif* while, recent Bhima Kiran found best for late *Kharif* production. The raised bed (10 cm height, 3 m length and 2 m width) was used to prepare the nursery for off season onion to avoid water stagnation and it should be open (cover only during rainfall). However, nursery production of *Kharif*onion crop often affected severely by cloudy atmosphere, late rains and incidence of various pest and diseases. Therefore, at present *Kharif*onion cultivation is restricted to certain area with low yield potential and poor keeping quality. Successful raising of nursery during summer season is the main problem for growing of *Kharif*season crop. Seed rate and set planting time are also important factors which may influence the growth and yield of onion sets in nursery. In an experiment conducted in Lucknow, it was seen that raised bed cultivation was better when transplanting was done during July to September while, flat bed cultivation was better for April transplantation of Agrifound Dark Red onion.

Key Words:-Seedling growing, sapling, suitable variety, raising of crop through seeds or sets

Effect of biofertilizers and growing media on survivability of air layers of pomegranate

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An experiment entitled effect of biofertilizers and growing media on survivability of air layers of pomegranate (*Punica granatum* L.) was carried out under shade net house at College Farm, College of Horticulture, Jagudan during kharif, 2021 and laid out by FCRD with three repetitions. Finding regarding effect of biofertilizers and media on survivability of air layers is less hence the present experiment was conducted. It consists of total treatment combinations having two different biofertilizers [Bio NPK consortium and phosphorus solubilizing bacteria (PSB) and five different growing media combinations (soil + sand, soil + FYM, soil + vermicompost, soil + sand + FYM and soil + FYM + vermicompost) were used in 1:1: proportion on volume basis. With respect to interaction effect treatment combinations B1G5 Bio NPK consortium + Soil + FYM + Vermicompost (1:1:1, vv/v)) was found significantly superior for length of primary root, fresh weight of shoot and root, dry weight of shoot and root and maximum root to shoot ratio on fresh weight basis at 75 DAP with survival percentage at 60 and 75 DAP, respectively.

Key Words: Pomegranate, Biofertilizers, Growing media, Air layer, Survivability.

Optimizing mango (*Mangifera indica* l.) seedling growth: pre-sowing treatments impact on stone germination and shoot development

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This study discusses the impact of various pre-sowing treatments on stone germination and subsequent shoot development on mango seedling growth. The experiment was taking for enhancing early seedling vigor stage using different methods such as priming with growth regulators, seed scarification, and varied substrate compositions. The results demonstrated that seed priming treatments had significant effects on mango seedling growth. Priming with growth regulators such as gibberellic acid and cytokinins had significantly increase germination percentages and vigor index. Seed scarification treatments improved in faster water uptake and germination rates. Further, seed priming with different included organic materials and nutrient-rich mediums, had a positive effect on seedling growth characteristics. These treatments not only increased germination but also improve shoot elongation rates, root formation, and biomass accumulation in seedling. Physiological analyses indicate that treated seedlings had increased chlorophyll content, enzyme activity, and stress tolerance. Overall, the results show that pre-sowing treatments increasing germination, establishing vigorous growth in early-stage seedlings and vigour index in mango seedlings.

Key words : Mango, Pre-sowing treatments, Stone germination, Shoot development, Growth regulators, Seed scarification

Effect of different planting time and stimulants on growth, flowering and yield of chrysanthemum

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An experiment was conducted to study the effect of different planting time and stimulants on growth, flowering and yield of chrysanthemum. The experiment was laid out in Split Plot Design with fifteen treatment combinations, consisting offive planting time*i. e.,* Third week of August, First week of September, Third week of September, First week of October, Third week of Octoberand three stimulants *i.e.,* Control (No spray), $FeSO_4$ 0.5 % + $ZnSO_4$ 0.5 %, *Panchgavya*2.0 % and replicated four times. Chrysanthemum planted in thirdweek of August recorded maximum plant height, plant spread in N-S and E-W, number of branches/plant, weight of 10 flowers, number of flowers/plant, weight of flowers/plant, yield of flowers/plot and per ha. Minimum days taken for 50 % flowering and was noted with third week of October planting. While, maximum flower diameter was noted with first week of September planting. Foliar application of $FeSO_4$ 0.5 % + $ZnSO_4$ 0.5 %at 30, 45 and 60 DATP resulted maximum plant height, plant spread in N-S and E-W, number of branches per plant, flower diameter, weight of 10 flowers, number of flowers per plant, weight of flowers per plant, yield of flowers per plot and yield of flowers per ha with earliness for 50 % flowering. Chrysanthemum planting in third week of August and foliar application of$FeSO_4$0.5 % + $ZnSO_4$0.5 % at 30, 45 and 60 DATP resulted highest plant spread in N-S and E-W, number of branches, maximum number of flowers/plant, weight of flowers/plant, yield of flowers/plot and per ha with maximum net realization (Rs. 407166.00) and highest cost benefit cost ratio. From the result of the present study, it can be concluded that chrysanthemum var. Bidhan Gold planted in third week of August along with the $FeSO_4$ 0.5 % +$ZnSO_4$ 0.5 %

at 30, 45 and 60 DATP enhanced growth and maximize flower yield with highest net returns and benefit cost ration.

Dry matter partition of African marigold seedlings influenced by vermicompost based media

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Experiment was carried out to accomplish better growth and seedling production of marigold in vermicompost based media. The experiment was conducted during December 2021 to January 2022 at Advance Training Centre of Soilless System for Production of Various Crops, ASPEE College of Horticulture, Navsari Agricultural University, Navsari. The experiment was laid out in Completely Randomized Design (CRD) with four repetitions, which consisted of seven treatments (Table 1). Observations were recorded one week after germination of seeds at weekly interval till 4th week. The results revealed that seedlings grown in cocopeat + vermicompost based media were noticed promising to increase the growth parameters as compare to other growing media used in this experiment. Among various growing media (T5) was found most effectivefor higher germination percent (95.32 %). Significantly maximum plant height (7.89 cm, 13.11 cm, 17.80cm and 24.65 cm), number of leaves per plant (2.65, 5.30, 6.90 and 11.30), stem girth (0.45, 0.77, 0.95 and 1.21 cm), fresh weight of leaves (297.30 mg, 981.62 mg, 1743.72 mg and 4673.75 mg), dry weight of leaves (28.57 mg, 106.75 mg, 184.00 mg and 525.25 mg),fresh weight of stem (78.42 mg, 330.12 mg, 767.12 mg and 2217.15 mg), dry weight of stem (5.82 mg, 27.90 mg, 69.15 mg and 234.50 mg), fresh weight of roots (87.12 mg, 434.35 mg, 858.00 mg and 1545.25 mg), dry weight of roots (10.75 mg, 49.00 mg, 92.75 mg and 165.00 mg), dry weight of seedlings (45.15 mg, 183.60 mg, 345.90 mg and 925.25 mg) were recorded in seedlings grown in T5 (Cocopeat + Vermicompost produced from Eiseniafetida(2:1 v/v)media at first , second , third and fourth week after germination respectively and found statistically at par with T6 and T7.

Key words: Vermicompost, cocopeat, media and seedling growth;

Effect of FYM and Azotobacter on the yield and nutritional quality of cauliflower (*Brassica oleracea var. Botrytis*) cultivar Amazing grown in trans-Himalayan region of Ladakh

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Cauliflower (Brassica oleracea var. botrytis L.), is consumed for its white curd, which belonging brassicaceaefamily. It is in high demand by Indian shoulders and local residents of high-altitude regions due to its excellent nutritional value. A prolonged severe winter in a cold desert environment reduces the farming season 4 to 5 months per year due to high snowfall. Fresh, nutrient-dense food is scarce in this region all year. Following that, in difficult climatic and high-altitude situations, improve the yield and nutritional quality of cauliflower, which are major challenges that can only be solved by bio-organic farming. The present study was designed to evaluate the effect of FYM and azotobacter on the yield and nutritional quality of cauliflower (Brassica oleracea var. botrytis L.) cultivar Amazing grown at trans-Himalayan region(3340 metres, Leh-Ladakh, India)during the cropping season of 2020-2021. Experiment was carried out in randomized block design with three replications and four treatments [T1-(FYM @ 150 q/ha), T2-(Azotobacter @ 8.6 kg/ha), T3-(FYM @ 150 q/ha+ Azotobacter @ 8.6 kg/ha) and T4-(Control)]. The treatment T3 resulted in highercurd

yield compared to T1, T2 and control. The TSS, titratable acidity, crude protein, total carbohydrate, dietary fiber, crude fat, and minerals like N, K, Mg, Mn, Zn and Fe, contents were found higher in T3 treatment compared to T1, T2 and control. Overall, this study concludes that bio-organic farming for sustainable cauliflower production at cold desert regionresulted in more yield and nutritional quality compare to the control.

Keywords: Cauliflower, Bio organic, Nutritional quality, High-altitude

Effect of pinching and growth retardants on growth and flowering of pot chrysanthemum

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The study investigated the effects of different treatments involving pinching and foliar application of growth retardants on the growth and flowering of chrysanthemums (*Chrysanthemum morifolium L.*) grown as a flowering pot plant. The experiment comprised of eleven treatments, including different pinching timings and various concentrations of Paclobutrazol, Maleic Hydrazide, and Daminozide. The results showed that the treatment with pinching at 20 and 40 Days After Transplanting (DAT) resulted in significantly maximum plant spread (in both N-S and E-W directions), a higher number of branches and suckers per plant, maximum number of flowers per plant, and the longest flowering period. However, this treatment also led to reduced flower diameter and plant height. On the other hand, the control group showed early bud initiation, flower opening, 50% flowering, and the maximum flower diameter. Based on the visual appearance of the plants as a pot plant using the hedonic scale, the best visual score (8.27) was obtained from plants that were pinched twice at 20 and 40 DAT.

Keywords: Chrysanthemum, Growth Retardants, Pinching, Pot Plant, Visual Appearance

Session V

Innovative Production Technologies for Indian Needs

Recent trends in standardization of rootstocks for abiotic stresses in fruit crops

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India, the world's second-largest fruit producer, faces a concerning decline in fruit crop productivity over the past decade, dropping by 13.06% from 17.6 Mt/Ha in 2012-2013 to 15.3 Mt/Ha in 2021-2022. Abiotic stresses, exacerbated by climate change, are identified as major contributors, including intermittent precipitation, thermal stress, drought, salinity, and excessive irrigation. Addressing this challenge necessitates a strategic focus on rootstock selection and improvement, recognizing the critical role of roots in plant defense against abiotic stresses. Certain rootstock species and ecotypes exhibit key genes, molecular networks, and quantitative trait loci that enhance tolerance to various stresses. Studies emphasize the importance of purposefully selected rootstocks in increasing food security by optimizing natural resource utilization and reducing chemical inputs. This review highlights rootstock research in different national fruit crops, emphasizing their role in enhancing stress tolerance, improving fruit quality, and maximizing yields. The paper advocates for continued research to develop technologies tailored to the diverse climatic conditions of tropical, subtropical, semi-arid, and arid regions, aiming to secure sustainable fruit production in the face of changing environmental dynamics.

Exploiting water scarcity in positive way: Physiochemical and organoleptic aspects of drought stress in fruit crops

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Global horticultural crop cultivation faces a significant challenge due to insufficient water in arid or semi-arid regions. In India, horticultural production rose to 342.33 million tonnes in 2021-22, a 2.3% increase, yet changing climatic conditions, including drought, heat, salinity, and nutrient deficiencies, impact crop growth. India, with 51 million hectares of drought-prone land, spanning 74 districts in 13 states, experiences escalating drought severity due to climate change. Drought stress disrupts normal plant growth, water relations, and efficiency. Tackling this intricate mechanism involves interventions at various plant levels triggered during different developmental stages. Moderate deficit irrigation is beneficial, preventing excessive growth and enhancing fruit quality. Controlled soil drying and salt stress stimulate hormone production, reinforcing plant defense. Fleshy fruits, celebrated for nutrition and flavor, are affected by soil salinity, water deficit, light intensity, and vapor pressure deficit. Optimal fruit quality, crucial for consumer appeal, necessitates effective irrigation strategies. In drought-stressed areas, selecting rootstocks ensuring scion survival is vital for sustainable fruit production. Prioritizing Hydro SOS technologies for low to moderate water requirement crops and labeling them as 'hydro SOS products' can maximize returns in limited water conditions, offering high-quality fruit to consumers. Developing such technologies becomes imperative for sustainable and resilient fruit production in the face of changing climates.

Water chestnut (*Trapa natans* var *bispinosa* Roxb.*)* has Potential for Sustainable Wetland Horticulture

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Water chestnut (Trapa natans var. bispinosa Roxb.), a wetland crop, is gaining significance for its ecological and horticultural importance. Cultivated for centuries, it supports livelihoods for many Indian farmers. The crop, historically neglected, holds ethnobotanic importance, used fresh, boiled, or ground into flour for religious fasting. It fosters biodiversity by providing habitat and forage for wetland birds. Water chestnut aids bioremediation by scavenging heavy metals and fixing nitrogen and phosphorous. Its biomass enriches soil fertility post-harvest. Despite increasing cultivation, scattered information and lack of standard varieties pose challenges. Farmers rely on traditional practices due to the absence of standardized planting materials and cultivation guidelines. The germplasm exhibits wide variability, and farmers, aiming for higher yields, resort to indiscriminate agri-chemical use. The absence of standardized doses and increasing availability of plant protection chemicals contribute to this practice. Given these challenges, there is a crucial need to develop technologies for water chestnut cultivation, aligning with existing literature to ensure sustainable and optimized practices.

Vegetable based annual cropping sequence under multistorey cropping system for Tripura

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In the tropical northeastern climate of Tripura, cultivation of winter and summer vegetables thrives, yielding a total production of 688,268 MT over 39,119 hectares with a productivity of 17.59 MT/ha. To enhance land equivalent ratio and profitability, a vegetable-based multistorey annual cropping sequence was established. Vine crops like lablab bean and bottle gourd were grown in winter, with low-height vegetables cultivated under bamboo-framed bower structures. In winter, under lablab bean, ground crops such as French bean, peas, and brinjal exhibited profitable benefit-cost ratios (BC ratios) ranging from 3.1 to 4.0. Similarly, under bottle gourd, BC ratios for ground crops ranged from 2.9 to 3.5. In the summer season, under teasel gourd and ridge gourd, ground crops demonstrated BC ratios of 3.1 to 3.4. The land equivalent ratio (LER) values indicated the profitability of the multistorey cropping system. Monthly farm activities showed high BC ratios in January, February, July, December, May, and June. Ridge gourd, teasel gourd, lablab bean, bottle gourd, brinjal, and chilli exhibited the highest BC ratios in their respective months. The integrated nutrient management approach was followed, resulting in a highly profitable and sustainable vegetable cropping system, demonstrated successfully at farmers' fields.

High Density planting in tropical fruit crops

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In fruit crop cultivation, determining the ideal plant density per hectare is crucial for efficient land utilization. Factors such as scion characteristics, rootstock type, climate, soil fertility, and orchard management practices influence spacing decisions. While wider spacing reduces bearing units and yields,

global trends favor high-density planting to optimize land use, address increasing costs, and achieve early returns on investment. In tropical fruit crops, research focuses on high-density planting, considering climate zones and variables like spacing, rootstock, training, pruning intensity, and plant growth regulators. Mango cultivation employs dwarf rootstocks like vellaikolunban, with spacing at 2.5 x 2.5m and 3.0 x 2.0m for varieties like amarapalli and dashehari, coupled with annual pruning and rejuvenation techniques. Banana plantations adopt pair row systems with two to three suckers per hill. Pineapple cultivation reaches ultra-high density with over 60,000 plants per hectare. Citrus and cashew also benefit from high-density planting with open-center systems, and dwarfing rootstocks for citrus are identified. Private companies, such as Jain Irrigation and Reliance Foundation, contribute to high-density planting research. Fruit growers in tropical regions can embrace high-density planting for early returns, emphasizing careful consideration of increased plant density.

Collision and adjustment of climate change on Horticultural crops in Gujarat

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Climate change in Gujarat is evident through altering climatic parameters like temperature, wind velocity, and humidity, posing significant challenges for horticultural crops. Diurnal temperature variations persist throughout seasons, and rain intensity has increased with a prolonged monsoon period extending up to October. These changes impact the physiology of horticultural crops, reducing cold days and making them more vulnerable. The rise in temperature adversely affects growth, development, quality, and productivity of crops. Higher temperatures elevate respiration rates, modify photosynthesis, and affect the allocation of photosynthates to economic plant parts. Temperature-induced alterations in phenology, flowering, fruiting, maturity, ripening, and senescence become evident. Sensitivity to temperature varies among crops, with indeterminate crops showing more resilience due to extended flowering. Mitigating the adverse effects of climate change involves adjusting cultivation techniques. Using tolerant or resistant crop varieties, optimizing transplanting and planting times, adopting suitable training/pruning methods, and efficient irrigation and fertilizer management are crucial. Adaptations in maturity indices and harvesting practices further contribute to safeguarding crops from climate change impacts. While complete mitigation may be challenging, implementing these adjustments becomes imperative for successful horticultural cultivation amid changing climate conditions.

Potential indigenous fruits for the future

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Indigenous subtropical fruits because of their hardy nature of tree, high production potential in degraded lands and high nutraceutical value have immense potential for commercialization in India in the years to come. During last 50 years, most of the horticultural development efforts have been confined to the improvement and commercialization of major fruit crops like mango, banana, apple, guava, citrus, papaya, litchi, grapes, etc. Work done on under-utilized subtropical fruits in the country especially during last two decades has opened up new vistas of horticultural growth in general and arid and semi-arid regions in particular for enhancing small farmers' profitability and also the nutritional security. The crops like aonla (Emblica officinalis Gaertn), bael (Aegle marmelos Correa, jamun (Syzygium cumini Skeels), custard apple (Annona squamosa L.), khirni (Manilkara hexandra (Roxb) Dubard), carambola (Averrhoa carambola L.), mulberry (Morus spp), barhal (Artocarpus lakoocha Roxb), karonda (Carissa carandas L), tamarind (Tamarindus indica L.), chironji (Buchanania lanzan Spreng), wood apple (Limonia acidissima L.), jackfruit

(Artocarpus heterophyllus L.) and paniyala (Flacourtia jangomoas (Lour.) Raeusch) have a lot of diversity in hot spot areas and offer immense potential of identifying superior genotypes for commercialization. The present paper deals with the identification of superior types in these crops through survey in hot spot areas and characterization and evaluation and prospects of their utilization for enhancing profitability and nutritional security of small land holders. It also deals with the latest efforts made in the development of superior genotypes of such potential indigenous fruits in the country. Aonla cultivars like Kanchan, Krishna, NA-7, NA-10, Lakshmi-52, Goma Aishwarya have gained popularity while CISH B-1, CISH B-2, Pant Aparna, Pant Sujata, Pant Shivani, Pant Urvashi, NB-5, NB-7, NB-9, NB- 16, NB-17, Goma Yashi, Thar Divya and Thar Neelkanth of bael have spread in many new areas and contributed to enhanced profitability. Paras, Konkan Bahdoli, Thar Kranti, Goma Priyanka, CISH J- 37 and CISH J-42 (seedless) have been developed in jamun for commercialization. Arka Sahan and Balanagar custard apples re being adopted in various degraded areas. Thar Priya and Thar Rituraj identified in chironji and khirni, respectively have become a new hope for plateau of central and western India. Pant Manohar, Pant Sudarshan, Pant Suvarna, Maroon coloured, White Pink Blush and Thar Kamal in karonda and Konkan Prolific, Singapore/Ceylon Jack, Hybrid Jack, Burliar-1, PLR-1 (Palur-1), PPI-1(Pechiparai-1) in jackfruit are some of the promising cultivars developed for commercialization. New superior genotypes of jack fruit from Uttar Pradesh and adjoining areas have also been identified. The crops like mulberry, barhal, wood apple, khirni, chironji, carambola, paniyala have exhibited tremendous variability in fruit traits for selection and commercialization of new cultivars. As paniyala is confined only in certain areas of Gorakhpur and Kushinagar, efforts are on to obtain the GI status for the important fruit to save it for future generations, The expected economic returns from the crops like custard apple, bael, jamun, chironji, khirni, carambola, jackfruit, etc are very high when marketed properly.

Microgreens for enhancing sustainable food and nutritional security

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The access to safe and nutritious food is a fundamental right of every individual. Nutritional insecurity or malnutrition is one of the serious problems for today's world and severely affecting third world countries particularly weaker sections in the population,together with pregnant and lactating mothers, children and adolescent girls. Issue of food and nutritional security is also considered as critical for the security of any nation. According to a report about 42.1 per cent of the global population cannot afford healthy food and the situation becomes more frightening with respect to the developing countries. Therefore, ourfood systems must be revised to provide adequate nutrition while minimizing adverse environmental impacts. A new class of vegetable crops called microgreens (the tiny format of leafy vegetables), considered to be a dense source of nutrition and has the potential to be produced by any locale within a short period of time (7-21 days) that could be described asthe 100-yard dash of food crop production. They can be considered as better substitutes for sprouts as well as mature greens due to their rich nutritional content and more intense flavor and taste. Depending on species and growing conditions, microgreens are generally measure between 2.5 and 7.6 cm in height and usually harvested at the base of hypocotyl when cotyledonary leaves are fully developed, with or without the emergence of a small pair of true leaves. Even though small in size, microgreens can provide surprisingly intense flavours, different colours, and crisp texture, and can be served as a new salad ingredient or an edible garnish. Growing microgreens require 158–236 times less water than it does to grow a nutritionally equivalent amount of mature vegetable in the fields and 93–95% less time and without the need for fertilizer, pesticides, or energy-demanding transport from farm to table. Microgreens are loaded with minerals and phytochemicals and considered as the powerhouse of nutrients. They are rich in vitamins (e.g., vitamin C), minerals (e.g., copper and zinc) and phytochemicals, including carotenoids, phenolic compounds

and glucosinolates (GLS). Microgreens are currently considered among the five most profitable crops globally, along with mushrooms, ginseng, saffron and goji berries.

Key words: Antioxidants, minerals, microgreens, nutritional security.

Improved Technologies for Enhancing the Productivity and Profitability of Papaya

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Papaya (Carica papaya L.) ranks as the 4th most crucial fruit crop in India, with the country being the largest global producer, followed by Brazil, Mexico, and Nigeria. Worldwide, papaya production reaches 13.158 million MT across 4.6 lakh ha. In India, papaya cultivation spans 1.44 lakh ha, yielding 54.51 lakh tonnes at an average productivity of 37.85 t/ha. Papaya stands out due to its early flowering, year-round fruiting in tropics, high productivity, and palatable fruits. However, challenges plague papaya cultivation, including a shortage of genetically pure seeds, absence of suitable high-yield varieties resistant to viral diseases, limited awareness on improved technologies, and inadequate post-harvest facilities. Research efforts have led to the development of dioecious and gynodioecious varieties. Optimal cultivation practices involve seed propagation, enhanced germination with plant growth regulators, biofertilizer integration, drip irrigation, and micronutrient application. Aphids, transmitting Papaya Ring Spot Virus (PRSV), pose a threat, alongside papaya leaf curl virus, collar and foot rot. Cultivation in poly and net houses proves beneficial, offering protection against cold and viruses. Post-harvest practices are crucial, requiring careful handling during harvesting, transportation, and storage. Grading, immediate post-harvest cooling, and appropriate packaging are vital for reducing losses. Preferred market attributes include deep orange/yellow, uniformly round, fresh fruit, stored at 10-12° C with 90-95% R.H. to extend availability.

Low cost protected structure to enhance vegetable production during rainy season in the foot hills of eastern himalayan region

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Cultivation of vegetable crops become challenging from April to October months in the foothills of the Eastern Himalayan region due to excessive rain, waterlogging, high soil moisture and severe disease and pest infestation. Consequently, the price of fresh vegetable remains very high. The adoption of small-scale low cost protected structures for cultivation of high value vegetable crops has tremendous potential to enhance productivity, generate employment, utilize land efficiently and secure better market prices. To encourage vegetable cultivation during the rainy season under low-cost protected structures, three different vegetable-based cropping sequences were evaluated for their suitability under low cost protected structures. Preference was given to high-value and less competitive vegetables to achieve higher profitability for small farmers. The results showed that low-cost protected structures offered a comparatively suitable microclimate for the growth of different vegetable crops. Cauliflower, cabbage, French bean, palak and coriander leaves are highly remunerative during the rainy season under low-cost protected structures. Overall, the yield and quality of different vegetable crops have improved significantly which is not achievable under open field conditions. Moreover, low cost protected structures, can become a remunerative agro-entrepreneurship opportunity for small farmers. However, farmers need a minimum level of skills to take advantage of protected cultivation, especially in relation to effective management of crop sequences, inputs usage and management of disease and pest of crops. The full paper discusses the full spectrum of vegetable cultivation

under low-cost protected structures, performance of different cropping sequence, yield, profitability and major limitations in the adoption of the technology.

Key words: Low cost protected structures, Vegetable cultivation, Rainy season and Agro-entrepreneurship.

Potentials of Pomegranate for Health and Prosperity

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Pomegranate (Punica granatum L.) native of Iran and the Himalayas, is the most historic fruit tree domesticated for its innumerable health benefits since time immemorial. Folk medicines have been using this tree for a long time and its use in modern-day medicine continues. All parts of this miracle tree- the roots, stems, leaves, bark, flowers, fruits, seeds, rind, etc. are being exploited in pharmacy, the leather/dye industry and for decorative items. The nutraceutical, pharmaceutical, and cosmetic industries are having proliferating business with pomegranate especially in the European, American and some Asian markets including India. About two decades back consumer awareness towards its innumerable health benefits increased market demand, resulting in alluring monetary returns from this horticulture crop especially in India, resulting in constant increase in area and production of this crop. Analysis of pomegranate statistics in India for last 10 years shows that, average increase in area was 169%, production 340%, productivity was 64 % and export 264%. Today India is the global leader in pomegranate cultivation. In the coming years the pomegranate can become one of the most important horticultural crops of India. Analysis of Benefit:Cost ratio of different field, vegetable and fruit crops in Maharashtra revealed, maximum benefit (C:B::1:2.5) with pomegranate cultivation. Its cultivation in arid and semi-arid regions and tribal areas will not only be beneficial in monitory terms but its consumption will ensure nutritional security of the rural and tribal population. Further with advances in post-harvest technology and promotion of processed and pharmaceutical products in local and global markets, the pomegranate industry is expected to have a bright future. It will not be wrong to say that pomegranate is a highly remunerative crop for replacing subsistence farming and thus alleviating poverty levels. Pomegranate is a crop for health, wealth and prosperity.

Apricot Production in the trans-Himalayan Ladakh, India: Competitive Advantages and Future Directions

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Apricots and apples are major fruit crops in Ladakh, covering 15.1% of the total cropped area (23,612 hectares). In 2022, the region, the largest apricot producer in India, yielded 15,864 tonnes, with 5,059 tonnes from Leh and 10,805 tonnes from Kargil. Historically, Ladakh's dried apricots, like Phating and Raktsey Karpo, were traded with neighboring countries, and the region is gaining recognition for its premium fruit quality. Despite past restrictions, recent initiatives and government support have propelled Ladakh's apricots into new markets. In 2021, the maiden export to Dubai marked the beginning of global recognition. Subsequent exports to Singapore, Mauritius, and Vietnam followed in 2022 and 2023, totaling 58 tonnes. Under the One District One Product (ODOP) scheme, apricots in Kargil are a focus for value chain development. To further promote Ladakh's apricots, the Ladakh Tourism Department initiated the 'Apricot Blossom Festival' from 2021. The Defence Research Development Organisation (DRDO) and the Ladakh Administration established a model apricot processing plant in 2022, demonstrating a complete supply chain under the Government-Owned Contractor Operated (GOCO) model. Ladakh's Raktsey Karpo received the

Geographical Indication (GI) tag in December 2022, elevating it to the region's first GI-tagged product. These efforts position Ladakh as a potential global hub for quality apricot production.

Prospects of exotic leafy vegetable cultivation in North East India

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North East India, being a mega bio-diversity hotspot, abounds in diverse bio-resources owingto different climatic conditions of the region. All types of vegetables, ranging from sub-tropical to temperate, can be cultivated at different locations and season in the region. Hence,there is tremendous scope for crop diversification through introduction of exotic leafyvegetables, synchronising time of cultivation between plains and hills, to ensure round-theyear availability of the vegetables in the market. The hill districts of the region experiencecold winter and mild summer, which offers congenial environment for year-round productionof leafy vegetables. These vegetables will have better acceptance by the local population, asleafy vegetables are preferred for preparation of boiled delicacies by the people of the hills. Few exotic leafy vegetables such as Pakchoy, Lettuce, Swiss chard, Chinese cabbage, Parsleyand Celery has been cultivated under greenhouse as well as in the open field at Defence Research Laboratory R&D Centres at Tawang, located at an altitude of 10,000 feet and Salariat 3500 feet in Arunachal Pradesh since 2018. Good growth of these leafy vegetables hasbeen observed at both the locations with good acceptance by the local populace. Standardcultivation practices of these leafy vegetables at high altitude and mid-hill condition of Arunachal Pradesh are being developed through various on-going field trials. Arunachal Pradesh have the geographic advantage over Assam, as these vegetables can be grown hereduring summer, while it can be grown during winter in Assam, thereby ensuring round theyear availability of these vegetables in the market. The improvement in road conditions hasresulted in decrease of transportation cost and time to Assam, thereby opening better marketprospect for farmers in Arunachal Pradesh.

Keywords: Exotic leafy vegetables, North East India, Arunachal Pradesh

Screening and a deeper understanding towards drought tolerance in (*Cucumis sativus* L.)

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Cucumber is a widely cultivated summer season vegetable that faces frequent water scarcity during its growing season which can limit the plants growth and ultimately yield. In this study, to understand basis of drought tolerance; different cucumber genotypes were screened in control and field condition. six genotypes belonging to 3 different drought response group (tolerant, intermediate and susceptible) were subjected to osmotic stress after growing in hydroponics and different tissues were analysed. Leaves were most sensitive to drought stress. Tolerant genotypes maintained better relative water content, membrane stability, and osmotic potential and exhibited higher rates of photosynthesis, transpiration, lower canopy temperature. Intermediate and susceptible genotypes showed higher malondialdehyde, hydrogen peroxide levels and tolerant genotypes had significantly higher proline content. Gene expression analysis revealed hormones like auxin, ethylene-responsive transcription factors, heat shock proteins, MYB transcription factors and tonoplast intrinsic proteins might have contributed towards drought tolerance. These findings will potentially lay the ground work for better understanding and targeted strategies to enhance stress tolerance in cucumber plants.

Keywords: Tolerant, osmotic, malondialdehyde, membrane, gene

Smart Irrigation management in tomato: FDR soil moisture Sensor, evapotranspiration and cropwat 8.0 Model - based deficit irrigation to enhance WUE

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Globally, 0.76% of Earth's total freshwater is available for human use and staggering 70% of this limited resource is allocated to agriculture. Inefficient farming practices contribute to a substantial 60% of waste, underscoring the sector's inefficient water utilization. In India, 48.8% of agriculture relies on irrigation, while the remaining 51.2% depends on rainfall. Food security is complicated by diminishing agricultural land, water scarcity and concerns related to climate change. Enhancing Water Use Efficiency (WUE) and minimizing the 60% waste in agricultural water are pivotal to tackle these issues. This study, titled "Smart Irrigation Management In Tomato: FDR Soil Moisture Sensor, Evapotranspiration and Cropwat 8.0 Model - Based Deficit Irrigation to Enhance WUE" spanned two years and featured eight treatments with three replications under a pooled Randomized Block Design. The investigation explored Deficit Irrigation (DI), deliberately supplying less water than the full demand, as a potential solution. Utilizing three distinct irrigation scheduling approaches - Frequency Domain Reflectometry (FDR) based soil moisture sensor, Pan Evaporation Fraction (P_{EF}) and Irrigation simulation model - Cropwat 8.0 the study revealed significant influences on diverse tomato crop parameters based on varying irrigation levels. The research demonstrated that Treatment T_1 (FDR soil moisture sensor-based irrigation at 100% FC) yielded the highest values across growth parameters, yield aspects, quality metrics related to fruit morphology and economic considerations. Treatment T_2 (FDR soil moisture sensor-based irrigation at 90% FC) closely followed, exhibiting comparable data in terms of yield components and quality parameters, while demonstrating better water productivity with a 10% water savings and negligible reduction in Benefit-Cost Ratio (BCR).

Understanding the thermosensory behaviour of cauliflower through developmental transitions and morphologies at variable sowing time-points

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Cauliflower (*Brassica oleracea* L. var. *botrytis* 2n = 2x =18) is a highly thermosensitive crop, showing specific temperature requirements for curding and flowering. Based on its temperature requirement for curd initiation it is classified as Early (20-27 °C), Mid-early (16-20 °C), Mid-late (12-16 °C), and Late (10-16 °C). To widen its curding and flowering plasticity, a clear understanding of the effect of temperature on its growth and development is necessary. In the present investigation, three varieties from each maturity group (i.e., Early,Mid-early, Mid-late, and Late) were sown five times (S1: 30.07.2022, S2: 30.08.2022, S3:30.09.2022, S4: 30.10.2022 and S5: 30.11.2022) in Randomized Block Design (RBD). Eight morphological and seven developmental transition traits were recorded from 30 August 2022to 30 May 2023. The period of testing

coincided with a gradual reduction in temperature from July (30.5 °C) to January (12 °C) and thereafter, rise up to May (28.8 °C). Early groupvarieties, showed maximum reduction in days to curd initiation (-31.58%), bolting stage (-28.66%), flowering termination (-28.71%) in S4 sowing, and plant height (-63.8%), plant spread (-65.96), leaf length (-63.11), leaf width (-72.08%), leaf number (-41.26%), curd length (-58.12%), curd width (-61.63%), stalk length (-55.48%) in S3 sowing compared to their recommended sowing time (30.07.2022). The maximum days to curd initiation were observed for early group (105 days), mid-early group (138 days), mid-late group (149 days) in S5 and for late group (154 days) in S1. Leaf number could not result strong correlation with curding and subsequent transitions in tropicalized cauliflower. In conclusion, temperature showed a direct relationship with developmental transitions and also had an impact on morphometric traits in all the maturity groups. The study has the prospect of further understanding the genomic-physiological regulations of these developmental transitions for breeding wider plasticity varieties in cauliflower.

Keywords: Curding, developmental transitions, flowering, morphology, temperature, thermosensitive

Effect of Transformed Rooting Zones on Dragon Fruit Yield, Storage Quality, and Profitability in Water-Scarce Rocky Regions

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Land degradation is one of the key and extensive challenges which bring uncertainty for achieving goals of food security and ecological sustainability worldwide. A major portion of water scarcedegraded areas in peninsular India are constituted by shallow basaltic soils where agricultural crop sespecially fruit trees are constrained with several edaphic stresses. To improve soil water and nutrient dynamics of the rooting environment, the effects of replacing poor water retentive and low fertility soil of planting site were evaluated. Method of planting was shifted to trench instead of pit planting for better root anchorage. Trenches (30 m length × 1 m wide × 0.5 m deep) and pits (1 m × 1 m × 0.5 m) spaced at 3.5 m were dug along the breadth of the experimental field (0.33 ha). Trenches were refilled either with i) original native soil (*T*-native, loamy sand; clay 10.3%; mostly *murrum* with 26.7% stones (> 2mm), field capacity, FC 19.7%; OC 0.0.17%; Av-N 54.6 kg ha^{-1}; Av-P 1.3 kg ha^{-1}),or ii) black soil transported from adjoining fields (T-black, clay 54.4 %; FC 42.2% , Org-C 0.70%;Av-N 157.1 kg ha^{-1}; Av-P 6.3 kg ha^{-1}) and iii) mixture of the two soils (*T*-mixed, 1:1 Black: Native). Different trench soils were compared with pit filled with original native soil (P-control) a common practice adopted by farmers. Thereafter, response of dragon fruit (*Hylocer eusundatus*), belonging to Cacti family with fibrous root system and less sensitive to water stress, was evaluated and compared with pit planting in native soil for seven years. Recommended package of practices were followed at transplanting and the following plant growth. Marked differences in yields and quality of fruits were monitored for different trench soils over pit planting. When averaged for later 5-years, 45% higher fruit yield (18.2±1.0 Mg ha^{-1}) was harvested from *T*-mixed soil over *P*-control (12.4±1.2 Mg ha^{-1}) while the yield losses were reduced by 40%. The respective values for T-black soil were 32 and 20%. Even in *T*-native soil fruit yield improved by 13% with corresponding's 18% reductions in yield losses over *P*-control. Marketable quality attributes such as fruit weight, fruit size metrics and pulp/peel content were further improved under T-mixed soils. Accumulation of total soluble solid (TSS), sugar content, phenolic and flavonoid compounds which affect antioxidants capacity were higher in fruits harvested from *T*-native soil. During storage, fruits from the native soil (*T*-native and *P*-control) maintained minimum physiological weight loss (PWL) and retained more firmness, TSS, sugars, titratable acidity, phenolic flavonoids contents, FARP and DPPH activities. Highest

PLW (10%) was monitored in fruits harvested from *T*-black soil. It is concluded that *T*-native provided better hydrozone and nutrients for resilience of fruit plants while protecting them from the aeration problems as envisaged in poorly drained black soils. For the economic viability of dragon fruit cultivation, maximum B: C ratio (1.85) and lowest payback period of (4 years) on investment on orchard was found in *T*-mixed soils. Hence, soil management module of planting in trenches filled-in with mixture of native and black soils can be recommended to boost the productivity of dragon fruit on shallow soils in rocky terrain.

Keywords: Dragon fruit, antioxidant capacity, storage quality, degraded lands, cost-economics

Silicon – The most under appreciated element for vegetables

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Vegetables are so common in human diet that a meal without a vegetable is supposed to be incomplete in any part of the India. Vegetables are important food and highly beneficial for the maintenance of health and prevention of diseases. Silicon (Si) has not been recognized as an essential element for plant growth but beneficial effects of Si have been observed in a wide variety of plant species. The positive effects of Si are usually expressed more clearly in Si-accumulating plants under various biotic stress conditions. Silicon is effective in controlling various pests and diseases caused by both fungi and bacteria indifferent plant species. Silicon also exerts alleviative effects on various abiotic stresses including salt stress, metal toxicity, drought stress, radiation damage, nutrient imbalance,high temperature, freezing and so on. These beneficial effects are mainly attributed to the high accumulation of silica on the tissue surface although other mechanisms have also been proposed. This review paper is tribute to understand different aspects of silicon viz., silicon absorption by plants, reaction of silicon in soil, silicon transport and content in plants, sources of silicon and beneficial effects of silicon furthermore review of research work for vegetable crop production also included.

Key words : Vegetables, Silicon, Biotic and abiotic stress.

Challenges in organic farming

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While organic farming has gained popularity for its emphasis on sustainability and reduced use of synthetic inputs, it is not without its challenges. Some of the common problems associated with organic farming include: Yield limitations: Organic farming often yields lower quantities compared to conventional farming. This is primarily because organic practices rely on natural processes and may not use synthetics. Nutrient management: Organic sources of nutrients can be unpredictable in terms of nutrient content. Pest & disease control: Organic farmers relying on crop rotation, companion planting, and biological control methods. However, these methods may not always be as effective as chemical pesticides. Weed control: Organic farmers often use mechanical methods which can be labour-intensive and may not be as efficient as synthetics. Transition period: Transitioning from conventional to organic farming involves a financial challenge for farmers. Market Access, Price Premiums & Certification costs: Organic demand is increasing, but farmers face challenges in accessing markets and achieving price premiums due to rigorous certification processes and high costs. Knowledge & Education: Organic farming requires a comprehensive understanding of ecological processes and sustainable farming techniques, and inadequate knowledge and education among farmers can hinder its successful implementation. Limited research & extension services:

Organic farming may face less support compared to conventional agriculture, potentially hindering the development and dissemination of effective practices. Availability of inputs: Organic farmers face challenges in adopting and maintaining organic practices due to inconsistent availability and cost of organic inputs. Post-Harvest Handling: Organic produce needs to be handled carefully to maintain its organic status. It's important to note that while organic farming faces these challenges, ongoing research and innovations are helping to address some of these issues and improve the sustainability and efficiency of organic agricultural practices.

Keywords : Organic farming, Challenges, Problems, Production and Practices.

Nitrogen and protein content in the edible head of Red Cabbage (*Brasicca oleracea* var. *capitata* f. *rubra*) grown in open field conditions at DIBER, Haldwani

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Brassica oleracea is grouped under the one name of red cabbage which is a constituent of a well known antioxidant properties due to anthocyanin, flavones content and is a reddish purple-leaved variety of Capitata group which is also known as Blaukraut after preparation. It is an herbaceous plant with colored dark red/purple fleshy leaves. Freshly harvested heads are used as salad and dried cabbage extract powder marketed as natural food color. The major constituents of red cabbage are digestible carbohydrates, fat, proteins, fibres, fatty acids, and proximate minerals like calcium, magnesium, potassium, sodium, iron, zinc, manganese, copper etc. The anthocyanins are considered to be a potent medicinal compound and are found in the heads. In India it has been utilized as health improvement, prevention of diseases and recognized as antioxidant and anti-inflammatory properties raised its demand among western countries. Nowadays, it is most popular in Europe, USA, China and Africa; they are making powder with the red cabbage to use it as a food color. The exact stat of demand in international market is indeterminate, which is estimated much more higher than the present production. To meet the increasing demand, now farming system has been introduced in some parts of India. Recently, several farming systems for cultivating cruciferous crops with black polythene mulch have been studied. Using a mineral fertilization system, dissolved nutrient solution has been supplemented to an optimal level for red cabbage, which shown to be indispensable for the proper growth of the ball of tight leaves. The experiment was conducted during July - December 2022 at DIBER (DRDO), Haldwani. The objective of this study was to compare the nitrogen and protein content of edible leaves of red cabbage by using Kjeldahl method. To the conclusion, significant differences were found for N_2 content (0.62-2.62 %), protein content (2.73-11.55 %), fresh weight of leaf (1.58-33.40 g) and dry matter of leaf content (0.40-6.12 g) between the studied leaves. The reported changes accounted for head weight, fresh core weight, and dry matter of core content.

Fruiting, yield, and quality attributes of aonla as influenced by the foliar applications of Boron, Zinc, and NAA

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The Indian gooseberry, or Aonla (*Emblica officinalis* Gaertn.), a member of the Euphorbiaceae family and a native of tropical South-East Asia, mainly central and south India, has been grown in India since ancient times. It can be grown successfully on marginal wasteland, sodic soil, ravine land, arid and drought-prone areas. Its fruits are prized for its high nutritional content, therapeutic characteristics, anduse in the production of value-added products and herbal medications. Foliar application of plant bio-regulators and

micronutrients plays a huge role in boosting fruit set, productivity, and fruit quality. Boron is essential for value development, pollen tube growth and fruit set. An experiment was conducted in the Horticulture Garden of the C. S. Azad University of Agriculture and Technology, Kanpur (U.P.), India, during two subsequent years, namely 2018-19 and 2019-20, using ten treatments, namely borax at 0.1, 0.3 and 0.5%, zinc sulphate at 0.2, 0.4 and 0.6%, and NAA at 10, 20 and 40ppm, as well as a control (water spray). The goal of the experiment was to assess fruiting, yield, and quality attributes of aonla as influenced by the foliar applications of Boron, Zinc, and NAA. Data for both years of research were pooled and reported that a greater concentration of NAA (40ppm) considerably reduced fruit drop (68.75 %) and increased fruit retention (31.25 %). It also produced the highest fruit yield(84.18kg/plant), resulting in increased fruit length (4.11cm), fruit width (4.88cm), fruit weight (36.76g), fruit volume (33.65cc), specific gravity (1.17g/cc), pulp weight (35.21g), and maximum pulp stone ratio (24.51%). During investigation periods, plants treated with Borax @ 0.5% had higher ascorbic acid content (635.04mg/100g pulp), whereas foliar application of $ZnSO_4$ @ 0.6% resulted fruits with maximum TSS (15.04 brix) and total sugars (12.88%) under plains of north India.

Key Words: Aonla, Borax, Zinc sulphate, NAA, Fruit retention, Yield and Quality.

Studies on phenophase based nutrient scheduling on flower yield and quality in China aster

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The growth, flowering and yield performance of China aster cv. Arka Kamini with respect to phenophase based nutrient scheduling was evaluated during 2019-20, 2020-21 and 2021-22 at Floriculture Research Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, which comes under South Gujarat heavy rainfall zone-1, Agro Ecological Situation-III. The experiment was laid out in Randomized Block Design with four replications in *Rabi* season. The experiment had five treatments *viz*., F_1=33.3:33.3:33.3 % NPK (vegetative phase), 33.3:33.3:33.3 % NPK (bud phase) 33.3:33.3:33.3 % NPK (flowering phase) @ 180:120:60 kg NPK/ha/year (RDF); F_2=40:20:20 % NPK (vegetative phase), 30:40:40 % NPK (bud phase) 30:40:40 % NPK (flowering phase) @ 180:120:60 kg NPK/ha/year (RDF); F_3=33.3:33.3:33.3 % NPK (vegetative phase), 33.3:33.3:33.3 % NPK [(bud phase) 33.3:33.3:33.3 % NPK [flowering phase @ 135:90:45 kg NPK/ha/year (75% RDF)]; F_4=40:20:20 % NPK[(vegetative phase), 30:40:40 % NPK (bud phase), 30:40:40 % NPK (flowering phase) @ 135:90:45 kg NPK/ha/year (75% RDF)]; F_5=Present fertilizer recommendation of 180:120:60 kg NPK/ha/year as soil application (control). In case of F_5, 50% of recommended N and full dose of P and K were applied as basal dose while the remaining 50 % N was applied at 40 days after transplanting through top dressing. In case of $F_{1 to} F_4$, 25 % of its RDF was applied as basal dose and remaining 75 % through as per the treatment details using water soluble fertilizers. Various phenophase based nutrient scheduling significantly influenced various vegetative and flowering parameters, except shelf life. On the basis of pooled data of three years, maximum plant height (43.22 cm), plant spread in E-W (29.88 cm), plant spread in N-S (31.47 cm), flower diameter (6.16 cm), duration of flowering (64.42 days); minimum days to bud appearance (55.35) and days to flower bud opening (70.27) were recorded with the application of 40:20:20 % NPK (vegetative phase), 30:40:40 % NPK (bud phase), 30:40:40 % NPK (flowering phase) @ 180:120:60 kg NPK/ha/year (F_2).The same treatment (F_2) also recorded maximum number of flowers per plant (47.97), weight of 100 flowers (290.20 g), weight of flowers per plant (133.25g) and flower yield per ha (54.44 q). However, shelf life of loose flowers was found non-significant but maximum shelf life (3.75 days) was recorded in both F_1 and F_2 treatments. As far as soil analysis after experiment is concerned, maximum available N (243.03 kg/ha) and K_2O (556.68 kg/ha) were recorded in F_2 treatment whereas maximum P_2O_5 (66.53kg/ha) was noted in F_1. Moreover, organic carbon was

found non-significant. Looking to the economics, the application of 40:20:20 % NPK (vegetative phase), 30:40:40 % NPK (bud phase), 30:40:40 % NPK (flowering phase) @ 180:120:60 Kg NPK/ha/year (F_2) recorded maximum net return as well as B:C ratio (2.32).

Transformative Influence of VNR's Bagging Technology on VNR Bihi Guava

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Guava vendors encounter an increasing consumer preference for aesthetically pleasing, glossy fruits, which imposes comparable standards on fruit producers and farmers. Themodern horticultural method of bagging has surfaced as a viable strategy for attaining fruits of preferred quality through safeguarding against a range of stresses, including biotic and abiotic pressures. In guava cultivation, bagging was not a common practice before 2012. VNR Nursery adopted this technology for their proprietary variety, VNR Bihi - Guava,conducting numerous trials to determine the appropriate material and methodology. Thechosen three-layered packaging method, comprising a foam net, an anti-fog poly bag, and a newspaper, was the result of careful consideration. Engaging with manufacturers of foam nets and poly bags, VNR Nursery successfully persuaded them to produce the required bagging material, yielding visible results. Implementation of bagging in VNR Bihi - Guava not only prevents fruit fly infestation but also shields the fruit from sunburn and mechanical bruising, enhancing its overall appearance. This initiative not only ensured the production of high-quality fruits but also increased income for farmers and created job opportunities, especially for female workers. Farmers were motivated to adopt this technology in their first production, experiencing a significant income increase of 40-50% compared to non-bagged fruits. Furthermore, the use of plant protection chemicals has decreased, resulting in the production of healthier fruits for consumers. In summary, the utilization of the bagging technique produces favorable outcomes in terms of fruit quality, farmer income, and employment generation.

Innovative technologies revolutionizing vegetable production for global food safety and security

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The escalating global demand for increased food production and nutrient security, in the face of a rapidly expanding population, poses a critical threat to the sustainability of agriculture. Within this context, vegetables emerge as pivotal components, rich in essential vitamins and minerals, offering a viable solution to the multifaceted challenges at hand. To tackle these issues, innovative production technologies in the realm of vegetables prove indispensable, promising to address concerns related to nutrient security, boost production levels, enhance product quality, improve labor productivity, and cut down on both labor and material costs. Notable advancements include Arka Cucurbit lure, a kairomone blend demonstrating superior efficacy in trapping male melon flies by 50% compared to conventional methods. Arka Iron-fortified mushroom, derived from elm oyster mushroom (*Hypsizygus ulmarius*), presents a remarkable 149.37% increase in iron content. The Arka Sasya poshakras introduces a unique liquid nutrient formulation, ensuring a balanced blend of macro and micro-nutrients for soilless vegetable production. Arka Viral kit utilizes Loop-Mediated Isothermal Amplification (LAMP) for diagnosing tomato leaf curl Bangalore virus (ToLCBV). Arka Herbiwash, a plant-derived powder, proves effective in washing fruits and vegetables, removing surface residues of pesticides. The Arka Vertical garden structure facilitates safe cultivation of selected vegetables in diverse living spaces. Arka Neelkant, identified as an efficient rootstock, addresses flooding stress in

tomatoes through interspecific grafting. Additional innovations include the Arka Automatic dibbler cum seeder for vegetable nursery raising and talc-based neem seed powder pellets, optimizing insecticidal efficacy and shelf life. Collectively, these cutting-edge technologies offer a comprehensive and sustainable approach to meet the rising demands of food production, ensuring both quantity and quality to sustain the needs of our ever-expanding global population.

Effect of scion Dip treatments and timings on growth, vigour and survival of mango grafts under polyhouse

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The expansion of mango cultivation faces challenges due to the scarcity of quality planting material. To enhance grafting success and reduce prices, a study was conducted at the Fruit Research Station Imaliya, JNKVV, Jabalpur, from January to June 2022. The experiment tested plant growth regulators (PGRs) and grafting times on mango grafts' growth and survival. The factorial design included PGR levels (Kinetin and IAA at various concentrations) and grafting times (January and February). Results revealed that IAA at 100 ppm significantly improved graft growth and survival, followed by the combination of Kinetin (100 ppm) and IAA (50 ppm). February grafting proved most suitable for mango propagation. The treatment involving scion shoots dipped in 100 ppm IAA and grafted in February exhibited superior outcomes. This combination resulted in minimal days to sprout initiation (10 days), high sprouting and success percentages, increased survival, more leaves, longer shoots, and improved physiological parameters. The findings suggest that IAA at 100 ppm, especially when used in February, enhances mango grafting efficiency, offering a valuable approach for quality planting material production.

Off-season cultivation of cucumber (*Cucumis sativus* L.) under protected structure in Salari, Arunachal Pradesh

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Cucumber is a common and important vegetable crop cultivated worldwide and often eaten as salad vegetable. Cucumber contains around 96% of water, which makes it a preferred vegetable during the summer season. Cucumber is a warm season crop and hence its cultivation in open condition during the winter season is restricted. But it can be grown successfully inside greenhouse as off-season crop. With an aim to study feasibility of growing cucumber as off-season crop under Salari condition (3500 ft above msl) in West Kameng district of Arunachal Pradesh, its cultivation was undertaken during the winter months inside greenhouse. The seedlings of Cucumber var. Glossy were raised in polybag and transplanted in October 2022 inside naturally ventilated polycarbonate greenhouse at a spacing of 45 cm x 30 cm (R-R x P-P) under black polythene mulch of 30 μ thickness. Good growth of plants was observed with a average yield of 4.34kg / plant. Thus, cultivation of cucumber inside greenhouse at Salari is feasible, which will help the local farmers to reap higher market price during the winter months.

Integrated weed management in African marigold (*Tagetes erecta* L.) var. Pusa Narangi Gainda

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An experiment was conducted to study the effect integrated weed management in African marigold var. Pusa Narangi Gainda in 2019-20 at ACH, NAU, Navsari with aim to find out relative efficiency of weed management practices on growth and yield of African marigold. Marigold Seedling were treated with nine different integrated weed management methods along with weedy check and weed free and evaluated in RBD and replicated thrice. Minimum weed population (124.71 and 157.09 nos. /m^2 at 25 and 50 DAT respectively) and weed index (14.17%) found in T7. Whereas, maximum weed controlefficiency (100%), flower yield (6752.64 g/plot and 10048.57 kg/hectare, respectively), plantheight (94.16 cm), plant spread (38.33 cm in N-S and 34.42 cm in E-W) weight of 10 flowers(50.50 g), flower diameter (2.42 cm), *in-situ* flower longevity (30.87 days) and shelf life(4.62 days) and minimum days to first flowering (36.44) were recorded in treatment T_8. According to the analysis treatment T_8-weed free efficiently control the weedsand increase the yield however, T_7- Pendimethalin@ 0.75 kg a.i./ha + Paddy straw mulch (5cm thickness layer) + one hand weeding at 50 DAT recommended on the basis of economics.

Keywords: Pendimethalin, weed index, flower longevity, shelf life

Agronomic bio-fortification with iron and zinc on yield and quality of mango cv. Kesar

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One global agriculture strategy that can enhance human nutrition is bio-fortification. Agronomic bio-fortification is seen as an adjunctive measure and a temporary solution. For zinc and iron, agronomic bio-fortification is quite successful, particularly when applied through foliar spray. Mango cultivar Kesar was the subject of an agronomic bio-fortification experiment at ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat, to increase the micronutrients zinc and iron. Three replications, each comprising nine treatments, were included in the completely randomised design (CRD) of the experiment. The findings demonstrated that in order to increase fruit retention, production, and quality of mango cv. Kesar fruits, foliar treatment of 0.50 percent $ZnSO_4$ can be made at flowering, pea, and egg stages of fruit development. However, foliar spraying 0.50% $FeSO_4$ and 0.50% $ZnSO_4$ could also boost the mineral nutrients content, i.e., N, P, K, Zn, and Fe in fruit; and N in leaves.

Evolution of forchlorfenuron 0.1 % liq. (CPPU) on fruit set, retention and post-harvest quality of mango cv. Kesar

V. K. Parmar, C. D. Desai, B. M. Tandel and R. J. Patel

Mangoes experience numerous physical, chemical and environmental changes during the fruit development stage. Due to this, study was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture, NAU, Navsari (Gujarat), during the fruiting season of 2019-20 to investigate the effect of spraying of 0.1% Forchlorfenuron(CPPU) on mango Cv. Kesar. The experiment was laid out in a randomized block design with 6 treatment T_1: Forchlorfenuron 0.1% LIQ @ 1 ml/lit water, T_2:

Forchlorfenuron 0.1% LIQ @ 2 ml/lit water, T_3: Forchlorfenuron 0.1% LIQ @ 3 ml/lit water, T_4: Forchlorfenuron 0.1% LIQ @ 4 ml/lit water, T_5: Forchlorfenuron 0.1% LIQ @ 8 ml/lit water, T_6: Control, and replicated thrice. The result revealed that, Maximum fruit set per panicle at marble stage and grain or pea nut stage was recorded with $T_3$and maximum number of fruits at harvest stage per panicle was noted in T_2. Higher fruit yield per tree at harvest was reported in Forchlorfenuron 0.1 % LIQ@ 2 ml /lit water. Maximum number of fruit was noted in T_2. The minimum physiological weight loss of kesar mango fruits at 16 days was observed under T_2 treatment. In case of quality parameters, TSS, Acidity and total sugar were found non-significant with respect to application of different treatments. However, higher total soluble solids (^{0} Brix) was observed in $T_5$and total sugar was noted maximum in T_4.

Enhancing Growth and Yield of Parthenocarpic Cucumber (*Cucumis sativus* L.) through Nano-particles of Zn and Fe

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The study investigated the impact of zinc (Zn) and iron (Fe) nanoparticles on parthenocarpic cucumber growth and yield parameters in a polyhouse. Conducted from December 2021 to April 2022 in Rajasthan, the experiment utilized Zn and Fe nanoparticles at concentrations of 200 and 400 ppm, applied through seed and foliar methods, resulting in 32 treatment combinations. The parthenocarpic variety "Oscar-52" was cultivated, employing a Randomized Block Design with three replications. Among the treatments, seed treatment with Zn nanoparticles at 400 ppm and foliar spraying with Fe nanoparticles at 400 ppm (T28) yielded notable results. This treatment significantly increased the number of fruits per plant, fruit length, fruit diameter, average fruit weight, marketable yield per plant, while reducing unmarketable yield per plant and days to first harvesting compared to the control. In conclusion, the application of Zn and Fe nanoparticles demonstrated significant positive effects on various growth and yield parameters in parthenocarpic cucumber cultivation, providing valuable insights for sustainable and enhanced crop production..

Effect of mulch variants on growth and productivity of Chinese cabbage under protected conditions in high altitude areas of Tawang

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A protected cultivation trial was undertaken at Defence Research Laboratory, Research and Development Centre, Tawangto evaluate effect of organic and inorganic mulches on growth and economic yield of Chinese cabbage during summer season of 2022. Two species of Chinese cabbage namely *pe tsai* (cv. Spring Sun 60) and pak choi (cv. Choko) were planted under black silver polythene mulch (30µ; inorganic) and organic mulches (at 5 kg/m^2) comprising blue pine needle, red oak leaves and dry grass. Blue pine needle followed by red oak leaves mulch registered taller plants, profuse canopy/plant as well as the wide plant spread of both the Chinese cabbage cultivars and remained significantly higher than polythene and dry grass mulch. However, leaf length and leaf width of both the cultivars remain unaffected across the mulches. The economic yield of *pe tsai* and pak choi was also found significantly higher under blue pine mulch (406.2 and 533.3 g/plant)followed by red oak leaves (363.6 and 506.02 g/plant) mulch, respectively whereas polythene mulch negatively affected the growth and yield of *pe tsai* and pak choi. The blue pine mulch superseded other mulches in terms of economic yield of *pe* tsai, however, the pak choi yield under red oak leaves mulch was

found at par with later. Therefore, blue pine needle mulch which abundantly available in Tawang region can safely be utilized as an effective organic mulch to improve the growth and productivity of *pe tsai* and pak choi under protected conditions in high altitudes (8000 to 10000 feet) of Tawang sector.

Evolution of forchlorfenuron(CPPU) on fruit set, retention and post-harvest quality of mango cv. Kesar

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Mangoes experience numerous physical, chemical and environmental changes during the fruit development stage. Due to this, study was conducted at Regional Horticultural Research Station, ASPEE College of Horticulture, NAU, Navsari (Gujarat), during the fruiting season of 2019-20 to investigate the effect of spraying of 0.1% Forchlorfenuron (CPPU) on mango Cv. Kesar. The experiment was laid out in a randomized block design with 6 treatment T_1: Forchlorfenuron 0.1% LIQ @ 1 ml/lit water, T_2: Forchlorfenuron 0.1% LIQ @ 2 ml/lit water, T_3: Forchlorfenuron 0.1% LIQ @ 3 ml/lit water, T_4: Forchlorfenuron 0.1% LIQ @ 4 ml/lit water, T_5: Forchlorfenuron 0.1% LIQ @ 8 ml/lit water, T_6: Control, and replicated thrice. The result revealed that, maximum fruit set per panicle at marble stage and grain or pea nut stage was recorded with Forchlorfenuron 0.1% LIQ @ 3 ml/lit water and maximum number of fruits at harvest stage per panicle was noted in Forchlorfenuron 0.1% LIQ @ 2 ml/lit water. Higher fruit yield per tree at harvest was reported in Forchlorfenuron 0.1 % LIQ@ 2 ml /lit water. Maximum number of fruit was noted in Forchlorfenuron 0.1% LIQ @ 2 ml/lit water. The minimum physiological weight loss of kesar mango fruits at 16 days was observed under Forchlorfenuron 0.1% LIQ @ 2 ml/lit water. In case of quality parameters, TSS, Acidity and total sugar were found non-significant with respect to application of different treatments. However, higher total soluble solids (^{0} Brix) was observed in Forchlorfenuron 0.1% LIQ @ 8 ml/lit water and total sugar was noted maximum in Forchlorfenuron 0.1% LIQ @ 4 ml/lit water.

Impact of deleafing and foliar nutrient application for offseason flowering in Spider lily (Hymenocallis littoralis)

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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 treatment combinations along with absolute control consisting two levels of leaf cutting (1st week of May and 1st week of June) and foliar nutrient application (Urea @ 2 %, 19-19-19 @ 1.5 %, 12-61-0 @ 1.5 %, 0-52-34 @ 1.5 % and 13-0-45 @ 1.5 %). The treatments were replicated thrice. Based on pooled data of three years, results indicated that plant height, plant spread (N – S and E – W) and no. of leaves were recorded maximum with leaf cutting in 1st week of June. However, maximum leaf area, width of leaf, early flower stalk emergence, no. of buds per stalk, 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 were observed with leaf cutting in 1st week of

May. Concerning nutrient application, foliar nutrient application 19-19-19 @ 1.5 % recorded maximum plant height, plant spread (E – W) and no. of leaves. Maximum plant spread (N – S) was reported in the plants sprayed with 12-61-0 @ 1.5 % whereas, foliar spray of 13-0-45 @ 1.5 % resulted maximum leaf area and width of leaf. Early flower stalk emergence after cutting, maximum stalk length, no. of buds per stalk, highest flower bud in the month of July, August, September and October, total no. of buds per plant, per plot and per hector were recorded in the plants treated with foliar application of 13-0-45 @ 1.5 %. Maximum leaf area and no. of flower buds/plant in July and August month as well as per plant plot and ha with maximum net realization and BCR were obtained by deleafing of spider lily plant in 1st week of May along withfoliar nutrient application of 13-0-45 @ 1.5 %. It can be concluded that deleafing of spider lily plant in 1st week of May and subsequent foliar application of 13-0-45 (NPK) @ 1.5 % was found superior for getting higher production of flower buds during offseason and maximum net realization.

Effect Nutrient Management on growth and yield parameters of Little Gourd

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An experiment was conducted in Randomized Block Design at Regional Horticulture Research Station, NAU during kahrif season to find out effect of nutrient management on fruit parameters and yield of little gourd. For the purpose of identifying the most appropriate nutrients for better little gourd cultivation, T_1- 100% RDF (100-50-50 NPK kg/ha), T_2- FYM, T_3- Vermi compost, T_4- Castor cake, T_5- Neem Cake, T_6- Bio-compost, T_7- 50% RDF + FYM, T_8- 50% RDF+ Vermicompost, T_9- 50% RDF + Castor cake, T_{10}- 50 % RDF + Neem Cake, T_{11}- 50% RDF + Bio-compost got growth and yield attributes of little gourd. On the basis of results it can be concluded that combine application of Bio-compost along with 50% RDF was observed to be the best treatment when compared to other treatments for better fruit parameters and yield of little gourd. Bio-compost along with 50% RDF increases fruit length, fruit diameter, fruit weight and fruit yield and decreases the days to first initiation of flowering and days to first fruit harvest in little gourd.

Key word: Little gourd , nutrient, fruit parameters, bio compost

Effect of scion wood hardening and wedge grafting on nursery output of mango *(Mangifera indica* L.) under subtropical conditions of Himachal Pradesh"

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The studies were carried out in the fruit nursery Department of Fruit Science, Dr YSP UHf College of Horticulture and Forestry, Neri, Hamirpur, HP during the year 2021 and 2022. Among all the different times of grafting and methods under study, highest (70.67 %) graft take and graft success (63.33 %) in veneer grafted plants was observed in the month of August whereas, highest (58.67 %) graft take and graft success (46.00 %) in wedge grafting was noticed in the month of August. Plants grafted with scion defoliated 7 days before grafting recorded maximum (47.22 %) graft take and (39.39 %) graft success. Plants which were veneer grafted in the first fortnight of August took minimum (16.17) days to bud sprout and (18.04) days to first leaf emergence. Among duration of scion wood defoliation, plants grafted using scion defoliated 7 days before grafting took minimum (22.31) days to bud sprout and (25.72) days to first leaf emergence. In the first fortnight of August, veneer grafted plants had maximum number of leaves and plant diameter at 30, 45 and 60 days after grafting. Plants propagated with 7 days before defoliated scion wood had maximum number of leaves and plant diameter. Plants which were veneer grafted in August using scion defoliated 7 days before grafting had the maximum number of leaves and plant diameter. Veneer grafted plants in the month of August

exhibited maximum leaf area and graft survival (%). Plants grafted using scion defoliated 7 days before grafting recorded maximum leaf area and graft survival (%). Among all the time of grafting under study, in veneer grafting highest (61.33 %) saleable plants were recorded in August whereas, in wedge grafting (44.67 %) saleable plants were observed in the month of August. The average graft success among various times of grafting under study was observed to be highest when grafting was done in the first fortnight of August. Plants propagated with scion defoliated 7 days before grafting in the both grafting methods gave best results in respect to all the parameters. The interaction between time, method of grafting and duration of scion defoliation was observed to maximum among all the parameters when veneer grafting was performed using scion defoliated 7 days before grafting in the month of August.

Growth Regulators Studies in Mop Head Hydrangea (*Hydrangea macrophylla*) for Improved Vigour and Flowering

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Hydrangea a member of family Saxifragaceae is one of the most attractive and beautiful ornamental plant in the world. The word 'Hydrangea' was originated from the Greek word *'hydro'* and '*aggeion,*' which represents "water" and "vessel," respectively. The hydrangea flower represents grace, gratitude and beauty.The most extensively planted hydrangea species is *Hydrangea macrophylla* (Thunb.) Ser. which is commonly known as mop-head or big leaf hydrangea. The concentration and efficacy of plant growth regulators needs to be evaluated according to species and their uses in hydrangea..Growth regulator studies in mop-head hydrangea (*Hydrangea macrophylla*) for improved vigour and flowering was conducted at Horticulture Research & Training Station and Krishi Vigyan Kendra, Kandaghat, Solan of Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni (Solan). The experiment was laid in Complete Randomized Design (CRD) with ten treatments each having three replications. The experiment was conducted under naturally ventilated polyhouse. Uniformed developed one and half year's old stock plants were planted in pots. Plants were treated with different concentrations of plant growth regulators *viz*. control (water), GA_3 (25 ppm, 50 ppm and 100 ppm), BA (50 ppm, 100 ppm and 150 ppm) and GA_3 + BA (50 ppm, 150 ppm and 250 ppm each).On the basis of study, it can be concluded that GA_4 + BA @ 50 ppm when applied three times at 15 days interval during the vegetative growth of plant, plant had the maximum growth index and maximum pot presentability. Also, it significantly affected other parameters like plant height, plant spread, length of shoots, inflorescences per plant, flower stalk length and early flowering. The plants treated with GA_3 @ 100 ppm had highest plant height, maximum length of shoots, minimum days taken for visible bud formation and flowering, maximum number of inflorescences open at a time per plant and longest flower stalk. However, the maximum plant spread, number of shoots, longest duration of flowering, maximum vase life was remarkably found best in plants treated with BA @ 150 ppm.

Effect of different bio-stimulants on Dendrobium Orchid

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Investigation was carried out to assess effect of different bio-stimulants on *Dendrobium* Orchid at Practical Training Centre for High-tech Horticulture, Department of Floriculture and Landscape Architecture, Aspee College of Horticulture, NAU, Navsari. The experiment consisted of application of different bio-stimulantsviz.,T_1- Novel organic liquid (1%) once/fortnight, T_2 - Novel prime organic liquid

nutrient (1%) once/fortnight, T_3 - Novel organic liquid nutrient (2%) once/fortnight, T_4- Novel prime organic liquid nutrient (2%) once/fortnight, T_5 - Cow urine (1%) once/fortnight, T_6 - Cow urine (2%) once/fortnightT_7 – GA_3-50ppm (every two months) as a check and T8 – Control (no spray).The experiment was laid out in completely randomized design with three replication for three consecutive years and observations were recorded at every six months interval.Among different treatments, T_4- Novel prime organic liquid nutrient (2%) once/fortnight was found to be highly effective with regard to plant height (22.93 cm), number of leaves (11.79) and number of shoots (4.13). Further, flowering parameters such as spike length (41.90 cm), floret size (8.79 cm) and number of spikes per plant (3.40) were also observed to be maximum with 2% Novel prime organic liquid nutrient. Hence, it can be recommended to spray Dendrobium Orchid with 2% Novel prime organic liquid to obtain better plant growth and yield.

Key Words : Dendrobium, Bio stimulants, Novel prime organic liquid

DUS characteristic features of new pomegranate variety "SHARAD KING"

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Pomegranate (*Punica granatum* L.), is one the most important nutritional and medicinal rich commercial fruit crops play a vital role in sustainable development and livelihood security of arid and semi-arid regions. Diversification of varietal cultivation is need of the hour to breakdown the single varietal (Bhagawa) dominance and its consequences in pomegranate. In this context, newly identified farmer variety "Sharad King" has been characterized for in total 43 characters including 38 DUS traits as per PPV&FRA guidelines and additional 5 fruit quantitative characters, to identify the most important DUS characteristic features of the variety and its suitability for the commercial cultivation. The variety has been evaluated at Tupewadi, Aurangabad for two consecutive years (2021-2022) and its mean performance was compared with the standard check variety (Bhagawa). The examined new variety was found to have uniform bearing with better fruit size (302.19g), medium thick rind (4.33mm) and medium fruit maturity (160-170days after anthesis) in comparison to Bhagawa (280.49g, 3.95mm, 177-187days). Two sample T-test analysis has showed the presence of significant difference for fruit maturity (days after anthesis), number of arils/fruit, 100Seed weight(g), seed length(mm), seed width(mm), calyx width(mm), petal length(mm), petal width(mm), leaf blade width(cm), petiole length(mm) and petiole width(mm) characters which is recorded to be 160-170days, 747.26, 1.37g, 6.22mm, 2.44mm, 14.78mm, 26.36mm, 21.36mm, 1.95cm, 4.68mm, 1.06mm in "Sharad King" and 177-187days, 575.91, 1.56g, 7.05mm, 2.68mm, 12.45mm, 23.18mm, 19.04mm, 1.61cm, 3.90mm, 0.75mm in "Bhagawa" varieties respectively. The identified characters indicate the suitability of this new variety for commercial cultivation.

Keywords: Sharad king, Pomegranate, farmer variety, DUS characters, mean performance, T-test

Effect of saline irrigation water on Bermudagras[*Cynodon dactylon* (L.) Pers.] cv. Selection-1

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A new generation of salt-tolerant turf varieties might allow landscape development in saline environments and might be ideal in such environments where saline water is a problem, or where limited or no fresh water is available for irrigation. Keeping in view the importance, six saline irrigation treatments with EC levels of ≈ 2.0 (Best available water/control), 4.0, 6.0, 8.0, 10.0 and 12.0 dSm^{-1} were imposed on bermudagrass [*Cynodon dactylon* (L.) Pers.] cv. selection-1 for seven (7) months to assess its performance

under increasing salinity stress. The experimental results revealed that most of the qualitative and quantitative characters showed a decreasing trend with increasing salinity levels in irrigation water. The bermudagrass cv. Selection-1 exhibited tolerance against saline water irrigation and maintained acceptable average visual turf quality (7.55) and leaf firing (7.43) up to the salinity level of 6.0 dSm^{-1}. It also retained 81.66 % relative root growth and 78.04 % relative shoot growth up to the salinity level of 6.0 dSm^{-1}. The tissue analysis revealed that proline content was significantly increased with increasing salinity levels which means grass produced proline to counteract the salinity stress that occurred due to saline water irrigation. The highest total chlorophyll content (18.03 mg g^{-1}) was recorded with control ($\approx$2.0 dSm^{-1}), but it was maintained at the salinity levels of 4.0 dSm^{-1} and 6.0 dSm^{-1} (16.37 mg g^{-1} and 14.81 mg g^{-1}, respectively). The salinity effect was evident from increased leaf Na^+ content and decreased leaf K^+ content in turfgrass with increasing salinity levels in irrigation water that suppressed the growth and performance.

Key word: *Cynodon dactylon*, Bermudagrass, salinity stress, saline water irrigation, turfgrass

Beyond horizons: exploring the impact of vertical farming on horticultural crop production

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Vertical farming is emerging as a transformative approach to horticulture, presenting innovative solutions to challenges in traditional crop cultivation. The application of vertical farming techniques specifically customized for horticultural crops. Utilizing controlled environment agriculture (CEA), vertical horticulture optimizes space, enhances resource efficiency and ensures year-round production; the economic implications of vertical farming are explored in depth. Furthermore, the ecological impact of vertical farming is examined including its potential to mitigate soil degradation, minimize water usage and decrease reliance on chemical inputs. Hydroponic and aeroponic systems play a pivotal role in vertical horticulture and providing nutrient-rich environments for crops like leafy greens, herbs, strawberries and tomatoes *etc*. The integration of multi-tiered structures, including vertical towers and wall-mounted systems maximizes spatial utilization making it particularly suitable for urban environments. Temperature, humidity and light are all controlled climatic parameters that help to secure crop quality and continuous harvesting. LED lighting strategically implemented not only promotes photosynthesis but also allows for energy-efficient operation. The reduced exposure to pests and diseases in enclosed spaces fosters pesticide-free or low-pesticide production. While vertical horticulture holds promise for sustainable and locally sourced food production challenges such as energy consumption and initial investments warrant consideration. Future developments may address these challenges, further establishing vertical farming as a key component in the evolution of horticulture, ensuring food security and contributing to a more resilient and environmentally conscious agricultural future.

Key words : Vertical Farming, Controlled Environment Agriculture (CEA), Hydroponic and Aeroponic, Urban

Effect of foliar application of organics on growth and yield of coriander

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The current investigation entitled "Effect of foliar application of organics on growth and yield of coriander var. GDLC-1" was carried out at Regional Horticultural Research Station, ASPEE College of

Horticulture, Navsari Agricultural University, Navsari, Gujarat during *Rabi* season in the year 2022-2023. The experiment was laid out in Randomized Block Design with three replications and nine treatments *viz.*, *Panchagavya* @ 1.5 % (T_1), *Panchagavya*@ 3 % (T_2), Novel organic liquid nutrients @ 1.5 % (T_3), Novel organic liquid nutrients @ 3 % (T_4), vermiwash @ 1.5 % (T_5), vermiwash @ 3 % (T_6), cow urine @ 1.5 % (T_7), cow urine @ 3 % (T_8) and control (T_9). The foliar spray was given at 20 and 45 days after sowing. The results of the experiment revealed that foliar application of Novel organic liquid nutrients @ 1.5 % (T_3) was showed highest total chlorophyll content (1.64 mg g^{-1} and 1.71 mg g^{-1}), photosynthetic rate (12.24 µmol m^{-2} s^{-1} and 13.10 µmol m^{-2} s^{-1}), transpiration rate (3.48 m mole m^{-2} s^{-1} and 3.69 m mole m^{-2} s^{-1}), stomatal conductance (0.21 mol m^{-2} s^{-1} and 0.22 mol m^{-2} s^{-1}) at 30 and 50 DAS, respectively. In case of growth parameters, maximum plant height (39.14 cm and 27.87 cm), number of branches $plant^{-1}$ (11.73 and 20.20), petiole length (18.57 cm and 10.07 cm), leaf length (3.93 cm and 3.77 cm) and leaf width (4.05 cm and 3.84 cm) were observed under the same treatment. Among different treatments, foliar application of Novel organic liquid nutrients @ 1.5% (T3) recorded significantly minimum days taken for first cutting (30.00) and maximum fresh weight of herbage $plant^{-1}$ (18.47 g and 24.40 g) at 30 and 50 DAS, respectively. However, the data on herbage yield at first cutting (9.13 t ha^{-1}), herbage yield at second cutting (11.70 t ha^{-1}) and fresh weight of herbage (20.83 t ha^{-1}) at both the cuttings were also recorded highest in the same treatment. Economic point of view, maximum net income of Rs. 632592.00 ha^{-1} with benefit: cost ratio of 6.56 was found economical, profitable and highly remunerative by foliar spray of Novel organic liquid nutrients @ 1.5 % (T_3) as compared to rest of the treatments.

Key words: Coriander, foliar, organics, growth and yield

Effect of Integrated Nutrient Management on Growth and Yield of Radish (*Raphanus sativus* L.) cv. Japanese white

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An investigation was conducted at Horticulture Research Farm-I, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow (U.P.) during 2021-22 to assess the effect integrated nutrient management on growth and yield of radish cv. Japanese white. The experiment comprised of 9 treatments viz. T_1-NPK (RDF)-80:60:80 Kg/ha, T_2-Vermicompost @ 4 tons/ha, T_3-FYM @15 tons/ha, T_4-Poultry manure @ 3 tons/ha, T_5-NPK (50 %) + Vermicompost (50%), T_6-NPK (50%) + FYM (50%), T_7-NPK (50%) + Poultry manure (50%), T_8-Vermicompost (50%) + FYM (50%), T_9-Vermicompost (50%) + Poultry manure (50%) were evaluated in Randomized Block Design with three replications. The experimental findings revealed that the maximum plant height (17.08 cm, 26.45 cm, and 38.09 cm), number of leaves (5.96, 15.07 and 18.07), leaf length (8.33 cm, 18.45 cm, 19.07 cm) at 30, 45 and 60 days respectively was recorded from treatment T_5 [NPK (50 %) + Vermicompost (50%)]. The highest fresh weight of root (119.08 g), dry weight of root (21.09 g), longest root length (19.09 cm), maximum root diameter (4.54 cm), and highest yield (401.43 q/ha) were also recorded from treatment T_5 [NPK (50 %) + Vermicompost (50%)]. Overall results reveal that application of half dose of inorganic fertilizers with other organic fertilizers fulfilled 50 % requirement of chemical fertilizers which will also reduce the cost of cultivation at some extent.

Keywords: Integrated Nutrient Management, Radish, Growth and Yield.

Augmented Reality Applications for Horticultural Training and Surveillance

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Augmented Reality (AR) holds significant potential for training and monitoring in horticulture, offering innovative solutions to enhance efficiency, accuracy, and overall productivity. AR offers various applications in precision agriculture, maintenance and equipment operation, remote assistance, quality control, record-keeping and documentation, educational tours and demonstrations, as well as safety and compliance. For precision agriculture, AR aids in navigation, mapping, and integrating with sensors to provide real-time information for optimized field layouts. Additionally, it assists in equipment operation by offering visual guides and maintenance assistance through overlays. Moreover, AR enables remote assistance for farmers and workers in the field to connect with experts and access real-time support. Furthermore, it enhances visual quality control and facilitates hands-free documentation. Moreover, it can be used to provide virtual farm tours and educational demonstrations, improving accessibility and knowledge sharing. Lastly, AR contributes to safety in agriculture by providing real-time safety alerts and reminders. As technology advances, AR is expected to play an increasingly significant role in transforming horticultural practices by enhancing training and monitoring.

Keywords: Augmented reality, remote sensing, precision farming, mapping *etc.*

"Grafting is an Important Technique for Vegetable Production"

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Grafting is a technique for plant multiplication that directly affects the yield of vegetable crops by using certain rootstock and scion combinations for resistance against soil-borne diseases. Vegetable grafting has many uses around the world by increasing crop yields and lowering the cost of purchasing large quantities of pesticides and fertilizers, it can help the vegetable industry overcome its difficulties and increase farmers' incomes. As a result, greater net returns were made even during the off-season in a variety of soil and environmental stress circumstances. Vegetable grafting has the potential to promote vegetable cultivation in non-traditional conditions and fragile agricultural ecosystems. This technique was introduced to Europe and other countries in the late 20th century along with improved grafting methods suitable for commercial production and productivity of grafted vegetable seedlings. The first interspecific, herbaceous grafting was documented in 1920 for watermelon (*Citrullus lanatus*) in Japan and it took another 30 years (1960s) for grafting to be commercialized in the cultivation of solanaceous vegetables and the first record of eggplant (*Solanum melongena* L.) grafted on scarlet eggplant (*Solanum integrifolium* Poir.) was reported in the 1950s, one another example is that muskmelons grafted to interspecific hybrid squash (*Cucurbita maxima* × *Cucurbita moschata*) had resistance against vine decline caused by *Monosporasc*us spp. and it is tolerant to charcoal rot (*Macrophomina phaselina*) and Double grafted and single grafted tomato: Pomato is a plant resultant of vegetable grafting. If these scientists are confident, grafting vegetables would result in plants that are more tolerant to bacterial wilt, increasing their longevity as well as yields and reducing losses for vegetable growers and increasing their income.

Keywords:- Grafting, vegetable grafting, rootstock, cucumber, eggplant, pomato

Screening of eggplant (*Solanum Melogena* L.) for pest and disease incidence under natural field conditions

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The present investigation was designed in order to estimate the incidence of Shoot borer, Fruit borer and Bacterial wilt disease in eggplant under natural field condition. The experimental material comprised of 8 parents, their resultant 28 hybrids produced following half diallel mating design and a standard hybrid check "GJBH-4" of eggplant, which were evaluated in randomized block design with three replications. The experiment was conducted at three different locations *viz*., College Farm, N. M. College of Agriculture, Navsari (L1), Wheat Research Station, Bardoli (L2) and Hill Millet Research Station, Waghai (L3), Navsari Agricultural University, Navsari during *rabi* 2020-21. With regards to pest and disease incidence examined under natural field condition, the genotype's reaction ranged from highly resistant to susceptible for shoot and fruit borer infestation. The higher yielding hybrids reacted as fairly resistant to tolerant for shoot borer, tolerant to susceptible for fruit borer. All the genotypes (parents + hybrids + check) were found resistant to bacterial wilt disease incidence.

Key Words: eggplant, fruit borer, bacterial wilt disease

Performance of winter season guava with organic manures and biofertilizers concerning to yield, quality and physico-chemical characteristics

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In order to investigate the performance of winter season guava with organic manures and biofertilizers with respect to yield, quality and physico-chemical characteristics an experiment was carried out guava cv. L-49 in the garden, Department of Fruit Science, Acharya Narendra Dev University of Agriculture and Technology, Kumarganj (U.P.) using seven treatments *viz.,* T_1 (control), T_2 (FYM 100kg), T_3 (Vermicompost 31.25kg), T_4 (Poultry manure 3.34kg), T_5 (FYM 50kg + Vermicompost 15.625kg), T_6 (Vermicompost 15.625kg + Poultry manure 1.67kg), and T_7 (FYM 50kg + Poultry manure 1.67kg) in Randomized Block Design (RBD) with three replications. The soil was treated with varying amounts of organic manures at a distance of 1-2 feet from the tree stem. The guava plant's yield, physical and chemical qualities were improved with the application of organic manures. The optimum combination of organic manures for enhancing fruiting features i.e., fruit length (6.56cm), fruit width (6.19cm) and fruit weight (147.37g); fruit yield per tree (40.52kg); and fruit quality i.e., TSS (13.90 ^{0}Brix), Total sugars (11.45%), Ascorbic acid (145.03 mg/pulp) and Acidity (0.356%) was found with vermicompost + poultry manure, closely followed by FYM + poultry manure. On the other hand, it was found that the best treatment for boosting the number of flowers (212.05) per tree was the application of poultry manure.

Influence of bio-enhancers and bio-fertilizers on growth, yield and quality of Mango (*Mangifera indica* L.) cv. Amrapali

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To investigate the influence of bio-enhancers and bio-fertilizers on growth, yield and quality of Mango (*Mangifera indica* L.) cv. Amrapali, a field experiment was carried out in the garden, Department of *Fruit Science*, *Chandra Shekhar Azad University* of Agriculture and Technology, Kanpur (U.P.) during two consecutive years 2020-2021 and 2021-2022. The experiment was laid out using seven treatments such as T_1: FYM (25kg/tree/year)+Organic mulch (Paddy straw) *i.e.,* Control, T_2: FYM (25kg/tree/year)+Organic mulch (Paddy straw)+*Amritpani* (20%)+*Azotobacter* (100g/tree), T_3: FYM (25 kg/tree/year)+Organic mulch (Paddy straw)+*Panchagavya* (3%)+*Azotobacter* (100g/tree), T_4: FYM (25 kg/tree/year)+Organic mulch (Paddy straw)+*Jivamrit* (20%)+*Azotobacter* (100g/tree), T_5: FYM (25 kg/tree/year)+Organic mulch (Paddy straw)+*Amritpani* (20%)+PSB culture (100g/tree), T_6: FYM (25 kg/tree/year) + Organic mulch (Paddy straw)+*Panchagavya* (3%) + PSB culture (100g/tree), T_7: FYM (25 kg/tree/year)+Organic mulch (Paddy straw)+*Jivamrit* (20%)+PSB culture (100g/tree) which were replicated thrice in Randomized Block Design. Data of experiment obtained during both years were pooled, which clearly revealed that the application of FYM (25kg/tree/year)+Organic mulch (Paddy straw)+*Panchagavya* (3%) + *Azotobacter* (100g/tree)-T_3 resulted in significantly higher values for various growth, flowering, yield and quality parameters such as number of leaves/shoot (33.83), number of inflorescence per branch (9.67), fruit length (10.16cm), width (6.12cm), weight (214.33g), volume (227.29g/cc), pulp weight (74.27g), pulp: peel ratio (5.27), pulp: stone ratio (6.38), number of fruits/plant (226.17), fruit yield (48.56kg), TSS (19.56^{0}Brix), total sugars content (17.61%) and sugar: acid ratio (57.42). The same treatment resulted significantly minimum stone length (6.35cm), stone width (3.02cm), stone weight (11.64g), peel weight (14.61g), fruit drop per cent (85.67%), fruit retention (14.32%), titratable acidity (0.31%) and days to flowering (14.66 days) in mango plant. On the basis of above findings, it is rerecommended that for getting substantially more vegetative, flowering characteristics with quality fruits and more yield in mango cv. Amrapali, the plants should be treated with FYM (25 kg/tree/year) + Organic mulch (Paddy straw) + *Panchagavya* (3%) + *Azotobacter* (100g/tree) in the sub-tropical plains of Central Uttar Pradesh, India.

Keywords: Amrapali, *Azotobacter*, *Panchagavya*, Growth, Yield, Quality parameters etc.

Impact on fruiting, yield and quality of mango as influenced by pre-harvest application of plant bio-regulators and micronutrient

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To investigate impact on fruiting, yield and quality of mango as influenced by pre-harvest application of plant bio-regulators and micronutrient, an experiment was carried out in the Garden, Department of Fruit Science, C. S. Azad University of Agriculture and Technology, Kanpur (U.P.) during the cropping season 2021. The experiment was laid out in Randomized Block Design (RBD) with three replication and ten treatments *viz.,* GA_3 @ 20 ppm (T_1), GA_3 @ 40 ppm (T_2), GA_3 @ 60 ppm (T_3), NAA @ 20 ppm (T_4), NAA @ 30 ppm (T_5), NAA @ 40 ppm (T_6), $ZnSO_4$ @ 0.5% (T_7), $ZnSO_4$ @ 1.0% (T_8), $ZnSO_4$ @ 1.5% (T_9) including a control (water spray-T_{10}). Spraying of plant bio-regulators and micronutrient was done at pea stage of fruits set on Ist March, 2021. From the results obtained during experimentation, it is reported that pre-harvest

spraying of GA_3 @ 20 ppm results significant decrease in fruit drop (83.37%) with increase in fruit retention (16.63%) and number of fruits per panicle (6.03).Plants sprayed with the GA_3@ 40 ppm results significantly more fruit yield (50.13kg/tree) of fruits having more polar (9.66cm) and equatorial diameter (7.96cm), more pulp (72.55%) with decrease in peel (17.96%) and stone per cent (09.49%). Increased fruit weight (242.88g), volume (258.02cc), specific gravity (1.08g/cc), pulp: stone ratio (5.22), total soluble solids (18.86 ^{0}Brix), total sugars (17.89%), ascorbic acid (37.91mg/100g) were also found with the pre-harvest spraying of GA_3 at 60 ppm, whereas titratable acidity (0.51%) contents in the fruits ware drastically reduced under this treatment.

Key Words : Mango, Dashehari, Gibberellic acid, NAA, Zinc Sulphate, Fruit drop, fruit retention, Yield and Quality.

Response of plant bio-regulators and micronutrients on growth, yield, and quality of mango (*Mangifera indica* L.) cv. Amrapali

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The present investigation entitled "Response of plant bio-regulators and micronutrients on growth, yield, and quality of mango (*Mangifera indica* L.) cv. Amrapali" was conducted at Main Experiment Station, Department of Horticulture, Acharya Narendra Deva University of Agriculture and Technology, (Kumarganj), Ayodhya (U.P.) during 2021-23 with a view to find out the effect of GA_3, NAA, and Borax alone on growth, yield, and quality of mango fruit cv. Amrapali. Two doses each of GA_3 NAA *viz.,* 20, 25 ppm, and Borax 0.4% and control (water spray) were arranged in Randomized Block Design with three replications and a total of nine treatments. The maximum number of fruit set/panicles, fruit retention, fruit yield, and minimum fruit drop were recorded with the application of GA_3 20ppm. All the physical characters were influenced by foliar sprays of GA_3 20 ppm. The fruit polar diameter, fruitweight, pulp weight, and pulp/stone ratio were recorded maximum with the foliar application of GA_3 20 ppm. Chemical characters viz., Total soluble solids, non-reducing sugar, and total sugars content were also found maximum with the foliar application of theGA_3@ 20 ppm and maximum ascorbic acid and reducing sugar found under GA_3@20 ppm the acidity in the fruit was drastically reduced under GA_3@ 20 ppm treatment. Therefore, foliar application of GA_3@20 ppm, NAA@ 25 ppm, and borax @0.4 twice in the second fortnight of March and April can be recommended to mango growers of Eastern Uttar Pradesh for obtaining maximum yield and prime quality fruits.

Keywords: Plant bio-regulator's, GA_3,NAA, Fruit Drop, Mango Yield Optimizations, Quality

Impact of organic manures on Strawberry cv. Winter Dawn

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The experiment was carried out at NSP- 6 farm of ANDUAT, Kumarganj, Ayodhya, U.P. Theexperiment was laid out in RBD with 8 treatments comprising of FYM, poultry manure and jeevamrit

alone and in combination also. The maximum values with respect to growthparameters like plant height 17.35cm, plant spread 33.73cm, number of branches/plant 19.93,earliest initiation of flowering 28.47 days, earliest fruiting initiation 6.43 days, number offruit/plant 21.27, yield of berries 101.0172q/ha revealed under the T_7combination of 200qFYM+250L of Jeevamrit/ha followed by T_8 (60q poultry manure+250L Jeevamrit/ ha). On the otherhand, the lowest values with respect to all the parameters were obtained in T_1 (Control).Themaximum values during experimentation for the physico–chemical attributes of fruit *viz.,* weightof berry 11.40g, fruit length 4.71cm, fruit width 3.80cm, TSS 7.97^{0}Brix, acidity 0.56%, ascorbicacid 57.22mg/100g, total sugars 5.71%, reducing sugars 4.22% and non-reducing sugar 1.71%was estimated in the plants treated with 200 q FYM+250L Jeevamrit/ha (T_7) followed by 60 qPoultry manure+250L Jeevamrit/ha (T_8).Due to maximum harvest of berries from T_7combinationof 200 q FYM+250L Jeevamrit, the highest cost:benefit ratio of 1: 3.10 was recorded followedby T_8 (1: 3.06). The lowest cost:benefit ratio (1: 1.31) were recorded in T_1 (Control). Thus, theapplication of 200q FYM+250L of Jeevamrit/ha can be recommended for the commercialproduction of strawberry in eastern Uttar Pradesh with better economic returns.

Keywords : Strawberry, Organic Manures andEconomic returns

Fruiting, growth and quality attributes of Ber cv.Banarasi Karakaas influenced by foliar application of GA_3, NAA and Urea

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To assess the fruiting, growth and quality attributes of Ber cv. Banarasi Karaka as influenced by foliar application of GA_3, NAA and Urea" an experimentwas carried out during the year of 2019-20 in the garden,Department of Fruit Science,College of Horticulture,Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh.The investigation was laid out in CRD (Completely Randomize Design) with 13 treatments which replicated thrice. Thirteen ber trees with uniform size and vigour were selected and sprayed with different concentrations of different nutrients*i.e.,* GA_3 (10,15 and 20 ppm), NAA (20,30 and 40 ppm)and urea (1.0, 1.5 and 2 %).The results of present study revealed that the fruit characters *i.e.,*fruit set (170), fruit drop (84.25%), fruit retention (15.75%), volume (15.65cc), length (4.45cm), weight (15.4g) diameter (2.98cm), pulp weight (14.38g), and pulp stone ratio (14.10)were improved significantly with the use ofGA_3 20ppm + NAA 40ppm + urea 2% (T_{12}) and quality characters such astotal soluble solids (15.35^{0}Brix), ascorbic acid content (102.75 mg/100g pulp) was improved significantly under treatmentGA_3 20 ppm + NAA 40 ppm + urea 2% (T_{12})and significantly minimum (0.11%) titratable acidity was recorded under the treatment of GA_3 20ppm + NAA 40ppm + urea 2% (T_{12}).

Keywords: Ber, GA_3, NAA, Urea, Growth and Quality.

Impacts of organic manure and biofertilizers on the physico-chemical attributes of newly planted dragon fruit (*Hylocer euscostaricensis* L.) in Kanpur region of Uttar Pradesh

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To assess the impact of vermicompost and biofertilizers on physico-chemical attributes of newly planted dragon fruit, an experiment was carried out in the garden, *Department of Fruit Science,* Chandra

Shekhar Azad University Agriculture and Technology Kanpur, Uttar Pradesh, India using eleven treatments *viz.,* T_1-Control, T_2-Vermicompost(0.5Kg/plant),T_3-*Azotobacter* (50g/plant), T_4-*Azospirillium* (50g/plant), T_5-PSB (50g/plant), T_6 -Vermicompost (0.5Kg/plant) +*Azotobacter* (50g/plant), T_7-Vermicompost (0.5Kg/plant)+*Azospirillium* (50g/plant), T_8-Vermicompost(0.5Kg/plant) + PSB (50g/plant), T_9-Vermicompost (0.5Kg/plant)+*Azotobacter* (50g/plant) +*Azospirillium* (50g/plant), T_{10}-Vermicompost (0.5Kg/plant)+*Azotobacter* (50g/plant) + PSB (50g/plant) and T_{11}-Vermicompost (0.5Kg/plant)+ *Azospirillium* (50g/plant)+ PSB (50g/plant) with three replications in Randomized Block Design. The application of vermicompost and biofertilizers per pillar containing three plants were applied in all the treatments during I year and II year. There was a significant difference during second year in terms of physico-chemical attributes of dragon fruit as influenced by vermicompost and biofertilizers. The maximum length of the fruit(8.96 cm), diameter of the fruit (7.55 cm), weight of the fruit (205.90g), volume of the fruit (162.33 cc), specific gravity (1.27cc) and number of bracts per fruit (30.99), and in biochemical parameters, total soluble solids (14.80 °Brix), titratable acidity (0.39%), ascorbic acid content(9.42 mg 100 g^{-1}), total sugars (9.40%), reducing sugar (5.23%) and non-reducing sugar (4.17%) were found with the application of Vermicompost (0.5Kg/plant)+ *Azospirillium* (50g/plant)+ PSB (50g/plant).In Dragon fruit yieldis highly potential and is remunerative from the second year and onwards.

Keywords : Dragon fruit,Vermicompost, Biofertilizers, Physico-chemical aatributes.

Effect of Plant Growth Regulators on Yield and Quality characters of winter season Guava

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Guava is one of the most common and important fruit crops, cultivated in the sub-tropical region of India. It is a popular fruit among people primarily because of its moderate price in the market and also being a rich source of vitamin C. Guava is a good source of carbohydrates, minerals, iron, calcium, and phosphorus. It possesses a high nutritional value. To investigate the effect of plant growth regulators on yield and quality characters of winter season guava, the foliar application of different concentrations of Benzyl Adenine (15 ppm and 20 ppm) and NAA (150 ppm and 200 ppm) were made on 25 year's guava plants during 2021-22 in the garden, Department of Fruit Science, Acharya Narendra Deva University of Agriculture and Technology, Kumarganj, Ayodhya (U.P.). Among all treatments, the application of NAA @ 200 ppm was found most effective in increasing yield characters like; fruit weight (155.36g), fruit length (7.67 cm), fruit width (7.53cm), fruit volume (140.67cc), fruit yield (61.61 kg/tree), and qualitative characters like; TSS (12.01°Brix), ascorbic acid (234.14 mg/100 g), reducing sugar (4.21%), non-reducing sugar (3.72%) and total sugars (7.93%). Based on the results obtained it can be concluded that the foliar spray of NAA @ 200 ppm was found most effective to improve the yield and quality of guava growers in Eastern region of UttarPradesh.

Keywords: Guava, NAA, TSS, yield and quality.

Effect of different concentrations of auxin as well as cytokinin on shoot initiation, formation and multiplication of pepino (*Solanum muricatum* Ait.) cv. Valentia with MS semi-solid medium

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The pepino (*Solanum muricatum* Aiton) is conventionally propagated through vegetative means,but this approach of propagation is not feasible for commercial production of plants and has at more time the chances of reduction yield. Therefore, the availability of quality planting material is of urgent need. Recently, there has been a promising approach for pepino multiplication at large scales through tissue culture because it generates a large number of contamination free plantlets in a minimum space and time. The combination of different growth regulators was tried to maximize the initiation, growth and development of shoot in commercial propagation of pepino plants. The minimum days taken for shoot initiation (5.21 days) was noted under BAP 3.00 mgl^{-1} + IBA 0.50ppm and minimum days taken for shoot development (40.82days) was noted under of BAP 3.00 ppm + IBA 1.00ppm. The highest length of shoot (9.52cm) was produced in media supplemented with BAP 3.00 ppm + IBA 1.00ppm. Maximum percent of developed shoots obtained from the established culture (67.79) was noted under the treatment of BAP 3.00ppm + IBA 1.00ppm; while maximum shoots per explants/ inoculums from the established culture (4.06) was noted under the treatment of BAP 3.00ppm + IBA 1.00ppm. Maximum number of leaves/plantlets from the established culture (10.85) was noted under the treatment of BAP 3.00ppm + IBA 1.00ppm and maximum fresh weight (mg) of shoot / plantlet obtained from the established culture (26.05mg) was noted under the treatment of BAP 3.00ppm + IBA 1.00 ppm.

Effect of Gibberellic acid and Boron on the performance of growth, flowering, fruiting, yield and quality parameters of strawberry

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The present investigation was carried out to investigate the effect of Gibberellic acid and boron on the performance of growth, flowering, fruiting, yield and quality parameters of strawberry (*Frageria* x *ananassa* Duch.)" on 20 October 2018-19 and 19-20 in the Garden, Department of Fruit Science, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, (U.P.). It was a field trial with 16 treatments, replicated thrice in a Factorial Completely Randomized Design. Aqueous solutions of GA3 (0, 50, 75, 100 ppm) and boron (0, 0.10, 0.25 and 0.50%) along with their combinations were sprayed on the plants with a hand sprayer. Individual application of treatments withGA3 75 ppm and boron 0.50% improve growth, flowering, fruiting, yield and quality of strawberry. Plants treated with 75 ppm GA3 in association with 0.5% boron were found most effective as compared individual application.

Keywords: Gibberellic acid, Boron, Strawberry, Growth, Flowering, Fruiting, Yield and Quality

"Effect of IBA and NAA levels on growth traits of Kagzi lime (*Citrus aurantifolia* Swingle)"

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Kagzi lime (*Citrus aurantifolia* Swingle.), an important fruit that belongs to the family Rutaceae, originated in India. Kagzi lime is one of the important fruit crops grown throughout the world ansdis also grown commercially in tropical and subtropical regions of India.Kagzi lime is propagated commercially through seed but it can be propagated by cutting, layering and budding owing to the high intensity of polyembryony (90-100%) and the least chance of contamination of viral diseases. Maharashtra state is leading in acid lime cultivation. Kagzi lime is a principal citrus fruit grown commercially in the Vidarbha and Marathwada regions. The major Kagzi lime-producing countries are China, Mexico, Brazil and India. The present experiment was carried out in a completely randomized design with 16 treatments which were replicated thrice. The results of this study on the effect of IBA 1000-3000 ppm and NAA 1000-3000 ppm alone and in combination on the growth of citrus cutting are discussed and interpreted in the light of previous research in India and abroad. The experiment showed significant findings and concluded that treatment of T_{15} (IBA 3000ppm + NAA 3000 ppm) showed early days of sprouting (22.00 days), an increase in number of sprouts per cutting (8.33), sprouts length (14.56cm) and diameter (6.01mm), number of leaves per cutting (20.97), length of leaves (5.16cm), width of leaves (4.37cm) and percentage of sprouted cuttings (73.09%) was maximum. Therefore, a combined spray of T_{15} (IBA 3000 ppm + NAA 3000ppm) can be advocated to citrus growers for securing higher yield and better quality of citrus fruit.

Impact of calcium chloride and calcium nitrate on various characteristics of Aonla (*Emblica Officinalis* Gaertn.) cv. NA – 10

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The research on impact of calcium chloride and calcium nitratewas carried out at main experimental station of College of Horticulture, ANDUA&T, Ayodhya, (U.P.). The objectives were to analyse the effect of calcium chloride and calcium nitrate on physio- chemical properties and fruit yield of Anola. The experiment consisted of 7 treatments having 3 replications which were laid out in Randomized Block Design (RBD). The assessment of experimental data revealed that among all the treatments, physical parameters, chemical parameters and yield were found to be superior upon the spray of 1.5% calcium nitrate. Highest fruit length (3.82 cm) was obtained by treatment of 1.5% Ca $(NO_3)_2$ followed by treatment 1.5% $CaCl_2$ (3.62 cm). Highest fruit diameter (4.15 cm) was obtained by treatment of 1.5% Ca $(NO_3)_2$ followed by treatment 1.5% $CaCl_2$ (3.98cm). Similar trends were observed in other parameters also where 1.5% Ca $(NO_3)_2$ and 1.5% $CaCl_2$ showed maximum values for fruit weight (40.70 g and 39.69 g), fruit volume (40.30 cc and 39.48 cc) and pulp weight (31.37 g and 30.95 g) respectively. Among the biochemical parameters the treatments 1.5% Ca $(NO_3)_2$ and 1.5% $CaCl_2$ reflected parallel trends where TSS (12.67 ºB and 11.87 ºB), ascorbic acid content (493.16 mg/100g and 489.13 mg/100g), reducing sugars (3.11% and 2.81%), non-reducing sugars (2.46% and 2.37%) and total sugars (5.57% and 5.18%) respectively showed maximum results. Highest yield q/ha (145.29 q/ha) obtained was by treatment with 1.5% Ca $(NO_3)_2$ accompanied by 1.5% $CaCl_2$ (132.11 q/ha) and 1.0% Ca $(NO_3)_2$ (116.59 q/ha).

Influence of Integrated Nutrient Management on growth, flowering and yield attributes of winter season guava

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Guava (*Psidium guajava* L.) is one of the most important under subtropical fruits, which requires a distinct winter for developing good fruit quality, which is influenced greatly by the climatic conditions. Guava fruit is considered one of the delicious and luscious fruits. It is a rich source of Vitamin 'C' after Barbados cherry (1500 mg/100g) and aonla (700 mg/100g).The present experiment was carried out in using ten treatments *viz.,* T_1-Control (without nutrient application), T_2-100% RDF (500:400:400 g /tree), T_3-75% RDF + FYM (60 Kg/tree), T_4-50% RDF + FYM (60 Kg/tree), T_5-75% RDF + *Azotobacter* (250g/tree), T_6-50% RDF + *Azotobacter* (250g/tree), T_7-75% RDF + PSB (250g/ tree), T_8-50% RDF + PSB (250g/tree), T_9-75% RDF + *Azotobacter* (250g/tree) + PSB (250 g/tree) and T_{10}-50% RDF + *Azotobacter* (250g /tree) + PSB (250g /tree) replicated thrice in RBD during two successive years *i.e.,* 2019-20 and 2020-21. A single plant is taken as a Unit. Form the results it is clearly reported thatplant height(0.67m), plant girth (5.41cm), plant spread (North-South and East-West in0.73 and 0.78 m), number of leaves (33.70), shootlength (36.40 cm), shoot diameter (4.87 cm), number of flowers (511.73),number of fruits/tree (273.93), fruit drop (46.48%), fruit weight (203.04 g),fruit length (8.23cm), fruit diameter (8.37 cm),fruit volume (186.40 cc) and fruit yield (59.11 kg/tree)were recorded with the application of 75% RDF + *Azotobacter* (250g) + PSB (250 g/tree), whereas minimum value of all characters under control treatment.So, suggested that for getting substantial more vegetative growth, flowering and fruiting with higher yield of winter season guava, should be fertilized with 75% RDF + *Azotobacter* (250g) + PSB (250g)/tree in the plains of central Uttar Pradesh, India.
Keywords : Guava, PSB, Azotobacter and RDF.

Study the effect of green manures, biofertilizers and vermicompost on growth, yield and quality parameters of sapota [*Manilkara achras* (Mill.) Fosberg] cv. Kalipatti

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To study the effect of various organic sources on growth and yield attributes parameters of sapota cultivar Kalipatti, A field experiment was conducted at Horticulture Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during the years, 2019-20 and 2020-21. The experiment was laid out in a Completely Randomized Design with three replications and ten treatments. Green manure, vermicompost, Anubhav Bio NPK consortium, and microbial consortia are used in treatment combinations, with inorganic fertilizers serving as a control. It was found that highest plant height (22.33 cm), plant spread N-S (21.17 cm)andE-W (20.17 cm), canopy volume (2327.13 cm^3), fruit diameter (6.02 cm), fruit weight (83.36 g), fruit volume (82.11 cm^3), number of fruits per tree (1264), yield (104.88 kg per tree and 10.48 t/ha) were recorded with application of 50% RDN from vermicompost + 50% RDN from green manure of sun hemp + microbial consortium (AMBC I) 100 ml per tree (T_8) in both the years. Whereas 75% RDN from green manure of sunhemp + microbial consortium (AMBC I) 105 ml + 10 ml Anubhav Bio NPK consortium per tree (T_5) resulted significantly maximum total soluble solid (23.49

°Brix), reducing sugar (6.08 %), non-reducing sugar (11.88 %), total sugar (17.96 %), ascorbic acid (21.48 mg /100g pulp), shelf life (9.09 days) and minimum acidity content (0.182 %) of fruits in both the years. This treatment also increased nutrient contents of soil as well as leaf along with microbial count of the soil.

Keywords: Sapota, Green manures, Vermicompost, Biofertilizers and Microbial consortium

"Impact of biofertilizers and bioinoculants on yield and quality of mango cv. Mallika"

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Continuous use of inorganic fertilizers is hazardous to the soil health in respect of physical, chemical and biological properties of soil. Therefore, the cost effective, sustainable and alternative organic sources are required to fulfill the nutrient requirements. The experiment was conducted at Horticultural Research Farm, BACA, AAU, Gujarat, India on mango cv. Mallika during the year 2019-20 and 2020-21 in 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. Results indicated that among the biofertilizers, D_3 recorded maximum fruit weight, diameter, number of fruits per tree, yield, pulp: stone ratio, TSS, ascorbic acid, total sugar with lower acidity. Among bioinoculants, S_2 showed better results for same parameters. Combine application *i.e.*, D_3S_2 found significant in case of fruit yield, acidity, ascorbic acid and total sugar.

Key words: Biofertilizers, bioinoculants, soil drenching, foliar spray

Recent advances in Plant Bioregulators in Fruit Crops

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In order to meet the emerging consumer demand and challenges towards fruit production, there is a need to explore new interventions. Among them, plant growth regulator plays a crucial role in fruit crops. Plant growth regulators (PGR), recently has been known as plant bio-regulators (PBRs); defined as organic compounds, other than nutrients, that in small concentrations, affect the physiological processes of plants. There are five classical growth hormones which have a specific function in physiological processes of growth and development that were already commercially exploited in fruit crops. Moreover, the use of plant growth regulators in fruit crops is a recent and emerging trend. These are utilized in fruits starting from propagation to improving quality, including from biotic to abiotic stress resistance. Plant bioregulators, include auxins, gibberellins, cytokinins, ethylene, abscisic acid, brassinosteroids, Jasmonate, salicylic acid, polyamines, karrikins, strigolactones, and nitric oxide. Recent investigations via gene expression analysis enlighten that these growth regulators are involved in the endogenous modulation of certain major traits in plant systems. Similarly, natural, and synthetic compounds of auxin, gibberellins, brassinosteroids, and their analogues are involved in increased stem and cell elongation, development, and yield of fruit crops. Abscisic acid, ethylene, salicylic acid, jasmonates, and polyamines are involved in fruit ripening and resistance to biotic and abiotic stress in fruit crops. Hence, the use of plant bioregulators is an effective alternative for future fruit production

and for combating production challenges. By utilizing modern biotechnological interventions, these plant bio-regulators can be endogenously modified and utilized in breeding a new variety.

Future farms: Doubling Income Through Hi-Tech Vegetable Cultivation

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Horticulture is the branch of agriculture concerned with the cultivation, production, and sale of fruits, vegetables, flowers, herbs, ornamental or decorative plants. It forms a major share of agriculture. Hi-tech vegetable cultivation is a technology that is trendy, less environment-dependent, and capital intensive however with a capability to boost productivity and farmer's financial gain. With the increasing population and climate change, food insecurity is increasing day by day. In the present scenario, the increasing population is to be fed from declining land and water due to climate change. The effect of climate change is likely to increase in terms of high temperatures, weather instability, the emergence of new pests and diseases so that need double production. strategies for doubling production and income in hi- tech vegetable cultivation by hi-tech nursery production, protected/ greenhouse cultivation, precision farming, integrated nutrient management(INM) for improving soil health, integrated disease management (IDM) by soil solarisation & soil sterilization, drip irrigation/fertigation technology for high water/nutrient use efficiency, mulching strategies helpful in weed management, use of drones for spraying, use of robots for different purpose like grafting etc, Vertical farming, Hydroponics/ Aeroponics, cold storage for long term storage purpose, technologies tools like global positioning system (GPS), geographic information systems (GIS), Artificial intelligence (AI), Block chain etc. used for data collection, supply management etc. Hi-tech vegetable cultivation is beneficial not just for raising vegetables crops however conjointly for conservation, plant protection, and post-harvest management together with value – addition which ultimately increased the yield and income.

Key words : Horticulture,Vegetable, Hi-tech cultivation, Strategies, Income

Effect of fruit bagging on yield and quality of guava fruit

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Guava fruits are getting good return price because of their high quality. But due to climate change such as abnormal rains, sudden fluctuations in the temperature, fog and the incidence of pests and diseases, the quality is reduced up to a great extent. Fruit bagging is a simple and phytosanitary procedure widely used to improve the visual quality by promoting fruit coloration and also to enhance internal fruit quality. An experiment comprised with two factors consisting stage of bagging (S) i.e., marble stage (S_1) and egg stage (S_2) and type of bagging materials (B) i.e., control-no bagging (B_1), newspaper bag (B_2), butter paper bag (B_3), non-woven red bag (B_4), nonwoven green bag (B_5) and non-woven white bag (B_6). The experiment was carried out in Completely Randomized Design with factorial concept (FCRD) and repeated thrice. The effect of different treatments on physical, yield and quality parameters and their interaction were studied. The results indicated that significantly maximum fruit weight (134.79 g), fruit length (6.07 cm), fruit diameter (6.43 cm), fruit volume (133.99 ml), fruit retention (96.11 %), number of fruits per tree (28.83), yield per tree (3.95 kg), yield per hectare (9.87 t), shelf life (6.73 days), TSS (11.83 °Brix), reducing sugars (6.48 %), total sugars (8.32 %), ascorbic acid (170.66 mg 100 g-1 pulp), higher sensory evaluation scores and minimum PLW (7.34 %) and titrable acidity (0.55 %) were recorded in egg stage of fruit bagging. Among different type of bagging materials, maximum fruit weight (137.13 g), fruit length (6.22 cm), fruit diameter (6.53 cm), fruit

volume (138.81 ml), fruit retention (97.22 %), number of fruits per tree (29.17), yield per tree (4.12 kg), yield per hectare (10.29 t), TSS (12.07 °Brix), reducing sugars (6.61 %), total sugars (8.56 %), nonreducing sugars (1.95 %), ascorbic acid (173.46 mg 100 g^{-1} pulp), shelf life (7.00 days) and higher sensory evaluation scores and minimum days required for harvesting and PLW (7.04 %) were recorded in non-woven red bag. While, the lowest titrable acidity (0.52 %) was found in newspaper bag. Minimum fruit fly infested fruits and maximum marketable fruits were found in non-woven bagged fruits. Guava fruits bagged with non-woven red bag produced 35.50 % more yield as compared to non-bagged fruits (control). The maximum net return (Rs. 192931/ha) was recorded in bagging of fruits at egg stage with non-woven red bag (S_2B_4). The results obtained from this research work showed that fruits bagged at egg stage with non-woven red bag was found better for enhancing the yield and quality of guava fruit.

Studying the impact of different mulches on soil properties and bulb yield of tuberose (*Polianthes tuberosa* L.)

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Mulch conserved soil moisture, especially in the early stages and reduced soil and water losses considerably by allowing more water intake into the soil profile. Organic residues serve as effective mulching materials, promoting soil health and sustainable agriculture. The integration of these residues enhances soil fertility by releasing essential nutrients, facilitates moisture retention and suppresses weed proliferation. Therefore, an experiment employing a randomized block design with three replications and eight mulch treatments was conducted. These treatments included no mulch, black polythene film (50 µ), silver-black polythene film (50 µ), red-black polythene film (50 µ), mustard straw (2" thick layer), castor shell (2" thick layer), fennel straw (2" thick layer), and bishop's seed straw (2" thick layer). Seed bulbs are planted as per the recommended package of practice for the region. The impact of mulch materials on soil properties and bulb yield was significant compared to the control. Mulching with bishop's seed straw (2" thick layer) demonstrated the maximum organic carbon, available nitrogen and phosphorus, followed by fennel straw (2" thick layer) and black polythene film (50 µ).The same treatment also exhibited the maximum bulb yield of tuberose followed by fennel straw (2" thick layer) and black polythene film (50 µ).This study provides farmers with a cost-effective selection of mulching practices, aiding in the management of spice crop residues and promoting the commercial cultivation of tuberose in the future.

Influence of bulb size and soaking treatment on growth, flowering and yield of tuberose (*Polianthes tuberosa* l.) Cv. Suvasini

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To investigate the individual and interaction effects on growth, flowering, and yield parameters in tuberose, a field trial was laid out with three bulb sizes i.e. small (1.25-1.75 cm), medium (3.00-3.50 cm) and large (4.00-4.50 cm) and six bulb soaking treatments thiourea (500 ppm), paclobutrazol (10 ppm), GA_3 (200 ppm), NPK consortium (10 ppm), Novel (5 ppm) and control in a randomised block design in factorial arrangement with three replications. The findings showed that each parameter under investigation was significantly impacted by bulb size. Bulbs of1.25 to 1.75 cm diameter recorded earliest sprouting, while the plant height, number of leaves per clump, weight of spike, number of florets per spike and spikes, florets and bulblets yield per hectare was found maximum in large sized bulb 4.00-4.50 cm diameter. This treatment also showed the earliest emergence of spike, opening of floret, maximum longevity of intact spike and duration of

flowering. Early bulb sprouting was induced by soaking tuberose bulbs in a solution of thiourea (500 ppm), whereas, GA_3 (200 ppm) treated bulbs had maximum plant height and number of leaves per clump, spike and rachis length, florets per spike, weight of spikes, yield of florets, spike and bulblets per hectare. The early initiation of flowering was observed with the same treatment. For the best results in terms of spike and floret yield, bulbs with a diameter of 4.00 to 4.50 cm combined with soaking bulbs in a GA_3 (200 ppm) solution were found superior.

Effect of seed priming and foliar application of organic substance on growth and survival of *Khirni* [*Manilkara hexandra* (Roxb.)]

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The germination of *Khirni* seeds is very poor and slow growth rate of *Khirni* seedlings is also a drawback in its rapid and mass multiplication Hence, there is a need for standardizing the method of improving the growth of seedlings. An experiment was laid out in Completely Randomized Design with factorial concept, with twenty treatment combinations comprising of five levels of seed priming (S_1 - *Cow dung slurry* 3 %, S_2 - *Cow urine* 3 %, S_3- *Bijamrut* 3 %, S_4 - *Amritpani* 3 %*and* S_5 - Water soaking) and four levels of organic spray (F_1- *Bijamrut*1 %, F_2- *Amritpani* 1 %, F_3-Novel Organic Liquid Nutrients1 % and F_4 - control) and repeated trice. The results revealed that seed priming with 3 % *Bijamrut*for 72 hours and organic spray of 1 % Novel Organic Liquid Nutrients at 45 and 60 DAS individually as well as in their combination gave maximum incremental seedling height and girth, number of leaves and leaf area at 60, 90 and 120 DAS. While, individually they gave maximum the fresh and dry weight of shoot and roots as well as absolute and relative growth rate at 120 DAS.

Recent advances and commercial propagation techniques in tropical and subtropical fruit crops

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Tropical fruit crops are evergreen in nature, cannot withstand cool temperature but can tolerate warm temperature of about 37 °C. The fruits of this zone require strong sunshine warm and humid climate and very mild winter& cannot with stand against frost. A fruit crop has intermediate characters to tropical and temperate fruits are called as a subtropical fruit. They may be either ever green or deciduous in nature and are usually able to withstand a very low temperature but not frost. Plant propagation is raising or multiplication or reproduction of plants. All plants in this universe are multiply themselves both by sexual or asexual means. The most important objective of a propagation method should be to produce individuals that are identical to its mother or original plant. The different methods which can be used to propagate fruit trees, including seed, cutting, grafting, budding, layering & micropropagation. Propagation by sexual method is "natural" method, but recently new plants are not identical to mother plant. Thus, genetic and physical variability occurs. So, in fruit crops new techniques are needed to approach for propagation. There are some recently developed new

techniques in different fruit crops which are: in mango (saddle grafting), banana (tissue culture, macro propagation), mandarin (micrografting, microbudding), guava (air layering, saddle grafting, bench grafting), grape (bench grafting, tissue culture), papaya (cleft grafting, cutting, tissue culture), sapota (softwood grafting, saddle grafting), dragon fruit (tissue culture, cleft grafting), pineapple (tissue culture), custard apple (softwood grafting, bench grafting) *etc.*

Foliar application of micronutrients enhances growth, yield and quality of strawberry (*Fragaria x ananassa*Duch.)

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The experiment was carried out At Navsari Agricultural University, Waghai to evaluate the effect of foliar application of Zn and Fe on growth, yield and quality of strawberry (*Fragaria* × *ananassa*Duch.) cv. Winter Dawn. The $ZnSO_4,7H_2O$ and $FeSO_4,7H_2O$ were used as a source for Zn and Fe, respectively and applied as foliar sprays individually (0.2 % and 0.4%) as well as in combination to the strawberry plants at 30, 60 and 75 days after planting of uniform runners. The plants which received no spraying were treated as control. The results showed that foliar spraying of 0.4 % $ZnSO_4,7H_2O$ + 0.2 %$FeSO_4,7H_2O$ 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, marketable fruit percentage, marketable and total fruit yield over control plants. However, fruits with significantly the highest total soluble solid, acidity and anthocyanin content were recorded with the foliar application of 0.4 % $ZnSO_4,7H_2O$ + 0.4 % $FeSO_4,7H_2O$. However, the micronutrient treatments failed to influence any significant effect on days taken to 50.0 % flowering, fruit firmness and acidity content of the strawberry fruits. In plants that were not sprayed, the minimum values of all the parameters were recorded.

Keyword: strawberry, Winter Dawn, quality, micronutrient, flowering

Response of bottle gourd (Lagenaria siceraria (Mol.) Standl.) to foliar application of plant growth regulators

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The present investigation entitled "Response of bottle gourd (Lagenaria siceraria (Mol.) Standl.) to foliar application of plant growth regulators" was carried out at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan during Summer- 2020. Experiment was laid out in randomized block design with three replications. Particularly of bottle gourd is economically important for small and marginal farms. This study explores the impact of plant growth regulators (PGRs) on the yield and quality of bottle gourd. Results indicate that the application of Ethrel at 300 ppm significantly increased the number of fruits per vine, yield per plot, and fruit yield per hectare. Additionally, Ethrel application led to numerically maximum fruit length and diameter, as well as increased chlorophyll content and total soluble solids. Furthermore, the economic analysis revealed that treatment with Ethrel at 300 ppm resulted in maximum gross return, net return, and benefit-cost ratio. In conclusion, foliar application of Ethrel at 2-4 leaf stage is recommended for achieving higher yield, better quality, and maximum net return of bottle gourd.

Keyword: Ethrel, PGRs, Bottle gourd *etc.*

Effect of inorganic fertilizers and bio fertilizers on growth, flowering and soil nutrient status of papaya Cv. Red Lady

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The experiment was carried out at Regional Horticultural Research Station (RHRS), ASPEE College of Horticulture, Navsari Agricultural University, Navsari during the year 2017-18 to 2019-20. The experiment was laid out in Randomized Block Design having nine treatment (T_1: 200:200:250 NPK g/plant (RDF) + 10 kg FYM/plant, T_2: 80% RDN + soil application of *Azotobacter* 20 ml per plant at the time of planting, 3 and 6 months after the first application, T_3: 60% RDN + soil application of *Azotobacter* 20 ml per plant at the time of planting, 3 and 6 months after the first application, T_4: 80% RDP + soil application of PSB 20 ml per plant at the time of planting, 3 and 6 months after the first application, T_5: 60% RDP + soil application of PSB 20 ml per plant at the time of planting, 3 and 6 months after the first application, T_6: 80% RDK + soil application of KMB 20 ml per plant at the time of planting, 3 and 6 months after the first application, T_7: 60% RDK + soil application of KMB 20 ml per plant at the time of planting, 3 and 6 months after the first application, T_8: 80% RDF + soil application of *Azotobacter*+ PSB + KMB each 20 ml per plant at the time of planting, 3 and 6 months after the first application and T_9: 60% RDF + soil application of *Azotobacter*+ PSB + KMB each 20 ml per plant at the time of planting, 3 and 6 months after the first application) which repeated thrice. The results were pooled of three years. The results revealed that among the different treatments maximum plant height (133.74 cm) at 3 and 9 month was obtained with T_9 (60% RDF + soil application of *Azotobacter*+ PSB + KMB each 20 ml per plant at the time of planting, 3 and 6 months after the first application. While, maximum plant height (155.79) at 6 month was recorded in T_8 which was at par with T_9, T_2 and T_1. Treatment T_9 recorded significantly highest stem girth (18.80, 28.33 and 38.81 cm) and number of leaves (18.31, 23.04 and 29.01) at 3, 6 and 9 month after planting, respectively. In case of soil nutrient analysis and microbial count, available N (293.49 kg ha^{-1}), available P (70.18 kg ha^{-1}), available K (441.60 kg ha^{-1}), PSB count (122.44 x 10^5) and KMB count (238.11 x 10^5) were also recorded maximum in the treatment T_9 (60% RDF + soil application of *Azotobacter*+ PSB + KMB each 20 ml per plant at the time of planting, 3 and 6 months after the first application). Flowering characters and *Azotobacter* count were found non-significant.

Key words : *Azotobacter*, KMB, Microbial count, PSB and RDF

Role of New Generation PGRs in Fruit Crops

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Plant hormones are small molecules derived from various essential metabolic pathways, which are present in very low concentrations and act either locally, at or near the site of synthesis, or in distant tissues. Plant hormones include the new generation PGRs like brassinosteroids, jasmonic acid, salicylic acid, polyamines and triacontanol. We often refer to the five classical plant hormones identified in the early to mid 20thcentury (Mary Williams, 2004). The activities of new class PGRs depend on their concentration and environmental factors affecting their absorption and the plant's physiological state. PGRs have the ability to affect cell division, cell structure, cell expansion, cell function and mediate environmental stress even at low concentrations. direct application to roots, leaf, flowers, buds, and shoots has been shown to enhance resistance to biotic and abiotic stress. New class of plant hormones that play important roles in various physiological processes including, seed development and germination, flower sex expression, fruit development, improvement of quantity, quality of produce, and resistance to various biotic and abiotic stresses.

Keywords : Brassinosteroids, Jasmonic acid, Salicylic acid, Polyamines and Triacontanol

Pre mature fruit drooping: causes and advancing remedies

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There is increasing concern about the fruit growth, development and quality of tropical and subtropical fruit cropswhichiswidely cultivated in India. The growth and development of fruit is sometimes very low due dropping and shedding of the fruit at various stages of fruit development. The fruit drop begins soon after fruit set and lastsuntil fruit maturity, however the factors associated with various stages of fruit drop differ. Initially fruit set is very high,however the majority of the fruits fall off as they develop. Fruit drop is a crucial problem just before harvesting in many fruit crops. The knowledge of causes of fruit drop and related factors are very important to the farmer for effective control of fruit drop. Incomplete pollination and fertilization, embryo abortion, development of abscission layer, unfavorable soil and climatic condition, nutritional deficiency and invasion of disease and pest. Considering these facts, a number of studies in fruit drop, fruit development stages and their control measures have been reviewed to attract the attention of large number of workers and extension agents for minimizing the fruit drop problem. Exogenous application of recommended dose of macro and micro nutrient and also use of PGRS at proper dose in appropriate time, good irrigation, nutrition management, adoption of mulching have an important role in improving fruit set, fruit retention and fruit

yield as well as reduced fruit drop. Therefore, keeping in mind all this information, there is need to understand the factors responsible for occurrence of fruitdrop at physiological level which are hindering the quality production and export potential of our country and also a need to follow a different management approach to manage a fruit drop in particular crop.

Canopy Management in Sub Tropical Fruit Crops

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Canopy management in fruiting trees has been practiced over the years for increasing the productivity and quality of the fruits. Management of canopy architecture is one of the predominant technologies by which huge and unmanageable trees are properly managed to make them more productive. Canopy management is the manipulation of tree canopies to optimize its production potential with excellent quality fruits. Canopy management deals in fruit crops deals with the development and maintenance of their structure in relation to their size and shape for maximizing productivity with quality fruits. To optimize the utilization of light for increased yield of quality fruits, canopy management deserves greater attention by exploiting the various available techniques like training, pruning (dormant, summer and root pruning), branch orientation (bending), scoring, girdling, selection of proper rootstock, use of plant growth regulators or retardants, high density planting, appropriate use of fertilizer, deficit irrigation, use of genetically engineered plants with altered architectural characters would help in maintaining the ideal canopies of trees. The basic objective of canopy management is to maximize light interception to optimize light distribution within canopy and to maintain proper airflow. Canopy management enhances productivity, improves fruit quality, facilitates cultural practices and help in management of pest and disease. In new plantations initial training and pruning is given to develop strong framework of the tree whereas in old plantation the aim of canopy management is to reduce tree height and make provision of solar radiation inside the canopy by thinning excessive biomass.

Key words : Pruning, training, thinning, rootstock and plant growth regulators.

Effect of Plastic Mulch and Row Cover in Vegetable Crops

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Protected agriculture is any technique used to modify a plant's natural environment in order to optimize plant growth. Such techniques are often used to protect plants from frost in order to extend the growing season of a crop. Through earlier crop production, growers are able to capitalize on early markets and higher prices. Many leading vegetables can be grown successfully using plastic mulch and row cover to extend the field growing season Plastic mulch in combination with row covers, has been shown to increase yield of several vegetable crops by improving moisture uniformity in the soil and raising air and soil temperatures, thus creating a favorable microclimate for the growth of vegetable crops. Many vegetables like chilli, cow pea, muskmelon, watermelon, ridge gourd, summer squash and some other vegetables are growing with plastic

mulch and row cover.Besides producing early and increased yields, mulch and row cover have other benefits, such as more efficient use of water. For greatest efficiency and economy, mulch and/or row cover must be employed as a part of total production system.

Keyword : Microclimate, Mulch, Protected agriculture and row cover

Influence of different growth retardants on dwarfism, flowering, yield and quality of papaya cv. GJP 1

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The present study carried out explore theeffect of growth retardants on dwarfism, flowering, yield and quality of papaya cv. GJP 1 was conducted at Fruit Research Station, Lalbaug, Junagadh Agricultural University, Junagadh. The experimental design followed a Randomized Block Design with three replications and included 10 treatments. The plants of papaya treated with different growth retardants and result showed that that the foliar spray of cycocel (3000 ppm *i.e.*, 6 ml/litre of water) at 30th and 45th day after transplanting restricts vegetative growth, induces early flowering, fruit set which resulted in early maturity, maximum yield, net realization and BCR.Though, biochemical parameters were reported in fruits of treatment of ethrel (250 ppm *i.e.*, 0.64 ml/liter of water).

Key words: Papaya, growth retardants, dwarfism, flowering, yield, quality *etc.*

"Enhancing Cut Flower Production and Quality via the Enrichment of Chitosan"

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The escalating challenges posed by biotic and abiotic stresses on global plant growth and crop yield necessitate innovative and sustainable solutions. The detrimental environmental impact of conventional chemical interventions has led to a shift towards safer alternatives. Chitosan, a natural biopolymer derived from crustacean exoskeletons, stands out as a promising candidate. Applied during seed treatment, Chitosan acts as an elicitor, constricting stomatal openings and enhancing chlorophyll levels in young plant leaves. Its versatility extends to coating fruits and vegetables, functioning as a fertilizer, serving as a biopesticide and fungicide, and promoting various aspects of plant growth and development. With antimicrobial properties observed at a concentration of 0.1%, Chitosan exhibits pronounced bactericidal effects against gram-positive bacteria, influenced by factors such as pH, molecular weight, degree of deacetylation, and concentration. The environmentally responsible use of Chitosan in plant disease control aligns with the evolving paradigm of sustainable agriculture. In flower preservation, Chitosan nanoparticles prevent stem bending, suppress microbial proliferation, and maintain the quality of flower stems. Research on freesia cultivation and orchid tissue culture showcases Chitosan's effectiveness in improving plant height, leaf count, chlorophyll content, and corm yield. Furthermore, in Gerbera vase life evaluation, Chitosan extends post-harvest life when

combined with citric acid or salicylic acid. In Dendrobium orchids, it induces gene expression changes, chloroplast enlargement, and structural modifications, contributing to enhanced floral output. Chitosan's diverse applications and positive outcomes across various plant species underscore its role as a sustainable and effective solution in modern agriculture.

Recent Advances in Propagation Technique of Papaya

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Papaya (*Carica papaya* L.) is a tropical fruit crop which belongs to family Caricaceae. It is polygamous plant and generally propagated by seeds. Seedling are hindered by problems related to sex reversal, inherent hetrogygosity and dioecious nature of the crop, also, some diseases are seed borne, so, chances of their transmission through seeds. Seed propagation led to large variation in growth, low and late fruiting, diminished fruit quality. In context to recent propagation techniques is vegetative propagation methods*i.e.* cutting, grafting and tissue culture very successful techniques for papaya propagation. In Papaya, earlier main problem for vegetative propagation was complete pith cavity in old plant but in initial stage very less or no cavity found. So, in initial stage vegetative propagation recorded more successful. Vegetative propagation by leaf cuttings has been practices successfully in South Africa for over 40 years, because papaya ring spot virus has not been a problem. Cleft grafting method and soft wood cutting recorded much useful with confirmed female and male plants in dioecious varieties as well as reduce the cost seeds of papaya. In tissue culture, shoot tip culture technique mostly used for large scale papaya plant propagation. Therefore, it's verified that the vegetative means of propagation is new way for production of quality planting material of papaya

Keywords: Papaya, seed, cutting, grafting, and tissue culture.

Effect of different propagation methods and use of growth regulators in long pepper (*Piper longum* L.) Under the protected cultivation

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The present investigation was carried out to study the combined effect of propagation methods and growth regulators on growth of long pepper (*Piper longum* L.) during the year 2014 in Factorial Completely Randomized Design (FCRD) in polyhouse at RHRS farm of ACHF, NAU, Navsari. Treatments were comprises of three repetitions with two factors, the first factor was growth regulators having four levels. - IBA, NAA, and their combinations (each having concentration of 500 mgl^{-1} along with control). Another factor was propagation methods having three levels – single node, two nodes and three nodes cuttings. The cuttings were dipped in respective treatment solutions for 10 second and planted in mixture of red soil + sand + vermicompost (1: 1: 1). Application of IBA 500 mgl^{-1} + NAA 500 mgl^{-1} with three node cuttings having minimum days taken for first sprouting (10.46 days) with maximum number of shoots per cutting (4.9), number of leaves per shoot (15.3), average length of shoot (47.41cm) and diameter of the shoot (5.01 mm). 500 mgl^{-1} + NAA 500 mgl^{-1} with three nodes cuttings significantly increases shoot parameters of long pepper under south gujarat condition.

Key words: IBA, NAA, Growth Hormones, Node cutting.

Yield and yield attributing characters influenced by foliar spray of micronutrients and banana pseudostem sap at different pH levels of on mango cv. Kesar

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The present experiment was conducted during 2015-16 and 2016-17 at RHRS, ACHF, NAU, Navsari, (Gujarat). The experiment was laid out in Randomized Block Design with Factorial Concept comprising two factors *viz*., different pH levels of foliar spray solution (4.5, 5.5 pH and best available water) and banana pseudostem sap (5%), novel organic liquid fertilizer (1 and 2%), mixture Grade IV (1%), boric acid (0.2%). The treatments were replicated thrice. The individual effects of foliar applications at induction of flowering and full bloom stage and their interactions on yield and yield attributing characters of mango cv. Kesar were recorded. The results revealed that the foliar spray solution at pH 4.5 level and foliar application of 2% novel organic liquid fertilizer gave maximum yield viz., number of fruits/panicle, numbers of fruits/tree and fruit yield (kg/tree and t/ha) and yield attributing characters like, fruit weight (g), fruit length (cm), fruit breadth (cm), fruit volume (cm^3), specific gravity (g/cm^3), firmness of fruit (kg/cm^2), pulp: stone ratio and minimum peel percentage. Interaction of different pH levels with banana pseudostem sap and micronutrients was found significant in case of number of fruits per panicle, fruit yield kg/tree and fruit yield t/ha of mango during investigation, which were the maximum when mango cv. Kesar tree treated at induction of flowering and full bloom stage with 2% novel organic liquid fertilizer at 4.5 pH level.

Key words: pH level, banana pseudostem sap, novel organic liquid fertilizer

Effect of foliar fertigation in ber (*Ziziphus mauritiana*) under conserved moisture conditions in Bara tract of Gujarat

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Bharuch district of Gujarat is arid region where moisture is limited which drastically reduces the nutrient availability at the time of fruit setting and development ultimately reduces the ber productivity. Foliar fertilization is one of the important practices in which nutrient to be injected through foliage which increase yield and quality of ber. Therefore there is need to evaluate the effect of foliar fertigation old ber trees under conserved moisture conditions in Bharuch district of Gujarat. The experiment was conducted at two locations, one at College of Agriculture, N.A.U., Bharuch and other at Agricultural Research Station, NAU,

Tanchha for three years (2015-16 to 2017-18) with eight treatments, i.e. T_1: Control, T_2: Urea (2%), T_3: DAP (2%), T_4: KNO_3 (2%), T_5: Novel Organic Fertilizer (2%), T_6: Novel Organic Fertilizer (4%), and T_7: Novel Organic Fertilizer (6%), T_8: NAA (20 ppm). The experiment was conducted in randomized block design with three replications and eight treatments (two trees per treatment).Different mulching treatments were done after the cessation of monsoon. Data on fruit yield per tree, sugar content, maturing period, T.S.S., N, P, K content in fruit and soil parameters pH, E.C., O.C., Available N, P_2O_5 and K_2O (Initial and after harvest) were recorded. The effect of foliar fertilization in old ber orchard was found significant on fruit yield and the pooled data analysis indicated that maximum fruit yield was recorded for T_6 treatment (34.88 kg/plant) which was at par to all the remaining treatments. L x Y × T, Y x T and L × T interaction results were found non-significant. The effect of foliar spray on maturing period showed non-significant effect of treatments during all the seasons. The sugar content was affected significantly by foliar fertilization at both the locations during all the years. In pooled analysis, the maximum sugar content was recorded for T_6 (10.59 %) which was significantly at par all the remaining treatments. The TSS (^{0}Brix) was found non-significant over the year sand location in pooled analysis. L × Y× T, Y × T and L × T interactions were found non-significant. The maximum TSS was recorded for T_6 treatment (15.99 ^{0}Brix) while minimum value was recorded in T_1 (15.42 ^{0}Brix).N content in fruit was found significantly affected by foliar spray. In pooled analysis, the maximum N content was recorded for T_2 treatment (3.08 %) which was at par with T_4 (3.07 %), T_7 (3.03 %) and T_8 (2.99 %). The effect of treatments on P content in fruit was found non-significant in pooled analysis over the years and locations. The effect of treatments on K content in fruit was found significant in pooled analysis over years and location. The maximum P content was recorded for T_4 and T_7 treatment (1.39 %) which was at par with T_5(1.37 %) and T_6(1.36 %).The various treatments have no significant effect on soil pH, EC, OC, available N, available P_2O_5 and available K_2O throughout the experimental years. Therefore, three times spray of 4% Novel organic fertilizer, *i.e.* first spray at flower initiation stage, second spray at pea stage and third spay at marble stage of fruits has shown significant effects on yield with good quality fruits and maximum net realization

Effect of mulching in ber (*Ziziphus mauritiana* L.) under conserved moisture conditions in Bara tract of Gujarat

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Bara tract of Gujarat comes under arid region where moisture is a limited factor for crop productivity. Ber is known for arid fruit whose productivity is low under rainfed situations. Generally, farmers of this region do not adopt any moisture conservation practices. Therefore, an experiment was conducted to evaluate the effect of moisture conservation techniques at two locations, one at Agricultural Research Station, NAU, Tanchha, and another at College of Agriculture, N.A.U., Bharuch for three years (2015-16 to 2017-18) with six treatments, i.e. T_1: No Mulch (Control), T_2: Dry grass mulch of 10 cm thickness, T_3: Wheat straw mulch of 5 cm thickness, T_4: Black plastic mulch of 25 microns, T_5: Cover crop (Green gram), and T_6: Soil mulch. The experiment was conducted in randomized block design with three replications and six treatments (two trees per treatment).Different mulching treatments were done after the cessation of monsoon. Data on fruit yield per tree, sugar content, maturing period, T.S.S., and soil parameters pH, E.C., O.C., Available N, P_2O_5 and K_2O (initial and after harvest) were recorded. The effect of moisture conservation techniques on ber trees was found significant on fruit yield and the pooled data analysis indicated that maximum fruit yield was recorded

for T_4 treatment (39.37 kg/plant) which was at par to all remaining treatments. L × Y × T, Y x T and L × T interaction results were found non-significant. The effect of treatments on sugar content and TSS (^{0}Brix) was found non-significant at both the locations over the years. In pooled analysis over years and location, maximum TSS was recorded for T_5 treatment (16.22 ^{0}Brix) while minimum value was recorded in T_3 (15.95 ^{0}Brix). L × Y × T, Y × T and L × T interactions were found non-significant. In pooled analysis, T_2 treatment recorded the maximum OC content (0.61 %) which was at par with T_3 (0.59 %) and T_4 (0.57 %). The use of black plastic mulch of 25 microns after the cessation of monsoon has shown a significant effect on ber yield with good quality fruits and maximum net realization.

Strategies for Improving Salinity Tolerance in Fruit Crops

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Soil salinity is a serious issue worldwide. Salinity is a most significant problem facing plant in agriculture.The most seriously salt affected areas in arid, semi-arid and coastal line where evapo-transpiration exceeds precipitation resulting in accumulation of salts in the soils rather than leaching out.As per the Central Soil Salinity Research Institute (CSSRI), Haryana in India, 6.73 M ha area is salt-affected and would increase to 16.20 M ha by 2050.Among horticultural crops the tropical and subtropical fruits are mostly regarded as salt sensitive.It is challenge for fruit production and quality due to its detrimental effects. Fruit crops as well as their cultivars differs in their tolerance against salinity.In Bael cv. NB-5, Pomegranate cv. Manfalouty and Banana cv. Poovan exhibited higher salinity tolerance.Salt tolerant rootstocks viz. Carrizo citrange in mandarin, Olour and Kesar in mango, Crioula in guava, Salt Creek and Dogridge in grapes gives better performance under saline condition.Beside this, Inoculation with biofertilizers (AM and rhizobacteria), nanoparticles (nZnO and nSi), growth substance like Putrescine, PBZ, salicylic acid, uni-sal and proper nutrient management provides better tolerance against salinity stress in tropical and subtropical fruit crops.

Facade Greening: A Way to Attain Sustainable Built Environment

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In urban areas today, natural vegetation are been replaced with concrete pavements, buildings and other structures, which bring with it several consequences such as; noticeable increase in the amount of energy used in heating and cooling buildings which led to urban heat island (UHI) effect, degrading of air quality, increasing the amount of hard surfaces in cities which led to rise in temperature and also increase the volume of storm water collected. The technology of integration of plants on building façade became a trend in the last decade. This paper outlined different types of green façade and their benefits to the built environment. The paper through review of related literature is aimed at discussing how façade greening positively affect the built environment through the moderation of air quality; mitigate urban heat stress through transpiration cooling and shading. The paper also shows that façade greening will help in attaining a healthier living and a pollution free work place in the urban areas and any other place. The research concluded that the use of greenery on building façade provides a way to attaining a sustainable built environment.

Keywords: Green Façade, Sustainability, Urban Heat Island, Air Quality

Biomass yield of spice crops as affected by light intensity under different photo- selective colour shade nets

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The photo-selective netting (shade house) with different colour shades were studied in spices viz., fenugreek, coriander and garlic grown at Soil and Water Management Research Unit, N.A.U., Navsari, Gujarat-396450 during summer season. In the experiment, five different photo-selective colour shade nets viz., Yellow (S_1), Red (S_2), White (S_3), Blue (S_4), Green (S_5) with relative shading (50% PAR) were used. Exposure of full sunlight used in open field as Control (S_6). Light intensity and radiation were found lower under different colour shade net as compared to open field. Growth parameters like plant height was significantly the highest in the garlic (22.49 cm) grown under red shade net (24.71 cm). Number of primary branches per plant was significantly found higher in coriander (5.84) in red shade net (5.40), the maximum root length (7.51 cm) and number of leaves per plant (23.92 per plant) in fenugreek and in red shade net 6.92 cm and 20.69, respectively. Fresh biomass was significantly recorded the highest in fenugreek (93.81 kg/100m²) under red shade net (80.22 kg/100m²) which was at par with green shade net 73.44 kg. Dry matter yield was highest in garlic (16.22%) as compared to coriander (11.57%) and fenugreek (11.44%); and it was observed higher in white shade net (14.06%) which was at par with red (13.56%), blue (13.47) and green (13.39) shade nets.

Responses of INM on Growth and Yield of Kalmegh

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The discovery of the present study *was carried out with eight treatments in simple* randomized blocks design *with three replications at d*epartment of Plantation, Spices, Medicinal & Aromatic crops, College of Horticulture, Mandsaur, Madhya Pradesh during the year2021-22. *The treatments accompanied with different doses of FYM, vermicompost and three bio-fertilizers (Phosphate solubilizing bacteria, Azotobactor and Azospirillum) along with a constant dose of nitrogen*. All the parameters were noted at 30, 60, 90, 120 days after transplanting and at harvest. Result revealed that the maximum plant height, leaf number, branch number, leaf area, leaf area index, leaf area duration, relative growth rate, crop growth rate, fresh weight, dry weight, number of pods, number of seeds, pod length, pod dry weight, harvest index by herbage& seed, dry herbage yield, seed yield, gross return, net return and benefit: cost ratiowere noted in treatment T_7- N@40 kg ha^{-1}+50% vermicompost+ biofertilizers@5 kg ha^{-1} while, cost of cultivation in T_2- N@40 kg ha^{-1} +50% FYM@7.5 t ha^{-1}.

Keywords: INM, Morphology, Yield,*Kalmegh, Bio-fertilizers*

Effect of irrigation levels, land configurations and growth substances on marketable yield, economics and storage life of onion

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The present investigation was undertaken at Soil and Water Management Research Farm, NavsariAgricultural University, Navsari during the winter (*Rabi*) seasons of 2021-22 and 2022-23 on onion

cv. Gujarat Junagadh Red Onion-11 (GJRO-11). The experiment consisting three factors, two main factors viz., deficit irrigation (0.4 ETc, 0.6 ETc and 0.8 ETc), land configuration (raised bed and flat bed) and one sub factor *viz*., foliar spray of growth substances (control, salicylic acid 250 mg l-1, potassium silicate250 mg l^{-1} and kaolin 50 g l^{-1}). The onion plants exposed to irrigation regime 0.8 ETc yieldedsignificantly the highest marketable bulb yield (39.23, 32.81 and 36.02 t ha^{-1}, respectively) and shelf life(69.17, 73.33 and 71.25 days, respectively) during both the consecutive years and in pooled analysis. Land configurations did not show significant influence on the marketable bulb yield. While, the maximum shelf life (69.17 days and 69.92 days, respectively) was obtained from the raised bed land configuration during first year and in pooled analysis. The highest marketable bulb yield (33.26 t ha^{-1})was noticed under the treatment receiving foliar spray of potassium silicate 250 mg l^{-1} however, the maximum shelf life (69.78 days) was obtained with foliar spray of salicylic acid @ 250 mg l^{-1}. Theeconomics was calculated based on individual treatment effect and maximum net income of Rs. 2, 42, 682 ha^{-1} and benefit: cost ratio (1.28) was registered by individual effect of 0.8 ETc irrigation level.

Impact of Fertilization on growth, Yield and quality of dragon Fruit (*Hylocereusundatus*)

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The study, titled "Impact of Fertilization on Growth, Yield, and Quality of Dragon Fruit (Hylocereus undatus)," aimed to assess the influence of inorganic fertilizers on the mentioned parameters. Conducted in the 2021-2022 period at a 4-year-old orchard in Rahuri, the experiment followed a Randomized Block Design with five treatments replicated four times. Results indicated significant variations in growth parameters across treatments. Treatment T2 (450 kg N, 350 kg P, and 300 kg K) showed the maximum vine length/pole (2.86 m), number of cladodes/pole (67.00), cladode length/pole (102.45 cm), number of flowers/pole (78.34), and minimum days to first flower (219.50) and days to harvest (245.20).Concerning yield-related parameters, treatment T2 also demonstrated the highest number of fruits per pole (74.75), fruit length (19.23 cm), fruit diameter (8.00 cm), average fruit weight (402.67 g), and overall yield (30.10 kg/pole; 90.29 kg/plot; 222.71 q/ha). Treatment T5, the absolute control (native fertility), recorded maximum values for TSS (15.00 °Brix), total sugars (11.00%), reducing sugars (9.13%), and minimum acidity (0.25%). Maximum peel thickness (3.98 mm) and peel weight (89.90 g) were observed in treatment T3 (350 kg N, 250 kg P, and 200 kg K), while maximum pulp weight (316.76 g) was recorded in treatment T2. The peel-to-pulp ratio was highest in treatment T1 (350 kg N, 250 kg P, and 200 kg K). Fruit firmness (7.27 N) recorded its peak in treatment T5. In conclusion, treatment T2 (450 kg N, 350 kg P, and 300 kg K) was found to be beneficial for achieving maximum growth, yield, and fruit quality. However, further trials are necessary for confirmation. The application of inorganic fertilizers was observed to enhance the growth, yield, and fruit quality of dragon fruit.

Response of seaweed extract at different pH levels of foliar solution on physical attributes of mango (*mangifera indica* l.) cv. kesar

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The experiment entitled "Response of seaweed extract at different pH levels of foliar solution on physical attributes of mango (*Mangifera india* L.) cv. Kesar" was conducted during the year 2018-19 and

2019-20 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. The experiment was laid out in Completely Randomized Design with Factorial concept (FCRD) which comprising three acidity levels of spray solution namely, A_1 : 4.5 pH, A_2 : 5.5 pH and A_3 : Best available water and four concentrations of seaweed extract namely, S_1 : 1 %, S_2 : 2 %, S_3 : 3 %, S_4 : 4 %. All the twelve treatment combinations were repeated thrice. Results revealed that the foliar spray solution at pH 4.5 levels and 1 % seaweed extract were found better with respect to physical characteristics like, maximum fruit weight (g), fruit length (cm), fruit breadth (cm), fruit volume (cm3), firmness of fruit (kg cm-2), pulp: stone ratio and minimum peel percentage and physiological loss in weight of mango fruit cv. Kesar. Interaction of different pH levels with seaweed extract was found maximum in fruit weight (g) when mango cv. Kesar trees treated with 4.5 pH level of 1 % seaweed extract at induction of flowering and marble stage.

Keywords : Seaweed Extract, pH Levels, Foliar Solution, Physical attributes

Effect of foliar spray of micronutrients and plant growth regulators on yield and quality attributes of guava (*Psidium guajava* L.) cv. L-49

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Guava (*Psidium guajava* L.), Botanically, guava belongs to the family Myrtaceae.This fruit is a native of tropical America and extensively grown in South Asian countries. The fruit quality of winter season is far better than that of rainy season.PGRs play a significant role in many physiological phenomena. Various type of PGR like NAA,GA3 and Borax have been reported to be used for improving the flowering, fruit size and quality of fruit as well as yield. These are used in vegetative propagation, artificial induction of seed lessness. A field experiment was conducted during 2020-2021 at Horticulture Research Farm-1, BBAU, Lucknow on 11- year- old guava plants, Effect of foliar spray of Micronutrient and plant growth regulators on physical parameter of guava (*Psidium guajava* L.) cv. L-49",Experiment was laid out in Randomized Block Design with three replications. revealed thatyield (q/ha) Specific gravity of fruit,Total soluble solids (^{0}Brix), Acidity, Ascorbic acid, Total sugar, reducing sugar, non – reducing sugar and were maximized when foliar spray was done with Borax 0.5%+GA_3 40 ppm respectively.

Key words: Micronutrients, PGR, yield, quality.

Green Synthesis of Silver Nanoparticles and its Application in Tomato (*Solanum Lycopersicum*L.)

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Green synthesis of silver nanoparticles utilizing different plant components or microbes has been shown to be more economical, environmentally benign, reproducible and energy-efficient in contrast to physical, chemical and biological procedures.This study used an aqueous leaf extract of *Thevetia peruviana* to demonstrate theplant-mediatedsynthesis of silver nanoparticles. The nanoparticles synthesized were characterized by UV- Visible spectrophotometer,FTIR spectroscopy, Scanning Electron Microscopyand X-ray diffraction. The present study was conducted at Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow- 226025 (U.P.)India to standardize the optimum dose of silver nanoparticles on tomato (*Solanum lycopersicum* L.), an important Solanaceous fruit vegetable of the world. Different concentrations of the synthesized silver nano particles viz., 20ppm, 25ppm, 30ppm, 40ppm,

50ppm and 60ppm were applied on the tomato plants in a pot experiment laid out in CRD. Observations were recorded for growth parameters viz, plant height, no of leaves per plant, leaf length, no of leaf in branch. 25ppm of silver nanoparticles applied as a foliar spray 30days and45 days after transplanting yielded superior results.

Key words : silver nano particles, Tomato (*Solanum lycopersicum* L.)

Effect of Nano Urea, Titanium Dioxide and Zinc Oxide Nanoparticle on Growth, Yield and Quality of Okra *(Abelmoschus esculentus)*

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The present investigation was conducted to study the effect of nano fertilizer in the growth yield and quality of okra *(Abelmoschus esculentus)*. The experiment was carried out at the Horticulture farm of BBAU, LUCKNOW, during the year 2023. The experiment was laid out in randomized block design with three replications. eighteen different treatments were carried out with different combinations of Nanoparticles. The result obtained with treatment T13 (75%RDF+2ml/l Nano urea+ 50ppm Zno) was recorded the best among in all combination term of growth, yield attribute parameters like plantheight 125.67 cm, number of leaves per plant 32.25, stem diameter 2.7, number ofbranchesper plant 2.36, days to first flowering 39.50, days to first fruit formation 4, days to first harvesting 44.50, pod length 10.8cm, pod width 1.53cm, number of flower per plant, number of pods per plant 23.17, average of pod weight 9.5g, less Moisture 82.94% and Dry weight 17.06, pod yield per plant 220.08g, pod yield per plot 3.52kg, pod yield 163.02q ha where as, Chemical parameters like TSS 6.6^{0}Brix, Total sugar 4.1, reducing sugar 1.03, Non reducing sugar 3.1 and Acidity 0.32 were found superior with the help of combined application of 25%RDF+ 4ml/l Nano urea+ 10ppm Tio_2+ 50ppm Zno Nanoparticles (T_{18}).

Keyword : Nanoparticles , foliar application, Okra.

Effect of Phosphorus Levels and Bio-fertilizers on Growth, Yield and Quality of Garlic (*Allium sativum* L.) cv. G -282

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Garlic (*Allium sativum* L.) having diploid chromosome number 2n=2x=16 belongs to the family Amaryllidaceae (Alliaceae); known as Lahsun in Hindi, is one of theimportant bulb crops grown in India. This experiment was carried out at the Horticulture Research Farm-II of the Department of Horticulture, at Babasaheb Bhimrao Ambedkar University (A central University) Vidya -Vihar Raebareli Road, Lucknow-226025 (U.P.), India during Rabi season of 2016-2017. Treatment combinationT_0 Control,T_1 25 kg/ha P_2O_5,T_2 50 kg/ha P_2O_5,T_3 75 kg/ha P_2O_5,T_4 PSB, T_5 PSB + 25 kg/ha P_2O_5, T_6 PSB + 50 kg/ha P_2O_5, T_7PSB + 75 kg/ha P_2O_5, T_8 VAM, T_9 VAM + 25 kg/ha P_2O_5, T_{10} VAM + 50 kg/ha P_2O_5, T_{11} VAM + 75 kg/ha P_2O_5, T_{12} PSB + VAM, T_{13} PSB + VAM + 25 kg/ha P_2O_5, T_{14} PAB + VAM + 50 kg/ha P_2O_5, T_{15} PSB + VAM + 75 kg/ha P_2O_5.On the basis of the results obtained in the present investigation, it may be concluded that application of different phosphorus levels and bio-fertilizers enhanced the growth; yield and quality of garlic except days take bulb initiation in comparison to control. Application of 75 kg P_2O_5 and inoculation with PSB + VAM may be

considered as best treatment in terms of garlic bulb production (145.84 q/ha and 149.06 q/ha). It is recommended for higher production of garlic under Lucknow conditions.

Keywords: PSB + VAM + 75 kg/ha P_2O_5, Garlic.

The role of far-red light in driving the circadian clock for photoperiodic timekeeping in chrysanthemum flowering

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Chrysanthemums are photoperiodic plants and the circadian clock plays an important role in regulating photoperiodic timekeeping and flowering in plants. In chrysanthemum morifolium, a short-day plant, the involvement of phytochrome in the flowering response has been established. However, the specific role of far-red (FR) light in driving the circadian clock and its relationship with photoperiodic regulation of flowering remains unclear. Role of FR light in flowering of chrysanthemum and its effect on circadian clock-related genes. We found that flowering in chrysanthemum was strongly inhibited by exposure to FR light followed by short days combined with blue light (B-SD). However, when B-SD was supplemented with red light (B+R-SD), the inhibitory effect of FR light was abolished. These results indicate that the presence of red light during the daily photoperiod alters the light quality required for effective FR light inhibition. The inhibitory effect of FR light after B-SD can be partially reversed by subsequent exposure to the FR light pulse. This suggests that FR light acts as an important regulator of the circadian clock in chrysanthemum, possibly by influencing the expression of circadian clock-related genes.

Keywords : Far-red light;photoperiod; chrysanthemum

Foliar application of zinc in the agronomic biofortification of radish

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Micronutrient malnutrition is an important issue in developing countries, especially in Asia and Africa, where millions of school-going children and pregnant women are affected. Poor people are more exposed to the risks of malnutrition and hidden hunger because of their intake of carbohydrate-rich but micronutrient-deficient plant-based food.In the developing world, especially India, where cereal-based diets are prevalent and where availability to fruits and vegetables is restricted, mineral (Fe and Zn) deficiency is a major food-related primary health issue. Zinc deficiency affects approximately 50% of India's land area. Malnutrition can be managed through various techniques, but the most effective, feasible, sustainable, and socially acceptable strategy is biofortification. A very affordable strategy to increase food consumption of micronutrients is agronomical fortification. Among the most important minerals that your body cannot produce on its own through metabolism is zinc. It helps with immunity, growth, DNA synthesis, and other processes. The well-established public health issue of zinc (Zn) insufficiency associated with insufficient dietary intake can lead to severe health and socioeconomic challenges. The objective of this study was to examine the potential impacts of a zinc biofortification strategy on the amount of zinc and phytochemicals found in root vegetables such as radish. Although it has remained a relatively new idea in India, bio-fortification of vegetables is the most effective way to increase plant quality by adding the necessary minerals to food items, which will help alleviate malnutrition.

Key word : Radish, Malnutrition, Zn fortification

Effect of soaking with plant growth regulators on growth, yield and quality of gladiolus (*Gladiolus grandiflorus*)

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The present investigation entitled "Effect of soaking with plant growth regulators on growth, yield and quality of gladiolus *(Gladiolus grandiflorus)*" was carried out during winter season, 2021-22 at Horticultural Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist. Mehsana, Gujarat. Experiment was laid out in randomized block design with three replications and was planted by soaking the corms for 24 hours in different plant growth regulators. *viz*. GA_3, NAA and BA. Total thirteen treatments were evaluated in the present study *viz*., T_1: without soaking; T_2: Soaking in 50 ppm GA_3; T_3: Soaking in 100 ppm GA_3; T_4: Soaking in 150 ppm GA_3; T_5: Soaking in 200 ppm GA_3; T_6: Soaking in 50 ppm NAA; T_7: Soaking in 100 ppm NAA; T_8: Soaking in 200 ppm NAA; T_9: Soaking in 300 ppm NAA; T_{10}: Soaking in 25 ppm BA; T_{11}: Soaking in 50 ppm BA; T_{12}: Soaking in 100 ppm BA and T_{13}: Soaking in 150 ppm BA. Treatments were evaluated with respect to growth, yield and quality parameters of gladiolus. Among various treatments, soaking in 100 ppm GA_3 was found significantly superior to rest of the treatments with respect to growth, spike yield, cormel yield and quality. However, treatment soaking in 100 ppm BA was found significantly superior among all the treatments with respect to maximum number of sprouts per corm and maximum number of corms per plant, per plot and per hectare. On the basis of economics of the treatments, the highest benefit cost ratio and net realization obtained with treatment of GA_3 at 100 ppm.

Keywords: gladiolus, GA_3, NAA, BA, growth, flowering, corm production, cormel

Evaluation of different dahlia (*Dahlia variabilis* L.) varieties in Saurashtra region of Gujarat.

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Experiment was conducted with 16 different decorative types of dahlia varieties at Jambuvadi Farm, College of Horticulture, Junagadh Agricultural University, Junagadh which falls under South Saurashtra Agro-climatic Zone during two years, i.e., 2021-22 and 2022-23. Results obtained from the pooled data analysis for both the years under present studies pertaining flowering parameters with respect to different varieties are as under. Variety Good Day recordedless number of days (46.44) to initiate flower bud Variety Nearest Blue recorded largest stem girth (11.39 mm). Maximum flower diameter was recorded in Prime Minister (17.07 cm). Highest stalk length (25.46 cm) was observed in variety Pusa Sona. Highest weight of single flower (79.55 g) was observed in variety Pusa Sona Maximum number of flowers per plant (5.56), per plot (83.50) and per hectare (21806.41) was produced in variety Pusa Sona. Flower yield per plant (430.47 g/plant), per plot (5.75 kg/plot), per hectare (1.79 t/ha) was recorded highest in variety Pusa Sona. Maximum vase life (3.69 days) was observed in variety Pusa Sona.

Keywords: Dahlia, Saurashtra, Decorative

"Effect of foliar application of biostimulants and silicon on fruit set and drop of mango (*Mangifera indica* L.) cv. Kesar"

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The present investigation entitled "Effect of foliar application of biostimulants and silicon on fruit set and drop of mango (*Mangifera indica* L.) cv. Kesar" was carried out at Fruit Research Station, Sakkarbaug, Junagadh Agricultural University, Junagadh during 2020-21 and 2021-22. The experiment was laid out in Randomized Block Design with Factorial concept consisting two factors with three replications. The treatment comprised with biostimulants viz., without biostimulant, humic acid (1.5%), panchagavya (3%), seaweed extract (0.2%), novel organic liquid fertilizer (2%) and silicon i.e., without silicon, potassium silicate (0.2%) and Orthosilicic acid (0.2%). The results of the study indicated that among the different biostimulants foliar application of humic acid 1.5% and out of the different silicon foliar application of potassium silicate 0.2% was recorded with maximum number of fruits at grain (71.21 and 70.25), pea (15.19 and14.23) and marble stage (4.36 and 4.08), fruits at pea (21.27 and 20.21%) and marble stage (6.09 and 5.77%) and minimum fruits drop at pea (78.74 and 79.82%) and marble stage (93.91 and 94.23%) during in pooled analysis, respectively. Interaction effect between biostimulants and silicon failed to produce any significant effect on all the above parameters during the year 2020-21, 2021-22 and in pooled analysis. It can be concluded that for improved fruit set and reducing fruit drop with foliar application of humic acid 1.5% along with potassium silicate 0.2% at initiation of flowering, pea and marble stage.
Keywords : Biostimulants, silicon, mango, Kesar

Diagnosis and Recommendation Integrated System (DRIS) norms in custard apple (*Annona squamosa*. Linn)

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A leaf sampling survey was carried out at 15 villagcs in statcs of Gujarat and Rajasthan in thc ycars 2018-2020 and collected 338 samples in custard apple to develop DRIS norms. The leaf samples were collected in july month and the leaves present in the middle portion of the recently matured twig were analyzed for the nutrients and classified based on standard deviation (SD) in to deficient (< (mean-8/3 SD)), low((mean-8/3 SD) to (mean-4/3 SD)) , optimum ((mean-4/3 SD) to (mean+4/3 SD), high ((mean+4/3 SD) to (mean +8/3 SD)) and very high (> (mean + 8/3 SD). The optimum concentration of nitrogen in the index leaf ranged from 1.96 % to 3.06 %, whereas phosphorus, potassium, calcium, magnesium, sulphur, iron, manganese, zinc and copper ranged from 0.13 to 0.17 %, 0.59 to 0.99 %, 1.48 to2.26 %,0.69 to 1.64 %,0.29 to 0.45 %, 126 to 328 ppm,243 to 323 ppm, 38 to 56 ppm and 21 to 36 ppm respectively. This information is used for developing DRIS and CND norms and to predict nutrient needs based on DRIS indices in nutrient management of custard apple trees.
Key words: DRIS, Custard apple, Nutrient management, leaf sampling

Evaluation of Rose varieties for pot cultivation inThiruvarur region of Cauvery Delta

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Rose belongs to family Rosaceae. It has diploid chromosome number of 14.For cultivation of rose Leghari *et al.*(2016) suggests that well-drained loamy, silty loam and sandy loam soil with pH between 6 and 7.5 is favorable for rose cultivation; however, rose can also grow and tolerate pH range up to 8.Xie L. *et al.*(2019) carried out research in "Physiological responses of garden roses to hot and humid conditions" on

varieties Marie Curie and Lapjau; further concluding that there were differences in chlorophyll content between the two cultivars both before and after being subjected to hot and humid conditions. The experiment was conducted in the Department of Horticulture, Central University of Tamil Nadu, Thiruvarur from July'22 to March'23. It was done in FCRD (Factorial Completely Randomized Design).There were two factors effecting the research i.e. genotypes (Paneer rose, Kashmiri rose, Arka Pride, Arka Parimala and Arka Sukanya) and media treatments (Local soil; Local soil and Red soil; Local soil, Red soil and FYM; Red soil and FYM; Red soil). Maximum number of flowers per plant was observed in G2T5 (Kashmiri rose + Red soil) at 30 DAT; only G5T1 (Arka Sukanya + Local soil) gave flowering at 60 DAT and remaining did not. G1T1 (Paneer rose + Local soil) and G2T3 (Kashmiri rose + Local soil, Red soil and FYM) gave maximum number of flowers per plant at 90 DAT.

Techno-interventions in extraction of essential oil from loose flowers and aromatic crops

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Many flowers and aromatic crops contain essential oils which carry beneficial effects. These crops have been exploited and used in many countries like China, India followed by Indonesia, Sri Lanka and Vietnam for essential oil extraction. Flower crops like rose, jasmine, lavender, tuberose etc. are very common examples of such flower crops. Aromatic crops like mentha, nigella, kodavan, vetiver, patchouli, lemon grass etc. are also used. Two types of methods are there for extraction of essential oils, broadly classified into: Traditional and Modern methods. Traditional methods include hydrodistillation, hydrolytic maceration distilled, expression, pelatrice process, sfumatrice and cold fat extraction methods. Whereas, modern methods include improved techniques like headspace trapping technique, solid phase micro-extraction, supercritical fluid extraction, phytosol extraction etc. Depending upon the requirements, different methods are needed. There are many more methods yet to be exploited efficiently in essential oil extraction. There still lies a great scope for this industry to flourish.

Keywords: Volatile compounds, essential oils, methods of extraction, distillation, aromatic compounds.

UNVEILING THE STABILITY PARAMETER FOR FRUIT YIELD AND ITS COMPONENTS OVER ENVIRONMENTS IN EGG PLANT (*Solanum melongena* L.)

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The present investigation was designed in order to estimate stability parameters for fruit yield and its component traits in egg plant. The experimental material comprised of 8 parents, their resultant 28 hybrids produced following half diallel mating design and a standard hybrid check "GJBH-4" of eggplant, which was evaluated in randomized block design with three replications. The experiment was conducted at three different locations *viz*., College Farm, N. M. College of Agriculture, Navsari (L1), Wheat Research Station, Bardoli (L2) and Hill Millet Research Station, Waghai (L3), Navsari Agricultural University, Navsari during *rabi* 2020-21. Stability analysis results indicated that both linear and non-linear component played an important function in building up G × E interaction in our experiment. The magnitude of environment (linear) over G × E (linear) for all characters were high except for fruits per plant, fruit weight and fruit diameter, which might be the reason for higher adaptation in relation to yield and other characters. Result of stability parameters of 37 genotypes (parents + hybrids + standard check) exhibited that none of the genotype was stable for all the traits studied. Stability ANOVA also revealed that G × E interaction was highly significant only for branches per plant against pooled error and pooled deviation. The stability parameters analysis for this character confirmed that BPG-3 displayed above average response and specifically adapted to unfavorable locations in comparison to all the other parents. GJBH-4 (check) displayed average response along with high stability under all locations for branches per plant.

Key Words: Stability analysis, G × E interaction

Session VI

Safe and Toxin Free Production and Protection Technology

On farm production of quality inputs for entrepreneurship development and organic production of horticultural crops

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Imbalanced use of chemical fertilizers, especially nitrogenous has resulted ins ome 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. Further, indiscriminate use of agro-inputs specially pesticides, has led todevelopment of resistance to pests to pesticides, while destroying irretrievably the beneficial ones *viz.*, honey-bees, pollinators, parasitoids, predators, besides causing harmful pesticide residues in the end product adversely impacting productivity and food safety. Availability of quality organic inputs in the markets are not assured and they do not meet the standard set by the BIS. Emphasis should be given for on farm production quality organic inputs for cost effective and sustainable production. After closely working with organic farming systems more than two decades, I am of the view that "on farm production organic inputs could be acheap and alternative tool to resolve many issues. In various organic farming systems viz; bio dynamic, natural, Natueco, Rishi Krishi and homaorganic farming inputs are produced with cow products and locally available materials. Biodynamic compost, cow pat pit, BD-500, 501, biodynamic liquidpesticides, Vermiwash, Amritpani, Panchagavya, Jeevamrita, Beejamrita, Ghan Jeevamrita, Agni Astra, Brahmastra, Dashparni Ark, Amrit Jal and othervarious preparations are rich source of microbial consortia, macro, micronutrients and plant growth promoting substances including immunity enhancers. In a study, test microbial isolates from various organic inputs showed that Vermiwash contained maximum number of P-solubilisingmicrobes ($26.4x10^6$ CFU ml^{-1}), bacteria ($22x10^6$ CFU ml^{-1}) and Azotobacter($22x10^6$ CFU ml^{-1}). In Cow pat pit, maximum number of actinomycetes($96x10^6$ CFU ml^{-1}) and pseudomonas population was observed, whereas Panchagavya contained maximum number of Azotobacter ($20.8x10^6$ CFU ml^{-1}). Based on morphological characterization, isolates from Vermiwash V10and V12 were tested positive for all PGP properties and isolates from cow patpit, CP2, CP7, C8, CP14 & CP16 observed highly positive for Zn solubilization, while CP2, CP7, CP8 & CP14 tested positive for P- solubilization. P8 isolatefrom Panchagavya, showed maximum PGPR properties including phosphorus, zinc solubilization and siderophore production. Production cost of theseinputs varies from Rs.1.5 to 35/liter/kg, therefore entrepreneurship can be developed by production and sale of these inputs.

Case study for homa farming in horticulture

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All live on this planet – plant kingdom, animal kingdom, and humans – are affected by the global destruction of our environment, our Mother Earth. Present day farming systems contribute to these problems: Conventional agrochemical horticulture 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 achieve a sustainable environment, to guarantee food and nutritional security - basically to save our planet. 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. 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. Also biodiversity is increased around places where Agnihotra and other Homa Fires are going on as Nature is coming back to Harmony

Impact of Customized Balance Nutrition on Productivity, Quality Soil Health & Climatic resilience in Tomato

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The importance of balanced nutrition in agriculture is underscored by its adherence to the 4R principles - right ratio, right dose, right method, and right time for fertilizer application. This practice ensures the sustainability of soil fertility, encompassing physical, chemical, and biological aspects. It leads to enhanced crop productivity, improved quality, and increased resilience to climate variations by reducing greenhouse gas (GHG) emissions. Nitrous oxide (N2O), a major GHG, is significantly emitted from agricultural activities, particularly nitrogen fertilizer application. Agriculture contributes substantially to global N2O emissions, with vegetable fields, known for intensive cultivation, being notable contributors. In India, a major vegetable producer, the cultivation of crops like tomatoes is projected to rise. The introduction of customized water-soluble fertigation grades, exemplified by Mahadhan Agritek Ltd.'s "SOLUTEK" brand, addresses the challenges of nutrient management in horticultural crops. Through extensive research and trials, these grades are tailored for specific crops and stages, enhancing nutrient use efficiency. The solutions not only boost productivity and quality but also contribute to reducing nitrogen application, mitigating GHG emissions. The "SOLUTEK" solutions, validated through studies at reputable institutions, offer farmers a streamlined approach to nutrient application, aiding decision-making and reducing the need for multiple fertilizers from various sources. This approach aligns with India's commitment to reducing GHG intensity, emphasizing the role of climate-smart technologies like "SOLUTEK" in achieving sustainable agricultural practices. Integrating Ag IOT with these solutions represents a forward-looking approach, addressing real-time challenges posed by climatic variations, stresses, and soil variability.

Effects of soil ameliorative measures on soil health, growth and yield attributes of broccoli – tomato cropping system under acidic soils of Meghalaya

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The diverse climatic conditions of north-east India provide farmers with opportunities to grow a wide range of vegetable crops. However, the productivity of high-value crops like tomatoes and broccoli in the region is very low, *i.e.*, mainly due to deficiency of the acid soil limiting nutrients and moisture stress. The experiment was conducted for two years (2018-2020) to study the effects of soil ameliorative measures on

soil health, growth and yield attributes of the broccoli–tomato cropping system under acidic soils in Meghalaya. Total of four treatments, i.e., T_1: Biochar (biochar 5 t ha^{-1}); T_2: Lime (0.25 t ha^{-1}) + Biochar (5 t ha^{-1}); T_3: Lime (78 % $CaCO_3$ equivalent) @ 0.25 t ha^{-1}; and T_4: Control were applied on broccoli hybrid Fiesta under irrigated and moisture stress conditions. To study the residual effect of the treatments, tomato (cv. Megha Tomato-3) was grown on the same plots. The experimental site was acidic in reaction (pH 4.6), high in organic carbon (1.31%), medium in available nitrogen (280.5 kg ha^{-1}), low in available phosphorus (9.1 kg ha^{-1}) and medium in available potassium content (175.2 kg ha^{-1}). The treatments have also shown significant improvement in soil pH (> 5.2) with an increase in the availability of NPK as well as Ca+Mg. Applications of lime and biochar alone as well as in combinations have shown significant effects on the growth and yield attributes of both crops. The highest marketable head yield (24.54 t ha^{-1} and 20.21t ha^{-1}) of broccoli was recorded from treatment (T_1) under irrigated as well as moisture deficit conditions, respectively. Moreover, the maximum yield (63.91 t ha^{-1}) in tomato was recorded from treatment T_2 (lime + biochar), followed by treatments with biochar (55.57 t ha^{-1}) and lime (48.16 t ha^{-1}) alone. Hence, lime in combination with biochar can be applied to improve soil health as well as crop yield.

Keywords : Broccoli, tomato, lime, biochar, yield, quality

Anthocyanin Guardians: Protecting Plants from Environmental Stress

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Global warming has become a significant factor leading to both abiotic and biotic stresses, hampering plant growth and productivity. Drought, low and high temperatures, pathogen attacks, and salinity negatively affect plant development, imposing challenges that plants, being immobile, cannot escape. However, plants have developed mechanisms to cope with these challenges. Anthocyanins, known stress mitigators, enhance plant resilience by accumulating anthocyanin levels, bolstering resistance against various stresses. In plant primary metabolism, anthocyanins improve photosynthesis rates, and membrane permeability, upregulate key enzyme transcripts in anthocyanin biosynthesis, and optimize nutrient uptake. Notably, genes in anthocyanin biosynthesis pathways are typically upregulated in response to diverse stressors. This review highlights anthocyanin-mediated stress tolerance in plants under various environmental pressures. It also compiles literature on genetically engineering stress-tolerant crops by overexpressing genes linked to the anthocyanin biosynthetic pathway or its regulation. In addressing these challenges, it is crucial to develop indigenous plant varieties that can combat abiotic and biotic stresses induced by climate change. Various national institutions and state agricultural universities are at the forefront of developing strategies to counter changing climates. The Vegetable Science Division at ICAR-IARI, New Delhi, has initiated efforts to create anthocyanin-rich varieties of vegetables, particularly cabbage, cauliflower, broccoli, radish, carrot, okra, and beans. This initiative aims to combat climate-related stress while enhancing nutritional security.

Keywords : Abiotic stress, Biotic stress, Anthocyanins, Reactive oxygen species

Pyracanthacrenulata: A wonder heart tonic from Uttarakhand Himalayas

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Pyracantha crenulata (D. Don) M. Roemer, Syn. *Crataeguscrenulata* Roxb. Fam. Rosaceae) is a unique plant found naturally in Himalayan hills from an altitude of 900 to 2400m. Locally it is known as "*Ghingaroo*". This thorny and bushy shrub grows in abundance in barren, rocky and dry grasslands.

Pyracantha is drought and frost tolerant species which can withstand temperature fluctuations from subzero to 35°C. This perennial, deciduous and thorny shrub is commonly known as Indian hawthorn. Plant is 5 to 15 ft high, profusely branched with dark green leaves and are laden with dark red coloured, pulpy berries, a pomlet fruit type during the month of Aug-Sept. Conventionally this plant is being exploited by the local inhabitants for fencing of agricultural fields and tool handles. Presence of bio-flavanoids in *Pyracantha* is useful in the treatment of disorders of the heart and circulatory system especially in case of angina. The fruits of *Pyracantha* are also having antispasmodic, diuretic, vasodilatation and sedative properties. The fruits and flowers of *Pyracantha* are having hypotensive properties hence are useful in case of high blood pressure. Hawthorn berries are very nutritious, having flavonoides (2-3 %), Vitamin 'A' (289±19 IU/ 100g), vitamin B_{12} (110±09 ug/100g), Vitamin 'C' (57.8±10.5 mg/100g), Vitamin 'E' (289±07 mg/100g) protein (1.6±0.2 %), calcium (3.79±0.2 mg/100g), magnesium (1.38±0.4 mg/100g), potassium (1.39±0.41 mg/100g). Flavonoids and oligomeric proantho-cyaninidins are the most important bioactive constituents present in fruits of *P. crenulata*. Various scientific studies have confirmed that this shrub has potential application for treatment of hypertension patients. Clinical trials on heart patients with hypertension have shown that total flavanoides of *Pyracantha* have the potential toreduce cholesterol level and improves cardiac functions. *Pyracantha* leaves are also found useful for antioxidant, immune-modulatory and anti inflammatory activities[4]. This plant is a storehouse of bioactive compounds with a variety of medicinal attributes. *Pyracantha* is identified for environmental benefits including soil and water conservation, desertification control and land reclamation in fragile mountain ecosystem.

Authentic sustainability: Embracing Organic Horticulture

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Horticultural crops, mainly fruits and vegetables are 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 have no idea regarding this harmful 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 farming or 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-fertilizers and 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

Keywords: organic farming, chemical fertilizers, bio-pesticides, biodynamic agriculture

Effect of dehanding and organic spray on bunch of banana cv. Grand Naine

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A field experiment was conducted Regional Horticultural Research Station, ASPEE College of Horticulture, Navsari Agricultural University, Navsari during 2020-21 to study "Effect of dehanding and organic spray on bunch of banana cv. Grand Naine". The experiment was laid out in completely randomized design with factorial concept, consisting of three levels of lower hand removal *viz*., removal of one hand (H_1), removal of two hands (H_2) and removal of three hands (H_3) and seven types of organic spray *viz*., Water spray (O_1), 5 % Cow urine (O_2), 5 % *Jeevamrut*(O_3), 3 % *Panchagavya*(O_4), 5 % *Gliricidia* leaf extract (O_5), 3 % Novel Organic Liquid Nutrients (O_6) and 3 % Sea weed extract (O_7), comprising twenty-one treatment combinations. The treatments were repeated thrice. Treatments were imposed after full emergence of bunch *i.e.*, hands at the distal end of the bunch were excised along with male bud, then two organic sprays were applied after 15 and 30 days of bunch emergence as per treatments. The results of present investigation revealed that minimum days (82.10) taken for harvesting of bunch from the day of hand removal, maximum weight of third hand (3.08 kg), finger length (24.45 cm) and finger girth from third hand (11.00 cm), TSS (18.51 °Brix), reducing sugar (6.62 %) and total sugar (14.58 %) were noticed in removal of three hands (H_3). Whereas, maximum bunch weight (33.12 kg), bunch length (94.18 cm) and fruit yield (114.99 t ha^{-1}) were recorded in removal of last hand (H_1). Among different types of organic spray, 5 % *Gliricidia* leaf extract (O_5) spray on bunch at 15 and 30 days after bunch emergence recorded minimum days (80.22) for harvesting of bunch from the day of hand removal, maximum bunch weight (34.91 kg), bunch girth (116.24 cm), weight of third hand (3.40 kg), finger length (24.58 cm) and finger girth from third hand (11.42 cm), fruit yield (121.20 t ha^{-1}), reducing sugar (6.84 %) and total sugar content (14.93 %) in banana fruit. In interaction effect, removal of three hands and bunch spray of *Gliricidia* leaf extract 5 % (H_3O_5) showed an early maturity of bunch (76.67 days), maximum weight of third hand (3.50 kg) and finger length (26.15 cm) from third hand. Whereas, removal of last hand and *Gliricidia* leaf extract 5 % (H_1O_5) gave maximum bunch weight (37.93 kg), fruit yield (131.70 t ha^{-1}) in banana.

Pomological and nutritional analysis of high altitude grown apricots

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Ladakh is the primary producer of apricots in India contributing to 62% of the total production. The objective of this study was to assess the pomological and nutritional characteristics of fresh apricots cultivated in high altitude region of Leh-Ladakh. Pomological characteristics such as the size, weight and colour of fresh apricots and their kernels were assessed. Additionally, the TSS content, Titratable Acidity and nutritional factors including Minerals, Moisture Content, Total Carbohydrates Total Calories and Crude Fibre were determined using standard procedures. Pomological characteristics of apricots showed round, oblong shaped apricots with pale yellow-orange skin and rich yellowish-orange flesh. Dimensional characteristics included length 4.10 ± 2.0 cm, width 3.82 ± 3.0 cm, thickness 3.61 ± 0.9 cm and average weight was found to be 24.10 ± 4.6 gm. TSS was found to be 13.066 ± 1.48 °Brix and titratable acidity was 0.73 ± 0.11 mg of citric acid/100ml. Nutritional parameters of these apricots were also determined showing 83.90 % Moisture Content, 3448.22 cal/gm Total Calories,12.72gm Carbohydrates and 3.2% Crude Fiber.

Apricots were also examined for shelf life which was found to be around 21 days (3 weeks) when kept at refrigeration. Changes in texture showed skin softening, browning and rotting with increased time during storage. Mineral analysis of these fresh apricots showed that they are rich in Potassium, Phosphorus and Calcium. These pomological and nutritional characteristics can offer valuable insights into the contribution of apricots cultivated at high altitudes, to the food industry.

Keyword : Apricots, High Altitude, Nutrition, Pomological, Shelf Life

Jivamrita: A Tonic for Horticultural Crops

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Indiscriminate use of agrochemicals causes negative impact on human, soil and environmental health. Soil is getting depleted with the fertility. Growers and consumers both are at serious health risk because of the toxicity in the food come from agrochemicals. Toxic agrochemical causes contamination in ground water also. Besides, use of agrochemical makes farmers depend on the market, which eventually put farmers in a huge financial crunch. So, Indian agriculture essentially needs a way, where farming should be minimum or less market dependent in term of input procurement with the assurance of toxic-free healthy food and the entire process of farming should be in harmony with the nature keeping human, soil and environment healthy. *Jivamrita*is the answer to these problems.is a fermented microbial culture. It provides nutrients, but most importantly, acts as a catalytic agent that promotes the activity of microorganisms in the soil, as well as increases earthworm activity. *Jivamrita* also helps to prevent fungal and bacterial plant diseases. Plant growth promoting rhizobacteria, cyanobacteria, and phosphate solubilising bacteria, mycorrhizal fungi, and nitrogen-fixing bacteria are some important microorganisms present in the product. During the 48 hour fermentation process, the aerobic and anaerobic bacteria present in the cow dung and urine multiply as they eat up organic ingredients (like pulse flour). A handful of undisturbed soil is also added to the preparation, as inoculate of native species of microbes and organisms. A series of investigations were carried out to study the effect of different doses and combination of *Jivamritaon* growth, flowering and yield attributes of different horticultural crops including mango, cabbage, cauliflower, broccoli, rose, etc. Findings revealed that the application of Jivamritahas significant effect on the various growth, flowering and yield attributes on crops and proved as a tonic to build the plant and soil health

Effect of planting geometry and manuring levels on banana growth, yield and soil properties under Organic farming

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A field experiment was conducted at organic farm during *Kharif* season of 2018-19 to 2020-21 on effect of planting geometry and manuring levels on banana growth, yield and soil properties under organic farming. The experiment was conducted in clayey texture and slightly alkaline but non-saline soil having high initial SOC, available P_2O_5 and K_2Ocontent while available N was medium. During the experiment 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 observed 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 while, significantly lowest days to 50 % flowering (288.5) was recorded with the spacing S_2. Similarly, the 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. In the case with manuring, 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. After harvest of the crop, OC contentwas found non-significant with spacing 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 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. The significantly higher available N was recorded with the treatment M_2 which was at par with M_1 in the year 2020-21.

Keywords: Spacing, NADEP compost, yield, soil properties, organic farming

Dissipation kinetics and dietary risk assessment of lambda-cyhalothrin and Spiromesifen in Tomato under open field and poly-house conditions

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Tomato, an important vegetable crop is infested by several insect-pests. This crop has successfully been grown under open field and protected environment all across globe. Lambda (L)-cyhalothrin (synthetic pyrethroid) and spiromesifen (lipid synthesis inhibitor) insecticides are extensively used to control insect-pests on tomato crop. In the open field and poly-house conditions, the persistence, dissipation behaviour, and dietary risk assessment of L-cyhalothrin and spiromesifen in/on tomatoes were studied. In both conditions, the tomato crop was sprayed twice with the L-cyhalothrin (0.5% EC @ 15 g a.i ha-1) and spiromesifen (22.90% SC @ 150.0 g a.i ha-1) at the 50% flowering stage and again 10 days later. Prior to actual tomato sample analysis, the extraction procedure for L-cyhalothrin and spiromesifen in tomato was validated using single laboratory method validation guidelines and quantified on GC-ECD in terms of linearity, sensitivity (detection limits) of the instrument, accuracy (% recovery) and precision (% RSD) of the extraction process. The half-life (DT50) values of L-cyhalothrin and spiromesifen in tomatoes are 3.08 and 4.47 days, respectively, in open field conditions, and 3.30 and 5.76 days, respectively, in poly house conditions. Similarly, the safe waiting period for L-cyhalothrin and spiromesifen in tomatoes is 6.1 and 1.0 days, respectively, in open field conditions, and 6.5 and 1.0 days, respectively, in poly house conditions. Under both open field and polyhouse conditions, the calculated risk quotient for the above insecticides in tomatoes was less than one, suggesting no risk to Indian consumers.

Keywords: Dissipation, L-cyhalothrin, risk assessment, spiromesifen, tomato.

Effect of Different Organic Sources on Growth, Yield and Quality of Banana under Organic Farming

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A field experiment was conducted in the Organic farm, Department of Natural Resource Management,

ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat in the year 2016-17 to 2018-19 in *Kharif* season.The experiment was laid out in randomised block design comprising seven treatments with four replications. The treatments were , T_1:100% RDN through NADEP compost, T_2:75% RDN through NADEP compost + 25% RDN through Vermicompost , T_3 : 75% RDN through NADEP compost along with GM (One times), T_4 : 75% RDN through NADEP compost along with GM (Two times), T_5: 50% RDN through NADEP compost along with GM (Two times), T_6 :50% RDN through NADEP compost along with GM (Two times) + *Azotobacter* @5 l/ha + KMB@5 l/ha + PSB@5 l/ha, T_7: 50% RDN through NADEP compost + Jivamrut @ 1.0 l/plant. The data of experimental results revealed that **when** 50% RDN applied through NADEP compost along with two times of green manuring and *Azotobacter,* PSB and KMB each of applied @ 5kg/ha at the time of planting (*i.e.,* T_6) recorded significantly higher no. of hands/bunch, bunch weight and fruit yield. The quality parameters like protein, TSS, reducing sugar, β carotene and shelf life did not showed any significant variation of various organic treatments. Organic carbon content found significant and maximum content of was observed with treatment T_4. Available N and K_2O content were increased when compared to initial value and significantly maximum availability of N and K_2O were observed with treatment T_4. Considering the yield and net benefits in among the different treatments, treatment T_6 (50% RDN applied through NADEP compost along with two times of green manuring and *Azotobacter,* PSB and KMB each of applied @ 5 l/ha) recorded higher yield as well as net profit in banana under organic farming .

Keywords : Banana, Biofertilizers, Economics, Green manuring, Growth, NADEP compost, Organic farming, Soil properties, Quality, Yield.

Management of major pests of Rose

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Investigations was carried out on development of integrated pest management module against major pests of rose at floriculture farm, ASPEE College of Horticulture and Forestry, NAU., Navsari during September-2019 to February-2020. To find out suitable pest management module for management of important insect pests of rose, different four modules of pest management was tested. The four module includes IPM based module, biopesticides and bioagents based module, chemical based module and untreated control. In field condition incidence of aphid population start appearing from 40th standard meteorological week and remained active up to 2nd SMW. While, thrips and whitefly incidence started from 36th SMW and remained till 2nd SMW. Mite population starts appearing from 36th SMW and more or less homogenous showing non-significant difference up to 46th SMW. *Spodoptera* population starts appearing from 42th SMW and remained active up to 2nd SMW. Minimum incidence of aphid, thrips, whitefly, mite and *Spodoptera* were recorded in IPM module. Predatory larva recorded higher from 40th SMW to 50th SMW in all treatments except in chemical module. In IPM module, data on yellow and blue sticky trap indicated that lowest number of whitefly and thrips was recorded. The highest flower yield after all picking was obtained from IPM module and it was found at par with chemical module. Pooled data revealed that the highest net profit and BCR ratio was recorded from IPM module. IPM is an eco-friendly strategy that focuses on long term prevention of pests or their damage through a combination of techniques.

Adoption of Natural Farming for Chemical-Free Agriculture: A Comprehensive Review

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This comprehensive review of literatures navigates the profound shift in the global agricultural landscape towards sustainable and chemical-free practices, focusing on the adoption of natural farming as an impactful alternative to contemporary agricultural practices. Natural farming, underpinned by principles such as minimal soil disruption, diversified crop cultivation, and the utilization of organic inputs like compost and beneficial microorganisms, represents a fundamental departure from traditional agricultural methods. Within the spectrum of natural farming methodologies, encompassing approaches like permaculture and biodynamic farming, this review illustrates their versatility across diverse agricultural environments. It meticulously explores the manifold advantages inherent in natural farming, emphasizing enhanced ecological resilience, reduced operational costs, improved soil health, and minimized pesticide exposure benefiting consumer health. Yet, despite its promise, challenges obstruct its widespread adoption, including issues with knowledge dissemination, initial transition costs, policy barriers, and market complexities. Through compelling case studies from various global contexts, the review exemplifies successful natural farming implementations, highlighting its substantial contributions to environmental sustainability, climate change mitigation, biodiversity preservation, and sustainable rural livelihoods. The paper concludes by advocating for strategic measures such as policy support, research advancements, education initiatives, and heightened public awareness to facilitate the broader integration of natural farming, positioning it as a key driver in reshaping global agriculture towards sustainability and resilience.

Keywords : Natural farming, sustainable agriculture, environmental sustainability, agricultural transformation, biodiversity preservation, climate change mitigation, farmer empowerment

Endophytic Bacteria Showing Antioxidant Property from Periwinkle [*Catharanthus roseus* (L.) G. Don]

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The experiment was conducted in the year, April–December, 2020 at the Department of Microbiology, C. P. College of Agriculture, SardarkrushinagarDantiwada Agricultural University, Sardarkrushinagar, Gujarat, India to isolate and characterize promising antioxidant producing endophytic bacteria from periwinkle plant. Twenty four endophytic bacterial cultures derived from various parts of *Catharanthus roseus* (L.) G. Don were tested for total antioxidant capacity (TAC) and total phenolics content (TPC). The isolate R1 showed highest TAC (615.46 µg AAE mg-1 extract) followed by the isolate R2 (308.59 µg AAE mg-1 extract). Correlation coefficient observed between TAC and TPC was 0.7591, which shows that phenolic compounds were greatly responsible for antioxidant capacity of the bacterial isolates. 15 isolates showing higher TAC were studied for morphological and molecular characteristics. All the 15 isolates were

rod shaped and were monobacillus. Nine isolates were Gram positive whereas 6 were Gram negative. 16S *r*DNA amplification using universal primers 27F and 27R produced a band of 1.5 kb. Restriction digestion of PCR products of all the isolates with tetracutter restriction enzymes *Alu*I, *Taq*I, *Hae* III produced polymorphic diagnostic fingerprints. The dendrogram based on ARDRA profiling grouped the 15 bacteria into two groups (cluster A and cluster B) at a Jaccard's similarity co-efficient of 0.83. Cluster A contained eleven bacterial isolates whereas cluster B had only four. The isolates R1 and R2 may serve as an excellent source of antioxidants and may be exploited for commercial production of antioxidant.

Keyword: 16rDNA, Antioxidant, ARDRA, Endophytic bacteria, Periwinkle, UPGMA

Thriving with Zero Budget: A Blueprint for Natural Farming

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The 'Green Revolution' of conventional farming was successful owing to the use of better seed types, synthetic and chemical fertilisers, herbicides and farm machinery. By conventional methods in agriculture is like cancer to our soil and health, as well. It does not only make the soil poor but eventually, the farmer drives under debt. Therefore, this is the only way to deal with this ever-growing problem is Zero Budget Natural Farming. The word "budget" refers to credit and expenses, hence the term "zero budget" means using and without credit spend money on purchased inputs. 'Natural farming' is farming in harmony with nature and without the use of chemicals. Subhash Palekar, the discoverer of ZBNF, provided several ideas, concepts and procedures. Crop rotation, green manures and compost, biological pest management and mechanical cultivation are main methods of ZBNF. There are four popular pillars of ZBNF, which we shall explore later: Jivamrita, Bijamrita, Acchadana and Whapasa. ZBNF found that it was both ecologically sustainable and an effective instrument for achieving the Sustainable Development Goals, as well as cost-efficient because it freed farmers from debt.

Natural color from ornamental plants

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Natural colours are obtained from sources such as plants, insects/animals, minerals and microorganisms. Ornamental plants predominate as source for natural dye yielding a variety of colours including red, yellow, blue, black, brown and a mixture of these.Some of the flowers that are frequently used for natural dyeing are madder, hibiscus, marigold, Palash and parsley. Natural colour also extracted from other parts of ornamental plants like dark orange from Bixa seeds and from leaves of Henna. Natural colours increase consumer awareness and acceptance because they are non-toxic, environmentally friendly, and meet high demand in a variety of industries, including food, cosmetics, pharmaceuticals, nutraceuticals, textiles, etc. Natural colour pigments from ornamental plants are also used in smart packaging and also used as dye sensitize solar cell. The search for natural pigments has become atrend due to dangerous effects of syntheticdyes and leg is lations haveminimized the iruse as well. Plant-based pigments often used as an alternative, not only because of their high availability as dyes, but also because they exhibita wealth of health-promotingproperties such as antioxidant and antimicrobial property that are beneficial to humans.

Drawbacks of natural pigments including its stability and cost hindered its popularity in industry but the emerging modern technologies are expected to overcome these problems.

Keyword: ornamental, colour, natural, dye, anti-oxidant, anti-microbial, Bixa pharmaceuticals, cosmetics

Agnihotra Farming – The holistic approach of ancient science

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The agnihotra (Sanskrit: "Agni" = fire, "hotra" = healing) is a Vedic Yajna followed in the ancient times in India. It is mentioned in Atharva Veda and described in detail in Yajurveda Samhita and also mentioned in the Bhagavad Geeta. It is written in the Vedas that "Heal the atmosphere and it will heal you". According to Vedas, most of the nutrients come from the atmosphere. So we should focus on the atmosphere. Agnihotra is a process which is known to purify the surrounding atmosphere through a specially prepared fire along with specific chanting of Mantras. The most significant aspect of agnihotra is that it combines the energies of five elements – sun, space, air, water and earth to produce subtle changes in the living organisms and helps to restore the biorhythm. Healed and purified atmosphere imparts beneficial effects on man, animals and plants (Paranjpe, 1989). Jagdish Chandra Bose had proved by his experimental studies that plants grew better in response to music. Similarly, as most report says, "Agnihotra makes the plant happy". Agnihotra farming has already been adopted in countries like Poland, Germany etc. to increase the yield and improve the quality of soil. In India, agnihotra farming has been promoted by the Institute for Vedic Studies (Ramjivale, 1999).The agnihotra rituals were revived in the India at Ashram of Shivpuri (Solapur, Maharashtra) in 1969.Today it is mainly practiced by organic farmers in South America and India and so gaining more attention in North America and Europe. However, the scientific rationale behind the heavy growth stimulation remains to be answered.

Chaitanya Krishi Homa Farming for Sustainable Agriculture and Climate Change Adaptation

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Although Homa Therapy Farming surfaced after the Chernobyl nuclear disaster in 1986 and publication of the book, "Secretes of the Soil" by Peter Tompkins and Christopher Bird and another book written by Shri Vasant Paranjpe, " Homa Therapy our Last Chance" in 1989; its origin dates back to Vedic Period and Vedantic period and literature." Kashyapiya Krishi Sukti" a treatise whch may date back over 1200 years before ; recommends in unequivocal terms that Dev Yajnya and Bhut Yajnya should be performed for Agriculture and Environment. Homa Organic Farming or Vedic Krishi Paddhatior "Chaitanya Krishi" as it may be called in brief, is based on application of Agnihotra/ Homa/ Yajnya at the farm to create an agriculturally productive system with eco-balance in the surrounding environment in which the farm exists and forms part of the eco-system.Its basic objective is not only to improve yield and quality of farm produce but also to purify the atmosphere and establish equilibrium in the environment and the seasons. Homa Farming distinguishes itself from other organic farming methods by providing tools /techniques for reduction in atmospheric pollution and purification of elements like Air, Water and Earth (soil) through performance of Agnihotras/Homas/Yajnyas and use of Ashes therefrom. The Life Bio-Energy forces are enhanced due to purification of atmosphere for healthy growth of plants . The Resonance Point at the farm acts as a Cosmic Energy Centre connecting the farm with environment, elements and the cosmos. Agnihotra/Homas/Yajnyas

are tuned to the bio-rhythms of sun and moon cycles and the positions of constellations in the Zodiac.These performances heal the atmosphere and the healed atmosphere heals the plant life, animal life and human life. According to Vedic Sciences performances of certain Yajnyas have built-in techniques for establishing Atmospheric Order, Ecological Balance and Rain Induction. The two most important factors that received our focus for development of Chaitanya Krishi are (i) The relationship of Agnihotra / Yajnya with Agriculture and Environment, and (ii) Integration of Cow Family with the farm; for Sustainable Agriculture, Healthy and Cultural Way of Life. The Research Studies and field trials are giving positive results. In agriculture the two spheres which need judicious management are ,"Biosphere "and "Rhizosphere" and Chaitanya Krishi, which has been adapted , evolved and is getting further developed at our farm, seems to offer much wider scope for sound agronomic practices, for restoration of ecological balance in seasons and natural resources, health of the soil, climate change mitigation techniques and as a very promising option of Fully Integrated Agri-Eco Production System for Sustainable Agriculture.In its expanded form the methodolodgy has further scope to include performances of certain Yajnyas as per Vedic Yajniya System , for Ecological Balance, Environmental Engineering , Climate Change Adaptation and Mitigation.At the recently held Conference at Ahamadabad(Karnavati Baithak) organised by Akshay Krushi Parivar (All India Level NGO); on 30th-31st October,2023 the Author made presentation on , " Soumik Suvrushti, Rain Conception Rain Delivery (RCRD) Theory of Varah Mihir and Parjanya Yagas - for Rainfall Prediction and Rainfall during Monsoon." The Presentation was well-received by the Audience , which consisted Agri- Scientists (Krushi-Vaidnyanik) Vice-Chancellors of Agri-Universities , Farmer Scientists (KrushakVaidnyanik) and persons who have been working for more than 10-20 years in the field of Organic / Natural Agriculture ;from all over the Country.

The Potential of *Alternaria* Toxins Production by *A. Alternata* in Processing of Tomatoes

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Processing tomato is a cultivated type of common tomatoes that received its name from its thick skins, which is resistant to transport damage and suitable for processing. As a filamentous and spoilage fungus, *Alternaria* spp. can not only infect processing tomatoes, but also produce a variety of mycotoxins which harm the health of human beings. To explore the production of *Alternaria* toxins in processing tomatoes during growth and storage, four main *Alternaria* toxins and four conjugated toxins were detected by ultrahigh-performance liquid chromatography. The results show that the content of *Alternaria* toxins in an in vivo assay is higher than that under field conditions. Tenuazonic acid is the predominant toxin detected in the field (205.86~41,389.19 μg/kg) and in vivo (7.64~526,986.37 μg/kg) experiments and the second-most abundant toxin is alternariol. In addition, a small quantity of conjugated toxins, AOH-9-glucoside and alternariol monomethyl were screened in the in vivo experiment. The content of all forms of *Alternaria* toxins detected in tomatoes may not be very accurate because the conjugated toxins can escape detection. Therefore, it is necessary to accurately understand the pollution of *Alternaria* toxins in tomatoes prior to harvesting.

Keywords: Alternaria toxins, conjugated mycotoxins, field experiment, in vivo experiment, processing tomatoes

Role of biodynamic farming in vegetable crops

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Biodynamic agriculture was born when Dr. Rudolf Steiner gave eight lectures about a new method of agriculture to a large group of farmers in Germany, in 1924."Biodynamic is a holistic, ecological and ethical approach to farming, gardening, food andnutrition". The term biodynamic is taken from Greek word bios means life and dynamic meaning energy. Hence biodynamic farming refers "working with the energies which create and maintain life". Biodynamics has much in common with other organic approaches – it emphasizes the use of manures and composts and excludes the use of syntheticfertilizers, pesticides and herbicides on soil and plants. Biodynamicfarming is an advanced organic farming system that is gaining increased attention for its emphasis on food quality and soil health. In biodynamic farming, lunar rhythms are used as a calendar for scheduling farming operations like planting and harvesting of crops. It is a method of farming that aims to treat the farm as a living system that interacts with the environment, to build healthy living soil and to produce food that nourishes, vitalizes and helps to develop humanity. Biodynamic farmers use eight specific preparation such as cow horn manure (BD 500), cow horn silica (BD 501) and herbal preparations BD 502-507 to their soil, compost, special foliar sprays and peppering for pest control to the crops which could enhance vegetable quality, quantity and soil health.

Key words: biodynamic farming, cow horn manure, cow horn silica, lunar rhythms, vegetable quality

Response of Different Organics Spray on Yield and Biochemical Characteristics of Sapota Fruits

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An experiment was conducted to study the effect of different organic spray on yield and bio-chemical attributes of sapota [*Manilkara achras* (Mill.) Fosberg] cv. Kalipatti. Significant variation was noticed among the different treatments for all the characters studied. The highest physical and yield parameters like fruit weight (83.60g), fruit length (6.15cm), fruit diameter (5.78cm), number of marketable fruits (2553), marketable fruit weight (170.30kg/tree), minimum number of damage of fruits (54.25), minimum damage fruit weight (4.0 kg), total fruit yield (174.30 kg/tree) were in Novel Organic Liquid Fertilizer 5% (5 spray). This treatment also resulted in minimum physical loss in weight at 2nd, 4th and ripening stage (3.34%, 5.09% and 8.09% respectively), acidity (0.121%), spoilage (6.25%), while maximum fruit firmness (13.81 kg cm^{-2}), TSS (23.84^{0} Brix), ascorbic acid (10.80 mg 100 g^{-1}), reducing sugar (11.28 %), total sugar (19.47 %) and total phenol (133.87 mg 100 g^{-1}).

Keywords: Sapota, Organic spray, Novel, Cow-urine, *Panchgavya*

Assessment of Air Pollution Tolerance Index of Indoor Plants to combat indoor air pollution in Sub-tropical Climate

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The present investigation was conducted during 2017-2018 to assess the air pollution tolerance index of indoor plants commonly grown in subtropical climate. The study was carried out to determine the air pollution tolerance of indoor plants and use in urban indoor landscaping. In this study,30 flowering and foliage indoor plants were selected and the air pollution tolerance index (APTI) was assessed in which various bio-chemical parameters such as total chlorophyll content, leaf extract pH, relative water content and ascorbic acid content were estimated using CRD design. Maximum APTI value was found in *Aglaonema modestum* (9.18) followed by *Scindapsus aureus* (9.16), *Chlorophytum comosum (9.14), Nephrole pisexaltata (9.054) and Kalanchoe blossfeldiana (8.967).* Results concluded that A*glaonema modestum, Scindapsus aureus, Chlorophytum comosum, Nephrolepisexaltata* and *Kalanchoe blossfeldiana were found best to tolerate air pollution on the basis of APTI and these plants can be used in indoor landscaping for urban areas.*

Keywords: Air pollution tolerance index, *indoor plants, urban landscape, indoor pollution.*

Effect of plastic mulch and row cover in vegetable crops

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Protected agriculture is any technique used to modify a plant's natural environment in order to optimize plant growth. Such techniques are often used to protect plants from frost in order to extend the growing season of a crop. Through earlier crop production, growers are able to capitalize on early markets and higher prices. Many leading vegetables can be grown successfully using plastic mulch and row cover to extend the field growing season Plastic mulch in combination with row covers, has been shown to increase yield of several vegetable crops by improving moisture uniformity in the soil and raising air and soil temperatures, thus creating a favorable microclimate for the growth of vegetable crops. Many vegetables like chilli, cow pea, muskmelon, watermelon, ridge gourd, summer squash and some other vegetables are growing with plastic mulch and row cover.Besides producing early and increased yields, mulch and row cover have other benefits, such as more efficient use of water. For greatest efficiency and economy, mulch and/or row cover must be employed as a part of total production system.

Key words: Microclimate, Mulch, Protected agriculture and row cover

Green Route Synthesis of Zinc Oxide Nanoparticles using Neem (*Azadirachta Indica* L.) Leaf Extract for Sustainable Horticulture

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Employing plant extracts to synthesize metal zinc nanoparticles (NPs) is recognized as a potential approach for green synthesis of nanoparticle which have various advantages over standard physical and chemical approaches. In the current study we used neem (*Azadirachta indica*) leaf extract to produce zinc oxide (ZnO) nanoparticles (NPs). 20 ml leaf extract of neem (*Azadirachta indica*) was added to 40 ml zinc acetate dihydrate (0.01M) with 10 ml sodium hydroxide (0.01 M) was added drop by drop to this mixture. The reaction mixture was stirred continuously on a magnetic stirrer for 6 hours until colour of solution changed from light green to mustard yellow, indicating the synthesis of nano-particles. The structural and optical properties of NPs were Ultraviolet- visible (UV-Vis) spectrophotometer and Scanning electron microscope (SEM) and Powder X-ray diffraction (XRD) which determined the size of the nanoparticles synthesized. The functional groups of the metablome of neem extract responsible for formation of the nanoparticles were determined using Fourier transform infrared (FTIR) spectroscopy. Energy dispersive X-ray (EDX) was used to confirm the presence of elements of interest in the synthesized sample. UV- vis spectrum showed max at 320 nm. SEM showed the shape of NPs to be of a crystalline nature whereas PXRD analysis showed their size as 24.17 nm. Energy dispersive X-ray (EDX) studies confirmed 35.80 % zinc to be present by weight in synthesized ZnO NPs. Neem extract is thus, an effective medium for the synthesis of Zn nanoparticles which could be used in crops for improving the performance of the crop and enhancing yield.

Keywords: *Azadirachta indica*, Zinc oxide nanoparticles, Green synthesis

Phytochemicals from *Hymenocallis littoralis* as an antimicrobial drug

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Pharmacologically well-known species *H.littoralis* belongs to Amaryllidaceae family. The genus Hymenocallis, originally native to tropical regions of the Americas and the West Indies, was introduced and cultivated in Fujian and Guangdong provinces of China as a landscape plant. In Chinese folk medicine, the bulbs and leaves of *H. littoralis* have traditionally been employed to treat conditions such as rheumatic arthralgia, injuries, swelling, pain, carbuncle swelling and hemorrhoids. An Indian study, leveraging technological advancements, reports the screening of antimicrobial activity in extracts from different plant parts of *Tinospora cordifolia* and *H.littoralis*. These extracts were tested against opportunistic organisms, including *Staphylococcus aureus,Escherichia coli*, *Pseudomonas aeruginosa, Salmonella typhimurium* and the fungus *Candida albicans*, using the agar well diffusion method and Minimum Inhibitory Concentration (MIC). This approach has facilitated the extraction and quantification of biochemically active compounds from *H. littoralis*, highlighting its significant potential in traditional remedies that warrant further

exploration. Previously, the alkaloids from *H.littoralis*, such as Littoraline, demonstrated inhibitory activity against HIV reverse transcriptase, while lycorine and Haemanthamine exhibited potent in vitro cytotoxicity. Recent research on Amaryllidaceae alkaloids indicates their diverse biological effects, encompassing antitumor, central nervous system (CNS) activities, anti-inflammatory properties, antimalarial effects, and antiparasitic activities. Consequently, the alkaloids from Amaryllidaceae in *H. littoralis* represent valuable lead compounds for novel drug discovery, warranting further in-depth investigation.

Keyword: *Hymenocallis littoralis*, alkaloids, Pharmacological properties, Antimicrobial activity, In vitro cytotoxicity.

Effect of Biofertilizer and *Jeevamrut* on soil properties of Pomegranate (*Punica granatum* L.)

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The present investigation, entitled "Effect of Biofertilizer and Jeevamrut on Soil Properties of Pomegranate (Punica granatum L.)", was conducted at College Farm, College of Horticulture, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Gujarat, during August 2022 to June 2023. The investigation comprised two factors and was laid out in a Randomized Block Design with a factorial concept and three replications. The first factor was biofertilizer (b) with four levels, namely b1 (Control), b2 (Azotobacter + PSB + KSB each @ 5 ml/plant), b3 (Azotobacter + PSB + KSB each @ 10 ml/plant), and b4 (Azotobacter + PSB + KSB each @ 15 ml/plant). The second factor was Jeevamrut with three levels, i.e., j1 (Control), j2 (drenching of Jeevamrut 0.5 litre/plant), and j3 (drenching of Jeevamrut 1.0 litre/plant). Thus, there were a total of 12 treatment combinations under study. The distance between plant to plant and row to row was 2.5 m x 2.5 m.The results indicated that the drenching of biofertilizer b4 (Azotobacter + PSB + KSB each @ 15 ml/plant) gave maximum soil parameters, namely maximum available N (209.42 kg/ha), available P (40.78 kg/ha), and available K (277.80 kg/ha). The results showed that the drenching of Jeevamrut 1.0 litre/plant (j3) gave maximum available N (209.10 kg/ha), available P (40.65 kg/ha), and available K in soil after harvesting (276.89 kg/ha), which were found to be better than other treatments of Jeevamrut.

Increasing The Crop Production by Using sugarcane By Products as An Organic Formulation

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When sugarcane industrial processes are examined, a significant sizable portion of the goods that may be exploited are wasted. It is a laborious task to handle and manage the produced molasses, press-mud, and bagasse. It's made more challenging by the enormous spatial required. It has been shown that sugarcane grows more effectively when organic sugarcane industrial waste is added to the soil. This improves the soil's qualities, raises the yield, and improves crop quality. When sugarcane waste is used to produce sugarcane crops, the soil's ability to hold water is increased significantly. It also serves as a quick source of energy bursts for several important soil microbes, boosting soil life and reducing environmental pollution from chemical fertilizers. Consequently, hazardous inorganic compounds are kept from Hence, harmful inorganic materials are kept out of the food chain. By using byproducts from the sugarcane business, the number of inorganic fertilizers recommended is decreased, and the soil's organic matter is enhanced during crop cultivation. It has been demonstrated that the best yield is obtained when chemical fertilizers and by-products are combined in a balanced area-specific ratio. which proves to be very possible. As a result, trash is reduced and chemical

usage is decreased when we combine organic sugarcane waste with inorganic major fertilizers. The mixture can then be packaged and sold for easy access. The mixture would prove to be a worldwide solution to the problem of industrial-scale sugarcane by-product waste, as well as a blessing for the development of sugarcane crops.

Key Words: Molasses, bagasses, press mud, organic formulation, by-product wastage.

Determination of changes in insecticide residues in hot water treated cold stored apple using TQ LC-MS/MS

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The present study elucidates the effect of hot water treatment (HWT) on insecticide residue degradation in apple fruit while maintaining their optimum quality. Insecticide (chlorpyriphos, dimethoate, malathion and thiacloprid) residues were measured in apples by liquid chromatography coupled with tandem-mass spectrometry (TQ LC-MS/MS) after hot water treatment (48 °C, 50 °C, 52 °C, 54 °C for 2, 3, 4 and 5 min) and during subsequent cold storage (2±1 °C at 90–95% RH) for 90 days. The method was validated for linearity, specificity, accuracy and precision using SANTE guidelines. Recovery of the insecticides was within the acceptable range (87.72 to 117.21%) with 4.00 to 8.52% relative standard deviation. By increasing the temperature and duration of HWT significant reduction in residues (~28-100%) for test insecticides was observed. However, in terms of processing factors (PF), least values were observed in HWT at 52 °C and 54 °C (PF: 0.51, 0.19) for 4 and 5 min, respectively. Degradation of insecticides followed first-order kinetics. Malathion and dimethoate dissipated completely upon HWT, while chlorpyriphos and thiacloprid dissipated at a lower rate.

Keywords: Insecticides, Hot water treatment, Cold storage, Residue, Dissipation, QuEChERS, TQ LC-MS/MS

Potent Potato Production with Soil Solarization

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Soil solarization is a non-chemical environment friendly method which has beneficial effects in horticultural crop production. It is commercially use in area with very high temperature of air mainly in summer season, where much of the crop production area kept fallow because of excessive heat. Solarization of soil is mainly dependent on high levels of solar energy, as influenced by both climate and weather.

Reviewing the information that is currently available on soil solarization reveals the many benefits of the method in relation to the production of horticultural crops. Soil solarization has been reported to manage lots of weed species, control soil borne insects and diseases, manage nematodes. Soil solarization also increase thermo tolerant micro fauna in the soil, which includes beneficial microorganisms, nutrient solubilizers and nitrifiers, and thus results in higher availability of required plant nutrient and improvement in soil tilth. Method of soil solarization in controlling soil borne is well demonstrated. In the case of potatoes, soil solarization is also known to improve tuber quality and increase potato yield by lowering the number of weeds and soil borne diseases.

Key words: Non-toxic, Production, Soil Solarization, Sustainable.

Session VII

Effective Post Harvest Management and Processing

Export and import of fresh fruits, vegetables and flowers: Indian scenario

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To address the issues of crop resilience, low farm income, nutritional security and export earnings., horticulture has been recognized as a potential sector. Out of the overall growth rate of 3.9 per cent in agriculture during 2022-2022, fruit and vegetable accounted for 20.2%. Horticultural sector accounts for > 37% of the total exports of agricultural commodities with a rising trend in export values. India is a trade surplus country in the horticultural sector. But, the analysis of export and import trend gives a skewed picture. Despite being horticultural trade surplus, we are importing considerable volume of fruits and vegetables. During the year 2022-23, Indian fruit export remain worth 770.70 million USD and import of 148.56 million USD. The vegetables export and import value were 924.91 and 7.21 million USD respectively. Grapes, pomegranates, mangoes, bananas, and oranges account for the larger portion of fruits exported from the country while onions, snow peas, potatoes, tomatoes, and green chili contribute largely to the vegetable export basket. Major destinations for the Indian fresh fruits and vegetables are United Arab Emirates, Bangladesh, Nepal, Malaysia, Netherland, Sri Lanka, U.K, Qatar, Oman, and Iraq. Due to the concerted efforts of public and private sectors, there is increasing acceptance of horticulture produce from the country. Indian Horticulture sector needs to prepare a sustainable roadmap by focusing on country specific marketing intelligence, buyers and seller meet inputs, Agri Cells at different Embassies of India, farmer connect portal, new markets and new produce. Additionally, horticulture industry also needs to respond ever increasing consumer demand for exotic fruits and vegetables through R&D policies.

Horticulture: The Future of Indian economy

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India being globally recognised as one of the top producers of fruits and vegetables, the productivity of horticulture has increased significantly from 8.8 tonnes per hectare (TPH) in 2001-02 to 12.1 TPH in 2020-21, leading to a sharp rebound in production and acreage. In 2021-22, the total horticulture production was around 341.63 million tonnes, with fruit production at around 107.10 million tonnes and vegetable production at around 204.61 million tonnes. With its vast production base, there is ample opportunity for export, with fresh fruits and vegetables being a major contributor. APEDA estimates that India exported fresh fruits and vegetables worth INR 11,412.50 crore during 2021-22. Though India's horticulture sector is growing, the country's share in global trade remains insignificant, accounting for only 1% of the global trade in vegetables and fruits. Export growth is being undermined by production challenges, marketing challenges, inadequate transport infrastructure, fragmented supply chains. Top crops having short shelf-life because of the absence of / lack of knowledge on cold storage facilities, causes price fluctuation every year, though sufficient cold storage facilities have been created. Research need to be intensified to standardize post harvest management strategies for highly perishable tropical and subtropical fruits and vegetables and also series of value-added products to be developed to occupy stretch of petti-shops to malls (to replace junk foods), which can reach a peak of domestic and export market, Indians being in almost every country of the globe. Apart, horticulturalpostharvest waste management industry (*zero waste horticulture*) has a wide market and focus must be given to tap the maximum export earnings. Hence, horticulture as an industry for production of health-care products and nutraceuticals, eco-friendly non-chemical plant protection formulations, environmental safe edible colours, *etc*, provides enormous employment opportunites and become the Future of Indian economy.

Strategies for Post Harvest management of Medicinal Plants

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Over the past two decades, there has been a significant upsurge in the interest surrounding traditional medicine systems, particularly herbal remedies, evident in both developed and developing nations. This heightened interest has translated into a rapid expansion of global and national markets for medicinal herbs, resulting in substantial economic gains. Effective post-harvest management of medicinal plants is indispensable for preserving their therapeutic qualities and augmenting their market value. Key steps in this process include harvesting at the optimal growth stage, employing gentle harvesting techniques, and using proper drying methods. Creating an appropriate storage environment, encompassing cool, dark, and well-ventilated spaces with airtight containers, is crucial to prevent the degradation of active compounds. Rigorous quality control measures, routine checks for contaminants, and adherence to industry standards are essential for maintaining the integrity of harvested materials. Tailoring processing techniques, such as extraction or formulation into various products, aids in retaining bioactive compounds. Emphasis on thoughtful packaging that protects against environmental factors, coupled with clear labelling, facilitates product traceability. Implementing hygiene and sanitation practices throughout processing contributes to product safety. Additionally, engaging local communities, promoting sustainable harvesting, and embracing fair trade practices further enhance the overall quality of medicinal plants. Continuous education, research, and innovation are vital for ensuring that post-harvest management practices remain aligned with the latest advancements, ultimately contributing to the production of high-quality, effective, and sustainable medicinal plant products.This article reviews problems, developments and prospects for the strategies for post-harvest management of medicinal plants.

Keywords: Medicinal plants, GCP, post-harvest management

Bio-fortification in Horticultural Crops

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Mineral deficiency, often referred to as "Hidden hunger," poses a significant global challenge to human health, leading to various health issues such as poor growth, compromised psychomotor development in children, weakened immunity, fatigue, and even death. Vitamin A and zinc deficiencies alone contribute to 600,000 and 400,000 annual deaths, respectively, with iron and zinc deficiencies affecting over half of the world's population. Biofortification emerges as a solution to address these nutritional challenges by enhancing the nutrient content of crops. This process involves enriching crops with essential vitamins and minerals, providing a cost-effective and sustainable means to combat deficiencies, especially in remote rural areas. While biofortified staple foods may not match the nutrient levels of supplements or industrially fortified foods, they play a crucial role in increasing daily micronutrient intake, particularly for populations with limited access to commercially-marketed fortified foods. Biofortification, according to the World Health Organization (WHO), has the potential to positively impact global health, potentially curing two billion people suffering from iron deficiency-induced anemia. Although biofortification cannot single-handedly eliminate micronutrient deficiencies, it complements existing interventions, offering a relatively

inexpensive and cost-effective strategy to sustainably deliver essential micronutrients to vulnerable populations. As part of a comprehensive approach, biofortification contributes to addressing the complex issue of micronutrient malnutrition and holds promise for improving public health outcomes on a global scale.

Valorization of 'noni' (*morinda citrifolia* l.) Fruit

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The experiment was conducted to study the effect of enzymatic treatments on the recovery of noni juice using sixteen different enzyme treatments (Pectinase, cellulose and their combinations). 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. 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. The juice obtained form best treatment was also used for blending with mango pulp with 12 treatments for preparation of blended Noni mango nectar. The 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.

Keywords: Noni, Enzyme, Pectinase, Nectar, Juice

Utilization of cashew apple fruits (*Anacardium occidentale* L.) by preparing nectar blended with Pineapple (*Annanas comosus* L.) using sweetening agents

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The experiment was conducted during May-November, 2019 at Department of PHT, ASPEE College of Horticulture, NAU, Navsari, Gujarat, India. It was aimed to waste utilization of cashew apple fruits by preparing value added beverage using sweetening agents, evaluate the best blending proportion and sensory as well as nutritional quality of developed product during storage. An experiment was laid out using completely randomized design with factorial concepts using 20 treatment combinations with 3 repetitions. For preparation of cashew apple - pineapple blended nectar, different sweeteners (S_1- sugar, S_2- unbleached jaggery, S_3- bleached jaggery and S_4- honey) and cashew apple: pineapple pulp proportions (P_1- 20:00, P_2- 15:05, P_3- 10:10, P_4- 05:15 and P_5- 00:20) were incorporated. The results indicated that TSS and acidity of blended nectar were increased during storage with minimum change in treatment S_4P_4. Whereas, decreasing

trend was observed in total sugars with minimum change in S_4P_4 and S_4P_5. An ascorbic acid, iron and sulphur content of blended nectar were gradually decreased with storage period up to six months. The maximum ascorbic acid was found in treatment S_4P_1 whereas, iron content of blended nectar was noted highest in S_2P_1 with minimum change in treatment S_1P_1 and S_4P_4. The minimum sulphur content was noted in S_4P_5 as well as S_4P_4. Moreover, the score for overall acceptability with respect to colour, texture, flavour and taste was found maximum in treatments S_4P_5 and S_4P_4 equally up to six months storage. Overall findings of investigations revealed that blended nectar can be prepared by 05:15 blending ratio of cashew apple: pineapple pulp along with honey as a sweetener (S_4P_4) was found better. The blended nectar can be successfully stored at ambient temperature for a period of 6 months in PET bottle without much changes in physico-chemical, sensory and microbial quality. Thus, the developed technology can commercially be adopted by food processing industry to produce quality blended nectar to ensure better returns to processor and consumers as well.

Unveiling the Potential of Salicylic Acid Prestorage treatment for Shelf Life Extension of Bitter gourd

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Bitter gourd is an important tropical and subtropical climacteric cucurbitaceous vegetable, rich in charantin, saponin and ascorbic acid. Under ambient storage conditions, it spoils very rapidly due to excessive water loss, fruit softening due to its thin cuticle and corrugated surface, seed hardening, yellowing, fungal attack and quality loss. To address these problems immature green fruits were dipped in different concentrations of (salicylic acid (SA) 5, 7.5 and 10 mM) and control fruits were dipped in distilled water for 10 minutes. All the treated and untreated control (control) fruits were stored at 10 ºC with and 85–95% relative humidity (RH) for 20 days. Among control and other treatments, SA 10.0 mM treated fruits retained higher total phenol, anti-oxidant capacity, ascorbic acid, and total chlorophyll at day 20th of storage over control. SA 10.0 mM also showed highest inhibition of α-amylase and α- glycosidase and lowest decay percent than control. The results indicated that bitter gourd fruit can be successfully stored up to 20 days at 10 ºC by pre-storage treatment of SA (10.0 mM). A practical implication of the study suggests use of SA is an eco-friendly approach for quality retention of bitter gourd during storage. Hence, it can be gainfully utilized for the benefit of both the retailers and consumers.

Effect of pre harvest treatments on storage life of custard apple and guava fruit

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The custard apple (*Annona squamosa*) and Guava (*Psidium guajava*) are important fruit crops under semi-arid ecosystem of western India. The orchard of both crops gives healthy and quick return to the farmer. Both crops give good performance in semiarid soil as well as climate conditions, which normally face patchy and uneven monsoon distribution. Therefore, the pre harvest management practices plays key role in their

uniform harvesting and marketing of fruits in distant location. Therefore, an attempt was made to find out Effect of pre harvest treatments on storage life of custard apple and guava at Central Horticultural Experiment Station (ICAR-CIAH), Vejalpur, Panchmahals, Gujarat in field condition. The aim of this experiment was that to know the best chemical as pre harvest foliar application on storability and self life of the custard apple and guava fruits. The plant of custard apple and guava was sprayed with different concentration of Calcium Chloride (0.5%, 1.0%, 1.5%, 2.0%), GA_3 (100, 150, 200ppm), Potassium Sulphate (1.0%, 2.0%), and 0.0% (control). The result of this investigation has showed that 1.5% calcium chloride was found significantly best than other treatment in term of fruit quality and storage life of both the fruits with least spoilage loss Experiment was laid out in Complete Randomized Design (C.R.D) and which was replicated thrice.

Key words: Pre-harvest management, $CaCl_2$, GA_3, self-life

Effect of end point total soluble solids and layer thickness on processed guava leather quality and acceptability.

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An experiment was conducted at PHTC, NAU, Gujarat India to study the effect of end point total soluble solids (T1=20oBrix and T2=30oBrix) and layer thickness (M1=2mm, M2=4mm and M3=6mm) on guava leather quality and acceptability. Prepared leather was packed in 100µm LDPE pouch and stored up-to 8months at ambient conditions and analyzed at a monthly interval. In general; TSS(oBrix), acidity(%),total sugars(%) and reducing sugars(%) increased; while moisture content(%), ascorbic acid(%), pH and non-reducing sugar(%) decreased during storage. Considering the organoleptic evaluation of prepared guava leather, after 6 months storage the score for overall acceptability was reported lower than 7out of 9. The maximum overall acceptability average score were found 6.8 in the treatment combination of T2 x M1. Thus, it indicated that the guava leather with 30% sugar content at end point having 2mm layer thickness was found to be the best acceptability up-to 6months storage life in 100µm LDPE pouch.

Key Words: Guava leather, leather end point TSS, leather layer thickness, guava leather storage.

Development and performance evaluation of a Mahua (*Madhuca longifolia*) Seed Decorticator

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Mahua (*Madhuca longifolia*) seed is a tree-borne oil seed and one of the important non-timber forest products of India. The seeds are primarily processed for their oil which is used in various food and non-food industries. Prior to extraction of oil, mahua seeds are manually broken to obtain mahua kernel. The traditional process of decortication of mahua seeds to separate kernels is done manually using a wooden mallet or mechanically a cracking hand tool. The manual decortication process is tedious, time consuming, costly, low output, labour-intensive process, and injurious to human beings. To overcome this problem, the present investigation was carried out for developing a mahua seed decorticator and evaluates its performance. The performance parameters of the mahua seed decorticator were tested and evaluated with independent

variables, namely four levels of seed moisture content, i.e. 9, 12, 15 and 18 % (db), and four levels of concave clearance, i.e. 9, 11, 13 and 15 mm. The best performance of mahua seed decorticator was obtained in treatment: T2 (M_1C_2), i.e. at seed moisture content of 9% (db) and a concave clearance of 11 mm, which resulted in the maximum percentage of whole kernel recovery of 67.25% with decorticating efficiency of 98.18% and overall machine efficiency of 88.63%, and a desirability value of 0.932.

Keywords: Concave clearance; decorticator; Mahua seed moisture content; performance

Economic Aspect of Research-by products supplied by Defence Institute of High Altitude Research (DIHAR)

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Ladakh being high altitude, cold and arid region with diversified weather conditions, remains cut-off for over 5-6 months in a year due to heavy snowfall; therefore, has a short and monocropping season. Cultivation of vegetable crops is restricted to marginal land and for a limited season and availability of fresh fruits and vegetables decline during winter months. Maintaining the regular demand-supply chain of fresh vegetables of the expanding population and armed forces throughout the year is an uphill struggle. Importing commodities over air or on roads came at a high expense but after the establishment of Defence Institute of High Altitude Research (DIHAR) vegetable production has undergone a marked transformation. This institute is engaged in providing requisite support and technological help to the armed troops deployed at remote areas and the local population. The main aim of this study was to estimate the cost-effectiveness of the research by-products produced by DIHAR. The book debit voucher and the sale register of DIHAR, were used to collect the primary data for the vegetables provided to the army units at Leh district (Fresh Supply Depot, FSD) and the local populace respectively for this purpose. The rate list of DIHAR and the market rate list from the local vendors published by FCS & CA Leh for the years 2020 and 2021 provided information on the price per kg. This research laboratory provided approximately 58 tonnes of fresh vegetables to army troops and local residents during the years 2020 and 2021 at affordable rates as compared to market price. Importing these commodities by air or road incurred heavy cost and postharvest losses due to transportation thus increasing the price of vegetables manifolds. Thus, this research laboratory is conducting various innovative experiments at field and helping the local residents by providing the research by produce to them.

Keywords: crop diversity, economic aspect, market rate, transportation, vegetable production

Enhancing Farmers' Incomes through Value Addition in Green Peas under Fluidized Bed Drying

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Diversifications of climatic condition of India lead advantages in production of fruits and vegetables. This climate ensures availability of all varieties of fresh fruits and vegetables. *Pisum sativum* (commonly known as peas) is one of the major vegetable crop contributes approximately 2.5% (3.86 million MT) share of the total vegetable production and 4.6% of the total vegetable producing area in India (NHB, 2014). Due to its high moisture content, it cannot be stored well for a long period of time and must be subjected to some method of preservation such as, freezing, canning, cold storage or drying in order to make it available for later consumption. That's why to enhance the Farmers' Incomes, we tested different drying methods of peas and in this paper we evaluate the fluidized bed drying method for green peas drying. The investigation of fluidized bed drying of green peas was conducted in which included two pre treatments (un-blanched and blanched).

Matured fresh green peas were procured and deshelled manually to prepare samples and were blanched at 85°C for 1 min and cooled in running water and removed the surface moisture. Then green peas were put three level of bed heights (20, 40 and 60 mm) and three level of fluidized bed drying air temperatures (45, 55 and 65°C).The result of the study revealed that significantly lower enzymatic browning was found for blanched fresh green peas i.e. 0.05 (U/g) compared to un-blanched fresh green peas i.e.0.012 (U/g).The whole drying took place in falling rate period only. Significantly maximum protein was found in individual effect of drying air temperature at 45°C i.e.17.87 g/100g which was at par at 55°C i.e.17.85 g/100g.Significantly higher average chlorophyll content was found in treatment (blanched, 40 mm bed height and 45°C) i.e.106.98 mg/100g which was at par with treatment (blanched, 40 mm bed height and 55°C) i.e.106.68 mg/100g).The maximum overall drying rate i.e. 0.0158 (kg of water / kg of dry matter)/min was observed in treatment (blanched, 20 mm bed height and 65°C). The rehydration ratio (blanched, 40 mm bed height and 55 °C) was found significantly higher at 3.53 which were at par with (blanched, 20 mm bed height and 45 °C) with 3.52. It can be concluded that green peas should be blanched at 85° C for 1 min before drying under fluidized bed drying at a bed height 40 mm and drying air temperature of 55°C to produce best quality of dried green peas without altering quality.

Keywords: Green peas, Physico-chemical properties, Fluidized bed drying, Quality parameters

Extraction and drying of pigments from red dragon fruit [*Hylocereus polyrhizus* (Weber) Br. & R] pulp

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The experiment was conducted to ascertain the effect of solvent and encapsulating agent on the powdered pigments extracted from the red dragon fruit pulp on its physical and chemical properties. The experiment was laid out using completely randomized design with factorial concept comprising three solvents (acetone, ethanol and dimethyl sulfoxide) and three different levels of maltodextrin (20, 25 and 30 %) as encapsulating agent with three repetitions. For preparation of powder, the pulp of red dragon fruit was mixed with different solvents (acetone, ethanol and dimethyl sulfoxide) in 1:1 ratio for 24 hour at ambient temperature. Maltodextrin was added as encapsulating agent of pigments and homogenised the mixture. The mixture was dried by spray drying at inlet temperature of 180 °C and outlet temperature of 100 °C. The prepared red dragon fruit pulp pigment powder was packed in glass vials and stored at room temperature up to 4 months and analysed the physical and chemical parameters at two months interval. The results of present investigation indicated that the highest recovery (58.34%) of the powder was obtained by DMSO solvent and encapsulating with 30 per cent maltodextrin. Furthermore, powder prepared by spray drying of pigment extracted by dimethyl sulfoxide and encapsulating with 20 per cent maltodextrin was found superior with better quality on the basis of higher anthocyanin content (84.38 mg/100g), antioxidant activity (DPPH assay 36.01 % and FRAP assay 41.37%). In case of colour the powder prepared by spray drying of pigment extracted by dimethyl sulfoxide and encapsulating with 20 per cent maltodextrin exhibited lowest 'L' value (22.97) and 'b' value (2.90) while, highest 'a' value (12.50). During storage decreasing trend was observed in anthocyanin content, solubility, antioxidant activity and 'L', 'a' values of color while increasing trend was observed in 'b' value of color. The pigment powder has comparatively low cost for the production of better quality than other solvents. The powder remains shelf stable up to 4 months storage in glass vials at ambient temperature.

Keywords : Dragon Fruit, Pigments, Spray Drying, Extraction

Exploring potential of pointed gourd cultivation for longer shelf life and processing in Bundelkhand region of Uttar Pradesh

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The Bundelkhand region of Uttar Pradesh (U.P.) relies mainly on rainfed farming due to various challenges. These challenges include declining and erratic rainfall, undulated topography, and poor irrigation infrastructure. As a result, the region experiences frequent droughts, occurring approximately once every 3-4 years. To revitalize the agricultural scenario in Bundel khand, there is a need to promote climate-resilient farm enterprises. These may include dryland horticulture, oilseeds, pulses, and low-water-requiring perennial cucurbits like pointed gourd. Efforts should focus on screening and identifying promising clones of these crops that offer higher yields, longer shelf life, and suitability for processing. Such initiatives can create new avenues for livelihood and employment through distant marketing of fresh produce with reduced perishability. Moreover, there is potential to utilize the produce in value-added products such as confectioneries, dried chips, parwal powder, and canned parwal. Pointed gourd holds great significance in the Indo-Gangetic Plains of India, where it is extensively cultivated. However, its availability is seasonal, limited to the period from April to October. To ensure off-season consumption and year-round availability of this nutritious and beneficial vegetable, there is a pressing need for appropriate preservation technologies that maintain its nutritive value. Despite these numerous advantages, the limited seasonal availability of pointed gourd poses challenges in meeting the year-round demand. Without appropriate preservation methods, consumers often face a scarcity of this nutritious vegetable during the off-season, leading to increased pressure on the fresh market when it is available. To address these issues, it is essential to focus on screening and identifying pointed gourd genotypes that are suitable for processing and confectioneries. By developing appropriate preservation techniques and value-added products, the seasonal limitations can be overcome, ensuring a continuous supply of pointed gourd throughout the year.

Assessment of stability of crude anthocyanins at different pH levels

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The use of synthetic colourants in food material has directly affected the human health as they have been proved to be carcinogenic in nature. People made their food attractive by adding saffron, turmeric and other fruits and vegetable based dyes. Santa Rosa variety of plum is one of the leading commercial cultivar of plum for mid-hills of Himachal Pradesh. The waste of plum after processing is thrown out by the processing industries which contains sufficient quantity of anthocyanin pigment.Anthocyanins comprise a diverse group of intensely colored pigments responsible for the appealing colour of many fruits, vegetables and flowers. Besides the color attributes, interest in anthocyanins has intensified because of their possible health benefits. The optimum method of extraction was found to be pomace + water (1:1). This extraction method gives highest tintometer red unit along with lowest yellow unit and maximum no. of anthocyanins (Cyanidin-3,5-diglucoside, malvidin-3-monoglucoside and cyanidin-3-monoglucoside). During the experimentation different anthocyanins were precipitated from plum pomace extract at different pH levels. The pH values were maintained with addition of hydrochloric acid or ammonium hydroxide. Anthocyanin from extracts were precipitated with addition of lead acetate solution and there after the centrifugation were made. Precipitated anthocyanins were regenerated with addition hydrochloric acid, acetic acid and citric acid.

Colour analysis of the product was conducted with the help of spectrophotometer. Colour graph was plotted with the help of colour plotter.Lead content in precipitates of the anthocyanin was determined using atomic absorption method (AOAC, 1980). With change in pH value (3.3, 4.7, 6.1 and 9.4) there were changes in 'L', 'a' and 'b' values which shows the colour shades of different types of anthocyanins. Maximum 'a' value was recorded at pH 3.3 in plum pomace extract which indicates that the precipitates corresponding to anthocyanins have typical red colour of anthocyanins in the precipitate. The highest 'L' value recorded at 9.5 pH which may be due to the less quantity of anthocyanins in the precipitates. Changes in colour value 'a' took place when regenerated with different acids like citric acid acetic acid and hydrochloric acid. Highest 'a' value was recorded when precipitates were regenerated with hydrochloric acid at pH 3.3, while minimum 'a' value was recorded with acetic acid at pH 9.4. It shows better suitability of hydrochlocric acid than acetic acid. The maximum lead content permissible in the food product is 5 ppm. From this point of view, the lead precipitation through simple to perform and give higher yield of precipitation that corresponded to cyanidin-3-glucide, yet due to more lead content can not be applied for use in the food product. While the method is easy, it holds promise for bio-color extraction. It is worth exploring the application of alternative heavy metal salts in this context.

Key words: Plum, Bio Colours, anthocyanins, extraction, pH stability

To standardize the process for preparation of IMF (Intermediate Moisture Food) from Jackfruit (*Artocarpus heterophyllus* Lam.)

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Jackfruit (*Artocarpus heterophyllus* Lam.) of Moraceae family is one of the most significant trees in tropical home gardens. Jackfruit tree is native to the rainforests of Malaysia and the Western Ghats of India. Introduced to most Pacific islands, the tree can be found throughout the Pacific, primarily in home gardens, where it finds a place among other favorite multipurpose plants. In our country, the trees are found distributed in southern states like Kerala, Tamil Nadu, Karnataka, Goa, coastal Maharashtra and other states like, Assam, Bihar, Tripura, Uttar Pradesh, South Gujarat and foothills of Himalayas. However, jackfruit is a minor fruit and used only for table purpose. This fruit is not presently being used for any value added product in south Gujarat region. The fruit has got good potential for value addition into several products like squash, jam, candy, *halwa etc*. The ripe bulbs can be preserved for one year in sugar syrup or in the form of sweetened pulp. The unripe mature bulbs can be blanched and dehydrated for further use throughout the year. The present investigation was carried out to preparepreIMF (Intermediate Moisture Food) from Jackfruit (*Artocarpus heterophyllus* Lam.) with objective of standardization of the process for preparation of IMF with study the storage stability and to study the quality parameters of developed products during storage of the developed product. The results of present investigation indicated that jackfruit IMF prepared by mixing of 1 kg syrup (50° B) per kg pieces along with 500 ppm potassium metabisulphite (KMS) followed by gradual rise (10° B) in TSS up to 60° B found better during storage. The jackfruit IMF can be successfully stored for a period of four months in polypropylene bags (400 gauge) on the basis of sensory scores and nutritional composition.

Pre-harvest application of putrescine and calcium influences quality attributes of peach during storage

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Peaches are characterized by high perishability, and their postharvest shelf life is relatively short compared to some other fruits.Concerns about the potential health and environmental impacts of synthetic chemicals used in agriculture have led to increased research and development of alternative methodsincluding those for controlling fruit ripening and decay.Hence, the present investigation was undertaken to study the effect of preharvest sprays of putrescine (naturally occurring polyamine)and its combination with various levels of calcium 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) and6 storage intervals (0, 6, 12, 18, 24 and 30 days). The findings revealed that combined sprays of calcium nitrate @ 1.0% + putrescine @ 100 ppmfollowed by calcium nitrate @ 1.0% + putrescine @ 200 ppm had positive effects on the quality and storability of the peaches cv. Pratap. The treatment of putrescine combined with calcium enhanced firmness, total soluble solids and total sugars while having reducing effects on weight loss, shrinkage, and fruit decay percentage

Processing and value addition of watermelon pulp and its albedo

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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. Sothe 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.

Standardization of technologies for dehydration of mango peel and kernel for value addition

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The mango processing industry generates a large quantity of waste in the form of peel and kernels. This processing waste, if not handle properly, cause environmental pollution problems. Even the environment protection agencies are forcing the processed food manufacturer to control pollution. *The present investigation was aimed to standardize suitable pre-treatment for drying of mango peel and kernels into powder, their feasibility for value addition*and to evaluate nutritional, sensory and microbial quality of developed products during storage. During investigation, four different experiments were laid out using completely randomized design (with and without factorial concepts). First two experiments were conducted for dehydration of mango peel (Experiment-1) and mango kernels (Experiment-2) into powder by giving sixteen different pre-treatment combinations of potassium meta-bisuphite [Control (K_1), 500 ppm (K_2), 1000 ppm (K_3) and 1500 ppm (K_4)] and ascorbic acid [Control (A_1), 100 ppm (A_2), 200 ppm (A_3) and 300 ppm (A_4)]. Third experiment was conducted for preparation of *biscuits (Nankhatai) using sixteen different* formulation combinations of mango peel powder (0, 5, 7.5 and 10%), kernel powder (0, 5, 10 and 15%) and wheat flour "Maida" [100%-peel powder and kernel powder (%)] along with different ingredient such as wheat flour "Rava" (10g), sugar (100g), fat (50g), milk powder (3g), baking soda (4g) and small cardamom (1g). Fourth experiment was conducted for preparation of pre-biotic mango nectar using different peel fibre concentrations (0%, 0.2%, 0.4%, 0.6%, 0.8% and 1%). The results of present investigation indicated that mango peel dehydrated into powder by giving pre-treatment to peel with combination of 1000 ppm KMS and 200 ppm ascorbic acid (K_3A_3) found shelf stable based on nutritional as well as sensory quality upto six months storage in polypropylene bags. While, mango kernels dehydrated into powder by giving pre-treatment to kernels with combination of 1000 ppm KMS and 200 ppm ascorbic acid (K_3A_3) found shelf stable based on nutritional composition as well as sensory quality upto six months storage in polypropylene bags. Further, mango peel and kernel powder utilized for preparation of biscuits by incorporation of 5% mango peel powder, 7.5% kernel powder and 87.5% maidafound shelf stable based on nutritional as well as sensory quality upto three months storage in polypropylene bags. Furthermore, mango peel fibre utilized for the preparation of pre-biotic mango nectar by the addition of 0.6% peel fibre found acceptable on the basis of nutritional and sensory quality upto six months storage in glass bottle processed at 96±1°C. Thus, prepared products can commercially be explored by food processing industry ensure better returns to growers, processors and consumers as well.

Effect of maturity levels and spermine on biochemical properties at low temperature storage of papaya cv. Red lady Taiwan

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An experiment was conducted at the Department of Fruit Science and Department of Post Harvest Technology of ASPEE College of Horticulture and Forestry, Navsari Agriculture University, Navsari during December 2014 and April 2015. The experiment comprised of harvesting papaya cv. Red Lady Taiwan at three different maturity stages (Colour break stage, 50% yellow and 75% yellow stage), dipping them in aqueous solutions of spermine (0.0, 1.0 and 2.0 mM) and storing them at ambient as well as 12±1°C temperature. The eighteen treatments were evaluated in a Completely Randomized with Factorial Concept (FCRD) and replicated three times.Results indicated a significant impact of maturity levels on all parameters

included in the study. Postharvest application of spermine had a significant influence on all traits studied in this investigation.Whereas, total soluble solids, total sugar, reducing sugar and non reducing sugar were found maximum in fruits harvested at seventy five percent maturity.The highest values of TSS, total sugars, reducing sugars, non reducing sugars, titrable acidity and ascorbic acid content were found with spermine @ 2.0 mM. The fruits stored at low temperature having long perishability as compared to store at room temperature.

Utilization of overripe banana powder for development of puffed extruded snack

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Overripe banana (*Musa* x *paradisiaca* L.) is a rich source of sugar which can be used as a natural sweetener in foods. Understanding the gaps, the proposed research work was conducted which included a protocol for foam mat drying powder development from overripe banana and utilization of this powder as a functional additive for extruded snacks. Under the first objective, we compared four foaming agents *i.e.*, egg albumin, casein, soy and whey protein at a constant concentration level. Based on their foam stability, expansion, and density; egg albumin was found the best. Under second objective, process parameter comprising 26% banana flour with 200 rpm screw speed and 16% feed moisture, was reformulated and validated with the values predicted by the model (0.854 desirability). The proximate composition of extruded snacks showed that the developed snack is a fair source of dietary fiber with a slightly sweet tinge of overripe banana flour without any added sugar. Being very low in fat content, it can be categorized as a 'Fat-Free Snack'. Arrhenius model was used for shelf life prediction of control, optimized powder, and optimized extruded snack under accelerated shelf life study. The predicted shelf life was 6 months, 4 months, and 9 months for control, foam mat dried powder, and optimized extruded snack, respectively at 30°C and 75% RH.

Keywords: Extruded snack, Foaming agent, Stability, Expansion, Density

Nutritional and sensory quality of carrot (*Daucus Carota* L.) Candy during storage period

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The "Standardization of technology for preparation of carrot (*Daucus carota* L.) candy" was aimed to evaluate the sensory as well as nutritive quality of developed product during storage. The study conducted at Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari. The maximum carotene content was found in candy prepared by using 1kg syrup (50^0B) per kg pieces containing 1000 ppm KMS (K_2S_4). Furthermore, the scores for various organoleptic characters *viz*., colour, texture, flavor and taste were found maximum in candy prepared by using 1kg syrup (50^0B) per kg pieces with 1000 ppm KMS (K_2S_4) during storage. The yield of carrot was found maximum in candy prepared by using 1kg syrup (50^0B) having 1000 ppm KMS per kg pieces (K_2S_4). The investigation revealed that carrot candy can be prepared by mixing of 1 kg syrup (50^0B) per kg pieces along with 1000 ppm KMS followed by gradual rise (10^0 B) in the syrup strength up to 70^0B was found better. The carrot candy can be successfully stored for a period of 6 months in polypropylene bags without much changes in physico-chemical, sensory and microbial quality. Thus, the developed technologies can commercially be adopted by food processing

industry for the production of quality carrot candy. Therefore, profitable utilization of carrots grown in India for processing can ensures better returns to the growers and processors as well.

Key words: Carrot candy, Carotene content, Organoleptic parameters, Physico-chemical and microbial quality

Management of Postharvest Rot in Elephant Foot Yam

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After harvesting, tuber crops are generally loss their weight due to post harvest loss. Sometimes postharvest pathogens take the lead in increasing the loss. The pathogens of different genera like *Alternaria, Aspergillus, Botrytis, Fusarium, Mucor, Penicillium* and *Rhizopus* as well as sometimes moulds generally cause the most important postharvest diseases in elephant foot yam. Minimizing these post harvest losses may increases food availability to the people. At AICRP on Tuber Crops, Department of Vegetable Science, ASPEE College of Horticulture, Navsari Agricultural University, Navsari-396450, Gujarat, experiment was conducted with seven treatments in CRD design with three repetitions. 20 corms per replication were kept and the treatments were imposed within 2-3 days after harvest. The corms were fully dipped in the respective treatments for 10 minutes and dried in shade. Treated corms were stored in well ventilated place. In this experiment, number of corms affected, only on skin-surface area with saprophytic fungi (mould) and inside is normal (No infection) was found. Treatment T_5 [Combination fungicide containing Mancozeb+ Carbendazim 0.2%] found better among other treatment with no corms affected inside and ouside as well as no any incidence of mealy bug was found. Physiological loss in weight % was also less among the other treatments. This management under storage condition will definitely reduce the loss in productivity of elephant foot yam

Studies on preparation of mango pickle

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The study conducted at the Department of Fruit Science, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, Maharashtra during 2020-21 aimed to assess the impact of mango genotypes and recipes on the physicochemical and sensory attributes of mango pickle throughout a 150-day storage period. The factorial completely randomized design is used to find the interactions of Factor – A (Three genotypes; Galu, Shravanya, and Telya) and Factor -B (Four recipes (Recipe-1; Unripe mango flakes 1 Kg, Oil 250 ml, Salt 250 g, Mustard dal 100 g, Clove 10 g, Black pepper 10 g, Cumin powder 20 g, Asafoetida 5 g, Fennel 100 g, Cardamom 5 g, Fenugreek seed 5 g, Chili powder 20 g, Turmeric powder 10 g, Coriander powder 20 g.), Recipe-2; (Recipe-1 + Niger seed – 150 g), Recipe-3; (Recipe-1 + Garlic- 200 g), and Recipe-4 (Recipe-1 + Niger seed – 150 g + Garlic- 200 g), with Recipe-1 being common across all treatments. The findings revealed a gradual increase in TSS, acidity, total sugar, reducing sugar, and non-reducing sugar content during storage, while decreased pH, ascorbic acid, and moisture content. Notably, Genotype-3 (Telya) and Recipe-4 (Recipe-1 + niger seed 150 g + garlic 200 g) exhibited minimal changes in these parameters over the 150-day storage, especially when stored in an earthen pot at room temperature. The sensory evaluation indicated a consistent improvement in aroma, taste, texture, and overall acceptability over the storage period. However, appearance

scores decreased across all treatment combinations. Overall, the mango pickle prepared with Genotype-3 (Telya) and Recipe-4 was identified as superior, likely due to the inclusion of all 16 spice ingredients, enhancing the quality and acceptance of the pickle.

Keywords : Recipe, Genotype, Mango, Pickle, Storage, Niger seed and Garlic.

Enhancing beverage tastefulness: a study on blended dragon fruit rts

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Dragon fruit (*Hylocereus sp.*), commonly known as *Kamalam* or *Pitaya*, is a native to Southern Mexico and Central America and belongs to the family Cactaceae. It has very unique appearance, taste and crunchy texture. Its taste can be described as a slightly sweet cross between a kiwi and a pear. Its flavour is mildly sweet with subtle earthy notes. It is a low-calorie fruit that is rich in proteins, vitamins, fibres, iron, phosphorus, calcium and antioxidants like flavonoids, phenolic acid and beta-cyanin.It is useful for almost every organ of the body as it regulates digestive system, respiratory system, diabetes, balances the toxins present in the body, increases the platelets count, boosts immune system, prevent cardiovascular diseases and cancer. But the availability of the fruits is seasonal and hence, preparation of some value added products would help in availing the benefits of dragon fruit throughout the year. Amongst the wide range of value added products available in the market, Ready-to-Serve beverages can be of great importance as they not only provide convenience and efficiency in the fast-paced urban lives, but also eliminate the need of any preparation or mixing. It makes them ideal for on-the-go consumption, by catering to busy individuals and ensuring instant refreshment without compromising quality or taste. They also offer a hassle free solution for hydration, quick energy replenishment and enjoyment in various settings. However, to improve the quality and taste of dragon fruit RTS, blending can be commercially exploited by the food processers for the production of quality dragon fruit RTS. Blending with other fruits, like lime and strawberry, can be done, which would help in increasing the value and taste of the RTS and availing benefits from both the fruits used.

Keywords: Beverage, Blend, Dragon fruit, Ready-to-Serve, Value addition.

Preserving Freshness: Exploring the Role of Edible Coatings in Prolonging Shelf Life of Fruit Crops

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The post-harvest management of fruit crops is a critical aspect of ensuring food security and reducing food waste. Today, we should focus on the innovative application of edible coatings as a sustainable solution to enhance the shelf life of fruit crops. Edible coatings, composed of natural compounds such as polysaccharides, beeswax, proteins, and lipids, offer a protective barrier that minimizes moisture loss, gas exchange, and microbial growth, thereby preserving the freshness and nutritional quality of fruits. This poster will delve into the science behind edible coatings, exploring their mechanisms of action and their potential to extend the shelf life of a variety of fruit crops. By forming a thin, biodegradable layer on the fruit surface, these coatings not only serve as a physical barrier but also regulate gas permeability, providing an environment conducive to prolonged storage without compromising quality. Case studies and research findings will be shared, highlighting successful applications of edible coatings in diverse fruit crops. Practical insights into the optimization of coating formulations and application methods will be discussed, ensuring

that the technology is accessible and adaptable to different agricultural contexts. The economic and environmental implications of adopting edible coatings as a post-harvest management strategy will also be addressed. The poster aims to provide a comprehensive understanding of the potential of edible coatings in reducing post-harvest losses, improving marketability, and contributing to sustainable practices in the fruit industry.

Key words : Edible Coatings, Shelf life, Fruits.

Empowering farmers through value addition in mango cultivation: a path to self-reliance

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Among the commercial fruits grown in India, mango is one of the most popular and delicious fruits found in tropical regions. Adverse climates and improper handling of produce impact farmers heavily, which makes them unable to generate good returns. In order to increase farmers' self-reliance, value addition plays an important role in increasing their income. Mango, renowned for its economic significance, presents a unique opportunity for farmers to elevate their livelihoods through strategic interventions in the production and marketing processes. As the demand for mango is also high in the international market, especially for coloured varieties, there is huge opportunity for farmers to grow new coloured varieties for export purposes to boost their income. The discussion will encompass key aspects of value addition, ranging from sustainable agricultural practices to advanced post-harvest technologies. Practical insights into optimizing crop quality and minimizing losses will be shared, emphasizing the integration of innovative approaches at every stage of mango cultivation. Special attention will be given to empowering farmers through the establishment of on-farm processing units, allowing for value addition closer to the source. Furthermore, market-oriented strategies include exploring avenues for branding, packaging, and market linkages. Insights into global export opportunities and compliance standards will be provided, offering farmers a roadmap to tap into larger markets and diversify revenue streams.

Key Words : Mango, Post-harvest, Value addition, Self-Reliance

Banana Peel Value Addition For Nutritional Security

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Huge quantity of banana peel as a waste material is generated during the preparation of the banana puree in banana processing plant. The experiment has been carried out to optimize pre-treatment for prevention of enzymatic browning in banana peel prior to blanching and preparation of paste to be used in banana 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 using different formulations. The formulation of banana peel based sev possesses significant differences on the yield of the banana peel based Sev. The yield of the Sev 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 (F_6). Data depicted significant effect of formulations on the sensory qualities of the banana peel based Sev during three-month storage. Maximum sensory score were obtained by treatment F_1 (Sev prepared directly from the gram flour) while minimum by treatment containing 50% banana peel. The treatment F_1 was found statistically at par with the Sev prepared using 30% peel of banana. 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.

Keywords: Banana, peel, Formulation, TBHQ, Packing, waste utilization, Sev, value addition

Processing and value addition of Aloe vera to Enhance Sensory Acceptability

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*Aloe vera*is known from centuries for being used to care degenerative diseases. Therefore, different value added product viz. Aloe vera juice, nectars, vermicelli and dehydrated Aloe vera gel can be prepared from the Aloe vera by applying different approaches of processing and value addition.However, commonly occurring problem in consumption of these commodities in fresh from is due to its bitter taste (*Aloe vera*, bitter gourd) and highly acidic as well as astringent taste (aonla). Guava fruits besides having medicinal importance also possess good flavour and acceptability; thus having positive attribute for blending purpose. The present investigation was aimed to standardize pre-treatment for removal of the bitter compound 'aloin' from *Aloe vera* gel for value addition, to standardize formulation for preparation of *Aloe vera* based vermicelli, to optimize suitable drying temperature for dehydration of *Aloe*. Results of the investigations revealed that t**he** aloin free *Aloe vera* juice can be obtained by giving pre-treatment with 7.5 % ethanol for 3 hours to *Aloe vera* piece having preparation size of 5 cm or treatment with 1.5% soybean. *Aloe vera* juice can be utilized for vermicelli preparation by using formulation of 24 % *Aloe vera* juice, 1 % isabgol husk, 75 % wheat flour. *Aloe vera* gel can also be utilized for dehydration at four stage dehydration temperature of 75°C for 2 hours, 70°C for 3 hours, 65°C for 4 hours and 60°C for about 10 hours. Further blended nectar can be prepared by using 12% *Aloe vera* juice, 2% Bitter gourd juice, 2% Aonla juice and 4% Guava pulp having 16°B TSS and 0.30% acidity.

Keywords: *Aloe vera* juice, Aloin, Vermicelli, Dehydrated Aloe vera gel, Quality, Storage

Blockchain revolutionizing horticulture supply chain traceability: a novel approach for quality and sustainability

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The horticulture industry faces challenges in ensuring the quality and sustainability of its supply chain, with issues ranging from inconsistent product quality to difficulties in tracking the origin of produce. This poster explores the transformative potential of blockchain technology in addressing these challenges by providing a novel approach to traceability in the horticulture supply chain. Blockchain's decentralized and tamper-resistant ledger system presents a paradigm shift in how information is recorded and shared across the

supply chain. Through the implementation of smart contracts and a distributed ledger, stakeholders in the horticulture industry can establish a transparent and immutable record of every transaction and movement within the supply chain. This not only enhances traceability but also ensures the integrity of information related to product origins, cultivation practices, and transportation. The proposed blockchain-based system not only facilitates real-time monitoring but also allows for the verification of product authenticity and adherence to sustainability standards. By enabling stakeholders to trace the journey of produce from farm to consumer, this approach fosters consumer trust, supports quality assurance, and promotes sustainability practices within the horticulture sector. Moreover, the decentralized nature of blockchain mitigates the risk of fraud and counterfeiting, providing a secure foundation for fair trade practices. Through case studies and practical examples, this poster illustrates the potential impact of blockchain technology on transforming horticulture supply chains, highlighting its ability to enhance overall product quality, reduce waste, and promote sustainable practices. As the horticulture industry embraces this innovative approach, it stands to benefit from a more resilient, transparent, and sustainable supply chain ecosystem.

Key words : Blockchain, Sustainability, Traceability.

Studies on preparation and development of custard apple powder based instant ice cream mix

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Custard apple, a nutritionally rich but highly perishable seasonal fruit, faces challenges in storage and preservation, limiting its availability beyond three days. To address this issue a study was conducted at the Department of Postharvest Management, Kittur Rani Channamma College of Horticulture, Arabhavi during 2022-23, focuses on the development of a custard apple powder-based product, specifically an ice cream mix. The custard apple powder was prepared using an optimized spray drying process at an inlet temperature of 185°C and an outlet temperature of 90°C. Eight different treatment combinations of custard apple powder and other ingredients were tested for ice cream mix formulation, with the most organoleptically pleasing result achieved using 30 per cent custard apple powder and 15 per cent milk powder. This formulation exhibited optimal physico-chemical parameters, including moisture content (6.43%), water activity (0.52), overrun (34.17%), carbohydrates content (32.05%), protein content (3.96%), fat content (3.13%), total sugars (29.64%), ash content (0.75%), and returns per rupee of expenditure (2.39). This promising formulation maintained its quality throughout the storage period, making it a viable solution for extending the availability of custard apple products during the off-season.

Keywords: Custard apple, moisture content, protein content and ice cream mix

Effect of seed storage period and growth regulators on seed germination, growth and survival of jackfruit seedling

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An experiment entitled "Effect of seed storage period and growth regulators on seed germination, growth and survival of jackfruit seedling" was conducted in green shade net house at Horticultural Research Farm, Department of Horticulture, B. A. College of Agriculture, Anand Agricultural University, Anand during the year kharif- 2019. The treatment comprised three levels of seed storage period (S) viz., S1- 0 day after extraction of seed, S2- 5 days after extraction of seed and S3- 10 days after extraction of seed and five seed soaking treatments of growth regulators GA3 24 hrs (G) viz., G1- GA3 @ 100 mg l-1 , G2- GA3 @ 150 mg l-1 , G3- NAA @ 25 mg l-1 , G4- NAA @ 50 mg l-1 and G5- Control. The experiment was carried out in Completely Randomized Design (Factorial) with fifteen treatment combinations and repeated thrice. Sowing of fresh extracted seeds of jackfruit recorded minimum number of days (14.89) taken for germination with maximum germination percentage (81.60) and at 90 DAS maximum height of seedling (37.78 cm), girth of seedling (4.32 mm), number of leaves per plant (6.88), length of seedling (50.99 cm), root length (13.21 cm), fresh weight of shoot (8.04 g), fresh weight of root (2.33 g), dry weight of shoot (3.19 g), dry weight of root (0.69 g), and survival percentage of seedling (69.60). Jackfruit seed soaked in GA3 @ 100 mg l-1 for 24 hrs recorded significantly, minimum number of days (15.58) taken for germination with maximum germination percentage (76.67) and at 90 DAS maximum height of seedling (37.57 cm), girth of seedling (4.07 mm), number of leaves per plant (6.97) length of seedling (49.67 cm), length of root (12.10 cm), fresh weight of shoot (8.13 g), fresh weight of root (2.25g), dry weight of shoot (3.35 g), dry weight of root (0.73 g) and survival percentage of seedling (68.18). Fresh extracted jackfruit seed soaked in GA3 @ 100 mg l-1 for 24 hrs recorded minimum number of days (12.34) taken for germination with maximum germination percentage (96.67) and at 90 DAS maximum height of seedling (43.30 cm), fresh weight of shoot (10.33 g), dry weight of shoot (4.59 g), dry weight of root (0.97 g) and survival percentage of seedling (84.24).

Keywords: Seed storage period, growth regulators, germination parameters, growth parameters, survival of seedling

Preservation of fruits and vegetables by dehydration

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Dehydration of fruit and vegetables is one of the oldest method of food preservation. Dehydration done by removal of water by application of heat. Dried product are available throughout the year and product have long shelf life. There are different method of drying of fruit and vegetable. Which can be categorized into natural method and artificial method. Natural method such as sun drying, wind drying but this method are time consuming. Artificial method such as freeze drying, drum drying, spray drying, cabinet drying and tunnel dryer method. These techniques are demand due to there several advantages like time saving

technique, reduce the loss of produce, cost of processing is less, required less packaging material, easy to transportation and easy method to preservation and extend shelf life of the produce. Dehydrated fruits and vegetables are an excellent source of vitamins, minerals and fiber. Dried and dehydrated fruits and vegetables can be successfully used for different food preparations.

Characterization of properties of the healthy fortified breadfruit and karonda blended powder

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The breadfruit, or *Artocarpus Altilis*, is a member of the Moraceae family. Breadfruit is low in fat, cholesterol and high in minerals and complex carbs. It also contains a range of amino acids and is particularly high in leucine, isoleucine, phenylalanine, and valine making it a good source of essential amino acids, especially in countries fighting malnutrition. Karonda popularly known as "Christ's thorn" is an underutilized minor fruit crop of India. Karonda is harvested at both the mature and ripe stages. Unripe karonda fruit is sour in taste and astringent which is used in aphrodisiac, appetizer, antipyretic, hyperdipsia, diarrhoea, anorexia, and intermittent fevers. Karonda fruits are rich in protein, vitamin C and minerals especially iron, calcium and The ripe fruit is sweet in taste with a peculiar aroma which is also a good appetizer and antiscorbutic. Therefore, the experiment was conducted to prepare product from both these underutilized fruits. The dried powder was prepared from breadfruit pulp and karonda pulp. The dried product was prepared using a drying of karonda pulp and breadfruit pulp in ratios of 50:50, 90:10, and 80:20, respectively. The blends were homogenized and dry it by using of hot air oven at 60°C and made in powder. The physicochemical parameters of blended powder were analyzed. Among the different ratios, Karonda and breadfruit-based powder prepared with 50 percent Karonda and 50 percent breadfruit was found highly acceptable with respect to Acidity (0.059%), Antioxidant (64.26 mg/ml), Flavonoids (40.60 mg/ml), Phenol (126.91 mg/ml), Vitamin C (205.12 mg/100g) compared to other blends. Furthermore, Glucose and TSS was found nonsignificant among all the treatments. This blended powder can be used for the preparation of different value-added products like instant drinks, confectionery products, fruit bar toppings, fruit leathers, thickening agents, nutraceuticals, *etc*. This fortified product may help to eradicate the malnutrition problem.

Keywords: Appetizer, Fortification, Underutilized fruits, Vitamins, and antioxidants.

Unlocking Longevity: Strategies for Extending Custard Apple Shelf Life through wax application

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Custard apple (Annona squamosa L.), a tropical fruit valued in India and originally from America, is a member of the Annonaceae family. Custard apples are climacteric fruits, which means that they mature quickly after harvest, making them difficult to preserve even with their great flavor and aesthetic appeal. These fruits often keep alive for an additional three to four days in normal circumstances. After harvesting, the fruit continues to alter physiologically, which causes degradation. In order to preserve the mature custard apples' shelf life, these post-harvest alterations must be minimized. Extending their shelf life becomes feasible by managing transpiration rates, respiration rates, and sensitivity to microbial diseases. The softening and loss of firmness of these fruits are the main causes of the quality decrease and a major obstacle to their exportation. It is imperative to attend to these elements in order to maintain the fruit's quality and

structural integrity, so strengthening its appropriateness for local consumption as well as export markets. Using alternative packing and wrapping materials, applying wax emulsion, and applying potassium permanganate are just a few of the treatments that can be used to improve the postharvest quality of custard apples. Fruit coatings are a useful substitute because they improve the fruit's exterior texture while simultaneously modifying the fruit's inside environment.

Keywords: Custard apple, Physico-chemical composition, Post harvest, shelf-life, wax

Floriculture supply chain management: a conceptual model for improving visibility and coordination

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Floriculture is a dynamic and complex industry that faces various challenges in terms of supply chain management. The main objective is to propose a conceptual model of floriculture supply chain management that aims to improve the quality, efficiency, visibility and coordination of the supply networks of floriculture products. The model is based on a systematic approach that considers the key factors and challenges of the floriculture market such as demand fluctuations, product perishability, infrastructure gaps, information asymmetry and environmental sustainability. The optimization of floriculture supply chain management, quality factors are vital. This necessitates the amalgamation of innovative technologies for the real-time management of floriculture products across the supply chain. These technologies include tracking and tracing mechanisms like RFID, quality monitoring systems, wireless sensor networks, and internet-based solutions such as cloud computing and web services. Collectively, these tools ensure efficient supply chain management in the floriculture industry. Industry analysis reveals a stagnant market demand for flowers, despite a surplus supply. This is partly due to flowers being non-essential commodities with demand highly correlated with income. Meanwhile, consumer demand is becoming more complex and differentiated. Infrastructure development in the floriculture market should prioritize a systematic approach, encompassing elements of production, intermediary, floristic, design, marketing, financial, information, and agricultural components.

Key Words: RFID, Demand fluctuation, Product perishability.

Effect of post shooting spray of organics and bunch cover on yield and quality of banana

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A field experimentwas conducted on the topic "Effect of post shooting spray of organics and bunch cover on yield and quality of banana"at Instructional Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, Gujarat during 2021-22.The different levels of factor organic spray (O) areO_1: No Spray,O_2: 2 %*Panchagavya*, O_3: 4 %*Panchagavya*, O_4: 2 %*Jeevamrut*and O_5: 4 % *Jeevamrut.* The factor bunch cover (B) consists of levels B_1: No cover,B_2: Bunch covering with non-woven cloth of white colour and B_3: Bunch covering with blue LDPE.The individual effect of post shooting spray of organics and bunch cover as well as their interaction effect was studied. Among different treatments of organic spray, post

shooting spray of 4 %*Panchagavya* (O_3) produced maximum yield attributes *viz*.,bunch weight (28.74 kg), weight of third hand (2.66 kg),finger length from third hand (22.32 cm), finger girthfrom third hand (12.68cm), finger weight from third hand (138.59 g) andfruit yield (99.77 t/ha). Also, this treatment gave higher BCR of 3.56. This was at par withthe treatment with 4 % *Jeevamrut* (O_5). In case of bunch covers, the maximum average bunch weight (28.86 kg), weight of third hand (2.54 kg),finger length from third hand (22.02 cm), finger girthfrom third hand (12.44 cm), finger weight from third hand (136.94 g) andfruit yield (100.20 t/ha)were observed in treatment with blue LDPE. It was also found that the quality parameters of banana *viz.*,total soluble solids (18.91), ascorbic acid (6.10 mg/100g), reducing sugar (5.99 %) and total sugar (12.65 %) were significantly higher and titratable acidity (0.313 %) was lower in this treatment. This treatment gave higher BCR of 3.28.

Keywords : Panchagavya, Panchagavya, Jeevamrut, Jeevamrut and blue LDPE

Effect of chitin and its derivative chitosan on post harvest handling of horticultural crops

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Chitosan is the second most abundant, naturally occurring polysaccharide after cellulose and it is a natural, linear biopolymer which is completely safe for the environment. Chitosan is the deacetylated form of chitin having biological properties *i.e.* biodegradable, bio adhesive, antioxidant, antimicrobial, *etc.* Major source of chitosan is sea food waste but it is also found in cuticles of insects, cell wall of fungi, some algae and in some mushrooms in small quantities. Chitosan is easily and abundantly available as well as its application is also easy. Now a days, chitosan nanoparticles are broadly applied as it is biodegradable and nontoxic carriers for drugs. It is very useful as a coating in leaf, fruits and vegetables, as a fertilizer, as immunity booster, in plant protection, *etc.* Considerable economic losses to harvested commodities are caused by post-harvest decay due to biotic and abiotic stresses which is significantly controlled by using chemicals i.e. fungicide, bactericide, etc. but these chemicals are found hazardous to environment as well as human health. They might lead to cancer or such major medical abnormalities in humans. So, there is a need of nowadays to find alternative of chemicals used for enhancing post harvest life of horticultural commodities as they will be used in direct or indirect consumption by humans and has to be safe and non toxic with no residual effects. Chitosan can be that best alternative as it is abundantly available in nature, environment friendly, safe and nontoxic to humans. So commercial exploitation of chitosan should be done to utilize its benefits in preventing post-harvest losses.

Keywords : Chitin, Chitosan, Post-harvest, Handling, Shelf life, Vase life, Management

Effect of *jeevamrut* and *panchagavya* on growth, flowering and yield of chrysanthemum (*Chrysanthemum morifolium* Ramat.)

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This study examined the impact of *Jeevamrut* and *Panchagavya* applications on the growth, flowering, yield and quality of chrysanthemum plants. The experiment was conducted at College Farm, College of Horticulture, from August 2022 to January 2023. The researchers used the 'Ratlam Selection' variety of chrysanthemum and implemented a randomized block design with fourteen treatments. These treatments consisted of different combinations of *Jeevamrut* and *Panchagavya* applications, either through drenching or foliar spraying, at 15 days intervals until flowering. The study also assessed soil chemical properties and viable bacterial count. The findings indicated that treatment T_{14}, which involved *Jeevamrut* drenching at 500 l/ha and 8 % *Panchagavya* foliar spraying alternately at 15 days intervals, had the most significant positive effects on the growth and vegetative characteristics of the chrysanthemum plants. This treatment also led to early flowering and increased flower yield per plant, per plot, and per hectare, as well as larger flower diameter and weight. Additionally, treatment T_2, which included *Jeevamrut* drenching at 500 l/ha at 15 days intervals, resulted in the highest soil nitrogen availability and viable bacterial count. In terms of economic returns, treatment T_{14} exhibited the highest gross return, net return, and benefit cost ratio among all the treatments. In conclusion, the combination of *Jeevamrut* drenching at 500 l/ha and 8% *Panchagavya* foliar spraying at 15 days intervals showed positive effects on the growth, yield, and economic returns of chrysanthemum cultivation. However, to enhance soil nitrogen availability and microbial count, it is advised to opt for *Jeevamrut* drenching at 500 l/ha at 15 days intervals.

Keywords : Chrysanthemum, *Jeevamrut*, *Panchagavya*, FYM, Soil, Microbial count

Development of protocol for the preparation of shatavari candy

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Shatavari is one of the important medicinal crops having galactagogue activity. As the fresh roots of shatavari contain high moisture, they cannot be stored for longer time. Hence, fresh roots are used for the preparation of candy. In this regard, an experiment was conducted at Department of Post-Harvest Technology, KRC College of Horticulture, Arabhavi (UHS Bagalkot), Belagavi district, Karnataka, India to find out the suitable protocol for the preparation of candy using completely randomized design with ten treatments. The shatavari candies were prepared by varying the blanching time, method of preparation and with or without citric acid. During the storage, the shatavari candy showed an increasing trend with respect to mean moisture content (13.91 to 15.53%), water activity (0.35 to 0.57), total sugars (47.25 to 49.58%), redness (1.02 to 1.78), non-enzymatic browning (0.011 to 0.027 OD) and a decreasing trend in titratable acidity (0.56 to 0.43%), ash content (0.41 to 0.34%), lightness (66.87 to 61.74) and yellowness (10.18 to 9.65) during three months of storage. The mean organoleptic scores of the shatavari candy showed a modest decreasing trend *viz*., colour and appearance (8.06 to 7.08), texture (7.51 to 6.79), taste (7.74 to 6.86) and

overall acceptability (7.77 to 6.91) during three months of storage. Among different treatments, shatavari candies prepared by blanching for five minutes with a slow method and 1.5 per cent citric acid and 1.0 per cent citric acid were found better with respect to all physiochemical and sensory parameters.

Flower waste to fortune: an approach to produce valuable products

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Waste is described as undesired, useless stuff that is thought of being no utility. The primary problem of society is waste disposal. Different sources of trash creation include industrial, commercial, agricultural and household. Floral waste is being one of the major organic solid wastes generated in temples, functions, festivals, ceremonies, hotels and flower market *etc.*, with the emerging techniques in horticultural practices and with the increase of usage, flowers are cultivated in large scale. After gratifying their purpose, flowers along with other waste, find their way into the garbage or discarded into river, sea or oceans causing various environmental problems. Flower waste management is becoming a very challenging problem due to the huge time requirement for its segregation and biodegradation. The improper disposal of flower waste from cultural activities is one of the main challenges in certain countries such as India. As flower waste contains some of the qualitative values such as essential oil, pigments and substrate quality, nutrients and lignocellulosic materials. Various technologies have been developed to transform flower waste into value-added product such as incense sticks, dye extraction, herbal colours, handmade paper, vermicomposting, biochar, bioethanol, making of holi colours and bio-gas generation *etc.* As most of the flower contains secondary metabolites which can be further used in essential oil extraction and food additives. Thus, recycling of flower waste can contribute to a circular economy, converting discarded blooms to eco- friendly products, promoting a greener and more sustainable future.

Key words: Floral wastes, waste management, secondary metabolites, essential oil, value-added products

UV light effect on quality of nectar during storage

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The experiment was conducted to study the effect of UV light, preservative and heat treatment on quality of *Aloe vera* based blended nectar. Eleven different treatments were used for experimentation. Produce juice/ pulp after extraction and filtration was blended in ratio of 12:2:2:4 (*Aloe vera*: Bitter gourd: Aonla: Guava) with TSS level of 15°B and maintained with 0.30% acidity. The prepared nectar was filled into pre-sterilized glass bottles of 200 ml and sealed air tight with crown caps. The product was then processed as per treatments followed by cooling and storage for six months at room temperature and analyzed at regular intervals for physico-chemical as well as sensory attributes. The results of the present investigation indicate that blended nectar can be preserved for long time by adding 75ppm KMS (50% recommended chemical

preservative) followed by 30 minutes UV light treatment (T_{10}-$P_{75}U_{30}$) on the basis of higher sensory score as well as nutritional composition. Six month storage of blended nectar preserved by adding 75ppm KMS followed by 30 minutes UV light treatment (T_{10}-$P_{75}U_{30}$) exhibited minimum changes in nutritional as well as sensory attributes. Overall findings of investigation revealed that blended nectar can successfully be stored for 6 months in glass bottles with minimum changes in chemical, sensory and microbial quality. The Benefit cost ratio (BCR) of blended nectar was observed 1.20 at 20 per cent profit margin and 1.74 at minimum market sale price of Rs. 10.00 per bottle (200 ml). Thus, UV light treatment of blended nectar for 30 minutes containing 75ppm KMS can be utilized more beneficially for its preservation by food processing industry for a period of six months to ensure minimum changes in nutritional as well as sensory quality.

Value addition of Mango Peel for Preparation of pre-biotic nectar

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Mango (*Mangifera indica* L.) possesses great potential for processing into number of quality products utilizing about 20% of mangoes into different processed products. Due to such a huge mango processing share, the mango processing industry generates a large quantity of waste in the form of peel and kernels. This processing waste, if not handle properly, cause environmental pollution problems. Even the environment protection agencies are forcing the processed food manufacturer to control pollution. Thus, the experiment was aimed to optimize mango peel fibre concentration for preparation of pre-biotic mango *nectar* and to evaluate nutritional, sensory and microbial quality of developed products during storage using different peel fibre concentrations (0%, 0.2%, 0.4%, 0.6%, 0.8% and 1%). The results of present investigation indicated that mango nectar prepared by addition of 0.6% of mango peel fibre was found shelf stable based on nutritional as well as sensory quality during six months storage and can be recommended for preparation of pre-biotic mango nectar. During six months storage, mango nectar prepared by addition of 0.6% mango peel fibre observed minimum increase in TSS, acidity, reducing sugars, and total sugars while minimum decrease in ascorbic acid, non-reducing sugars, fibre, carotenoids and sensory quality parameter. These samples remained free from microbial contamination upto six months storage. Thus, mango peel fibre can be utilized for the preparation of pre-biotic mango nectar by the addition of 0.6% peel fibre and found acceptable on the basis of nutritional and sensory quality upto six months storage in glass bottle processed at 96±1°C.

Optimization of suitable formulation for preparation of vegetable enriched pasta

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Present investigation entitled "Optimization of suitable formulation for preparation of vegetable enriched pasta" was aimed to evaluate the sensory as well as nutritive quality of vegetable enriched pasta during storage. For preparation of vegetable enriched pasta, an experiment was laid out with seventeen treatment formulations of semolina flour (65, 63.5, 62.5 and 61.5 %), wheat flour (35, 34, 32.5 and 31 %), capsicum powder (0, 2.5, 5 and 7.5 %), carrot juice (20, 15, 10 and 5 %) and tomato juice (5, 10, 15 and 20 %) along with standard formulation (100 % semolina flour and 25 % water) using completely randomized design. The prepared vegetable enriched pasta was stored for a period of 6 month to analyse the quality attributes at two month intervals. The results of the investigation revealed that best quality vegetable enriched

pasta with higher sensory acceptability can be prepared using 63.5 % semolina, 34 % wheat flour, 2.5 % capsicum powder, 5 % carrot juice and 20 % tomato juice. This formulation of pasta also resulted higher storage stability of nutritional parameters like vitamin C, ash content, starch content, lycopene content, carotene content during six months storage. Prepared pasta can be stored successfully for 6 months in polypropylene bag (480 gauge) at room temperature. The developed pasta technology can be commercially explored by the food processors for production quality of vegetable enriched pasta and helpful for profitable utilization of vegetables for harnessing of their nutraceuticals and aesthetic properties.

Keywords: Pasta, Vegetable Enriched, Capsicum, Tomato, Carrot, Storage stability

Aloe vera value addition to prepare *Aloe vera* based wheat flour vermicelli

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The present investigation was aimed to prepare *Aloe vera* based vermicelli using seventeen treatment formulations comprised with different proportions of *Aloe vera* juice (18%, 20%, 22% and 24%), isabgol husk (0%, 0.5%, 1.0% and 1.5%) and wheat flour (100% – % *Aloe vera* juice and % isabgol husk) along with standard formulation (18% water and 82% wheat flour). *Vermicelli* of different formulations was prepared *using Dolly extruder* by kneading the entire ingredient in *feeding section of extruder followed by cold extrusion. Extruded vermicelli were dried in dryer at 50°C for 10 min to remove moisture up to 8 % followed by cooling at room temperature, packing in PP bags and storage at* room *temperature for six months for periodical analysis.* The results of the present investigation indicate that the vermicelli prepared using formulation of 24% *Aloe vera* juice, 1% isabgol husk and 75% wheat flour (F_{13}) was superior based on higher sensory score and better stability of nutritional as well as sensory quality during six months storage. During six month storage, vermicelli prepared using 24% *Aloe vera* juice, 1% isabgol husk, 75% wheat flour (F_{13}) was observed to have minimum increase in TSS, total sugars, reducing sugars, NEB and water activity while minimum decrease in acidity, non-reducing sugars and fibre.These samples remained microbiologically safe upto six months storage in polypropylene bag. The cost of production per 100g pack of vermicelli was worked out to be Rs. 10.96 for formulation of 24% *Aloe vera* juice, 1% isabgol husk and 75% wheat flour.

Effect of Sapota pulp and potassium sorbate on shelf life of Sapota milkshake

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Present investigation was aimed to study the effect of sapota pulp and potassium sorbate on sensory as well as physico-chemical quality of sapota milkshake during storage. For preparation of sapota milkshake, an experiment was carried out with nine treatment combinations comprised of three different levels of sapota pulp (A1- 8 per cent, A2- 10 per cent and A3- 12 per cent) and three levels of potassium sorbate (B1- control, B2- 75 ppm and B3- 150 ppm). Each treatment in the experiment was carried out with three repetitions using completely randomized design with factorial concepts. The prepared milkshake was stored for a period of 2 month to analyze the quality attributes at 15 days intervals. The results of the investigation revealed that TSS,

pH, total sugars, non-reducing sugars, potassium content, protein values of sapota milkshake decreased significantly and acidity, non-reducing sugars increased significantly while sodium and calcium contents decreased non-significantly up to 2 months storage. The TPC of all treatments increased in storage but the value were below the acceptable limit with minimum TPC in A1B3. Overall findings of investigation revealed that sapota milkshake with better nutritional and sensory attributes can be prepared by using 8 per cent sapota pulp (A1) and 150 ppm potassium sorbate (B3). The sapota milkshake can be successfully stored for a period of 2 months with minimum changes in physico-chemical and sensory quality. Thus, the developed technology can commercially be adopted by food processing industry for the production of sapota milkshake.

Keywords: Sapota, Pulp, Potassium sorbate, Milkshake, Shelf life

Development of process for Osmo dehydrated Pineapple cubes

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Pineapple (*Ananas comosus* (L.) Merr.) is one of the commercially important fruit crops of tropical world belongs to the family Bromeliaceae. A study on technology for development of osmo dehydrated pineapple cubeswas conducted to find out optimum sugar syrup concentration and drying temperature for better quality. Fully matured ripe pineapple fruits were collected, peeled and edible fruit portion was cut into cubes after removing the core. *Fruit cubes were put in different sugar syrup* concentration *i.e.* 50, 60 and 70°Brix in a ratio of 1:2 (fruit pieces: sugar syrup) and left for 24 h for osmosis. Drained pineapple cubes were dried at temperature of60° and 70°C under cabinet dryer as per the treatment. The osmo-dehydrated pineapple cubes were packaged in 200 gauge polyethylene bags and stored under ambient condition for six months storage. Osmo-dehydrated pineapple cubes were analyzed for physico-chemical and sensory parameters upto six months. The osmo-dehydrated pineapple cubes prepared with 60°Brix sugar syrup concentration with 60°C drying temperature were found better with respect to ascorbic acid retention, colour, taste, flavour, texture and overall acceptability. Storage study showed that there was a marginal decrease in TSS, total sugar, acidity, ascorbic acid and sensory attributes and increase in moisture content of osmo-dehydrated pineapple cubes.

Keywords: Pine apple, Preparation Process, Quality parameters

Boondi making process and it's quality evaluation

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People are highly conscious about hygienic and quality food even for snacks. An experiment was carried out to develop a*boondi* making machine at Centre of Excellence on Post Harvest Technology, NAU, Navsari to meet the demand of the consumers for making popular snack–*boondi*, which could be further utilized as; sweetand *khara boondi*, etc. The method of boondi making using developed automatic machine consists of preparation of gram flour batter; the batter is poured through the perforated ladle to obtain globules by repeated jerk to ladle;the perforated ladle is held above the hot frying oil for deep fat frying of globules and then it is fried till the desired colour and texture are developed which is called as*boondi*. The quality

parameters for *boondi* made using developed machine were; moisture content, fat content, diameter, bulk density, sphericity, hardness and fracturability reported as2.625%(w.b.),63.97%, 4.83mm,0.42g/ml,0.96, 5.52kgf and 27.25kgf, respectively.The moisture content of gram flour, moisture content of batter, temperature of deep frying oil and time of deep frying was observed as 10.25%(w.b.), 40.34%(w.b.), 179.6°Cand239.55s, respectively. The maximum score for sensory characteristics like taste, colour, appearance, texture and overall acceptability of boondi were found 7.14, 7.07, 7.29, 6.96 and 7.03, respectively in boondi making machine which washigher as compared to manually prepared boondi.

Key words: Boondi making machine, Quality parameters of boondi

Organic Vegetable Production: For the Betterment of Health and Environment

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Despite the increasing population and demand for food production, farmers are producing vegetables by following the conventional cultivation methods using injudicious chemical fertilizers and pesticides to boost the production. Application of insecticides, herbicides, fungicides, acaricides and rodenticides in the vegetable field in the form of granules, liquid and powder to control pests, increases the health risk of people as farmers are exposed to pesticides by different routes of exposure such as inhalation and dermal contact, it leads to acute and chronic health effects. Moreover, the consequences of overuse of insecticides lead to ecological imbalance and environmental degradation. The World Health Organization (WHO) and the United Nations Environment Program (UNEP) estimated that about 4.0 million people suffer from severe pesticide poisoning. For reducing the health risk of the people, farmers are being encouraged to cultivate chemical free vegetables by using compost and organic pesticides. Organic farming improves soil, ecosystem health and provide chemical free vegetable by avoiding the use of chemical fertilizers and pesticides, recycling farm waste and utilizing organic fertilizing resources efficiently. Thereby reduce the human and environment hazards. However, the most challenging factor is that farmers are unwilling to produce organic vegetables due to uncertainty of returns from selling the products.

Maximizing Vegetable Potential: Value-Added Products and Byproduct Utilization in Processing Industries.

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Currently, the agricultural sector struggles with a meager level of value addition, barely reaching 2%. This challenge is aggravated by insufficient infrastructure and suboptimal temperature management during the transit and storage of fresh produce, leading to reduced storability and a limited marketing window. To mitigate these issues and combat food loss, a particularly effective approach is secondary agriculture. Vegetables play a crucial role in providing essential vitamins, minerals, and disease-preventing phytochemicals to the human body. Despite India being the second-largest global producer of vegetables, with an annual output of 204.83 million metric tonnes, the availability of vegetables falls short of daily requirements. This scarcity may stem from inadequate post-harvest handling and a lack of low-cost cold chain facilities. Addressing this can be achieved through value addition, enhancing both the market value and

shelf life of vegetables. Moreover, even after the value addition process, vegetable waste retains reusable substances of significant value. Presently, there is a growing focus among researchers and industries on the technology of 'waste to fuel,' presenting an additional avenue for benefits. This holistic approach not only adds value to vegetables but also contributes to environmental sustainability by repurposing waste into valuable resources. In conclusion, the integration of secondary agriculture, value addition, and the utilization of vegetable waste for energy production emerges as a comprehensive strategy to enhance the efficiency, market value, and sustainability of the agricultural sector. By addressing post-harvest challenges and leveraging innovative technologies, such as 'waste to fuel,' the agricultural landscape can witness substantial improvements in both productivity and environmental impact.

Key words: Secondary agriculture, Value addition, Vegetable crops.

Evaluation of nutritional, phytochemical and microbial activity of annual edible flowers

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The existence of colourful flowers in nature which has attracted attention in various corners of the world due to their different attributes therefore the nutritional value and phytochemical content of the six annual flower petals such as Pansy, Petunia, Dianthus, Cosmos, Calendula and Geranium were assessed. The six annuals flower petals were evaluated for their nutritional and phytochemical content as well as antimicrobial and antioxidant activity. Gas chromatography- mass spectrometry was used to characterize for their metabolic profiling. Among all six flowers petals Dianthus was found to have the highest concentrations of total protein, ascorbic acid, anthocyanin, total reducing capacity, and hydrolysable tannin. While TPC and TFC values in all of the studied flowers varies significantly. Maximum TPC was found in geranium while, pansy showed minimum amount of total phenol. Calendula has the highest level of β-carotene, whereas the cosmos has the highest amount of carotenoid and lycopene among the flowers. Petunia flowers showed the highest antioxidant activity, according to the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, followed by pansies, cosmos, geraniums and calendula. The concentration of micronutrients differed significantly among all six flowers which accumulated nutrients in descending order from (highest to lowest) Fe > Zn >Cu with maximum concentration obtained in Cosmos, Dianthus, and Calendula, respectively. It was found that Petunia extracts exhibited the highest antimicrobial properties, with a maximum growth inhibition zone against *Salmonella typhi* A (*S. typhi* A), *S. typhi* B, *Enterobacter* and *Pseudomonas* with hexane extract, except for *S. typhi*. However, Dianthus extracts exhibited the highest growth inhibition zones against *Enterobacter*. Several bioactive metabolites were found in the petals during GC-MS analysis. Among others, notable metabolites include ß-Amyrin, Caryophyllene, 2,4-Di-tert-butylphenol, ß-Sitosterol, and Stigmasterol, while brewing samples include significant amounts of phenylethyl alcohol, indole, 4-Vinylphenol. It was significant information that may be utilized to promote the consumption of annual edible flowers and to recognize their usage as flower infusions or as tea supplements.

Key words: - Flower petals, Antioxidant, Antimicrobial, GCMS, Phytochemical

Extraction and drying of pigments from of Red Dragon fruit [*Hylocereus polyrhizus* (Weber) Br. & R] PEEL

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The experiment was aimed to find out suitable solvent and encapsulating agent for the extraction and drying of pigments from the red dragon fruit peel. The experiment was laid out using completely randomized design with factorial concept comprising three solvents (acetone, ethanol, dimethyl sulfoxide) and three different levels of maltodextrin (20, 25 and 30 %) as encapsulating agent with three repetitions. The peel was utilized for the preparation of pigment powder. The grounded peel was mixed with different solvents (acetone, ethanol, dimethyl sulfoxide) in 1:1 ratio for 24 hour at ambient temperature. Maltodextrin was added as encapsulating agent of pigments and homogenized the mixture. The mixture was dried by spray drying at inlet temperature of 180 °C and outlet temperature of 100 °C. The prepared red dragon fruit peel pigment powder was packed in glass vials and stored at room temperature up to four months. The results of present investigation indicated that the highest recovery (49.22%) of the powder was obtained by DMSO solvent and encapsulating with 30 per cent maltodextrin. The results of present investigation indicated that powder prepared by spray drying of pigment extracted by dimethyl sulfoxide and encapsulating with 20 per cent maltodextrin was found superior with better quality on the basis of higher anthocyanin content, antioxidant activity and color. During storage decreasing trend was observed in anthocyanin content, solubility, antioxidant activity and 'L', 'a' values of color while increasing trend was observed in 'b' value of color. The pigment powder has comparatively low cost for the production of better quality than other solvents. The powder remains shelf stable upto four months storage in glass vials at ambient temperature.
Keywords: Dragon Fruit, Pigments, Spray Drying, Extraction

Studies on preparation of bael (*Aegle marmelos* L.) powder for storage evaluation

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Bael (*Aegle marmelos* L.) has been known to be one of the most important medicinal plants of India since Charak. Bael also known as Bengal quince or golden apple which is medium sized, deciduous tree belonging to family Rutaceae. There are several medicinal uses of bael fruits. Ayurvedic and Unani medicine employ various components of the bael plant to treat a number of ailments, including diarrhoea, dysentery and dyspeptic symptoms. Bael is a high-nutritional-value fruit. Fresh fruit is not often consumed due to eating challenges caused by its hard shell, mucilaginous texture, abundant seeds and fibres. For preparation of bael powder an experimentation was conducted at KNK College of Horticulture, Mandsaur, MP where physio-chemical properties were evaluated. Thickness of bael slices were also standardised for drying purpose. Temperatures for drying of slices were standardized and bael powder was prepared using pulveriser. Further a storage study was also undertaken to evaluate the storage life of bael powder. The bael fruits were analyzed for its physical characteristics. The average weight of fruit (1372 g), length of fruit (126.3 mm), fruit diameter (113.8 mm), number of segments per fruit (13-15 segments/fruit), pulp: shell ratio (2.53), pulp: seed ratio (15.19), shell thickness (2.70 mm) and number of seeds per segment (16 seeds/segment) recorded

respectively. Three different slices 6 mm; 8 mm and 10-mm were tried for dehydration of bael slices using temperature 55°C, 60°C and 65°C for drying under cabinet dryer. In fresh bael powder maximum moisture content and ascorbic acid was found in the treatment T_3 (10 mm slices at 55°C). Maximum browning and drying rate were observed under the treatment T_7 (6 mm slices at 65°C). Maximum acidity recorded in T_1 (6 mm slices at 55°C) and dehydration ratio observed in T_9 respectively. After 90 days of storage study of bael powder maximum TSS, non-reducing sugar, reducing sugar, total sugar and organoleptic (flavour, colour, texture, consistency and overall acceptability) were observed in treatment T_4 (6 mm slices at 60°C). Prepared product was acceptable after three months of preparation with highest overall acceptability 8.76.

Keywords: Bael Slices, Drying, Powder, Storage Study and Organolaptic Evaluation

Studies on value added Aonla, carrot and ginger blended ready to serve beverage

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According to nutritive and therapeutic value of Aonla fruit, it considered to be rich source of ascorbic acid, pectin, citric acid, and minerals like calcium and phosphorous. Aonla fruits are rich source of vitamin-C having an ascorbic acid content varying from 600-700 mg/100 g. This fruit is highly valued among indigenous medicines. Even the vegetable, Carrot has a number of medicinal and nutritional uses. It contains more than 490 phyto-chemicals and major vegetables in diets worldwide mainly due to their pleasant flavour and perceived health benefits it is good for eye disorders, skin care, nervous disorders, indigestion, which have been associated with their vitamin, mineral and dietary fibre content. Carrot juice is rich in vitamin-A, β-carotene, minerals such calcium, potassium and it is easier to digest than raw or cooked vegetables only. As well as Gginger has also important constituents like, fibre, protein, resin, oil, etc. it is known for the medicinal and antioxidant properties. The pungency of ginger is due to an ether soluble non-volatile substance known as gingerol, a mixture of phenolic compounds containing the ketone zingerone. This study aimed at formulation of aonla, carrot and ginger mix beverage just to take advantage of both fruit and vegetable which are nutritionally diverse and have synergetic effect when consume simultaneously with particular taste, flavor and aroma. The blended beverage with 11 varying levels of juice of aonla, carrot and ginger with 15° Brix TSS, 0.3 per cent acidity was preferred and evaluated by complete randomized design and three repetitions for changes in chemical and sensory qualities during storage period of 0,2,4 and 6 months at room temperature. The chemical constituents like TSS, acidity, total sugars, reducing sugars were found increasing trend during storage while, sugar : acid ratio, ascorbic acid and β-carotene were found decreased during six months of storage. In sensory evaluation, T6 (aonla:carrot:ginger, 9:9:2) was rated best treatment on the basis of higher sensory scores in colour, taste, flavour and overall acceptability which exhibited minimum changes in sensory attributes. All sensory parameters decreased during six months of storage. According to results obtained, it may be suggested that for preparation of ginger flavoured aonla-carrot blended beverage, 9 per cent aonla, 9 per cent carrot and 2 per cent ginger (aonla:carrot:ginger, 9:9:2) juice blend should be used for optimum quality beverage. The overall results showed that combination of different sweet, tangy and spicy flavour gave better results for taste that of without herbal combinations. The developed RTS could be recommended for the large scale production at industrial level.

Standardization of technology for preparation of candy from ripe papaya (*carica papaya* linn.) fruits

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An experiment was conducted at Department of Post Harvest Technology, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. It was aimed to standardize the process for preparation of candy from ripe papaya (*Carica papaya* Linn.) fruits cv. Taiwan Red Lady and to study the quality parameters of developed product (candy) during storage. An experiment was laid out using completely randomized design using 6 treatments with 4 repetitions. For preparation of papaya candy by osmosis as per treatments (mixing of 500 g, 750 g and 1000 g sugar/kg pieces as well as 50 °B, 60 °B and 70 °B TSS sugar syrup/kg pieces) and dehydrated. Physico-chemical as well as organoleptic properties of candy were analyzed in Completely Randomized Design (CRD) with four repetitions. The observations were studied at an interval of two months up to 6 months *i.e.* 0, 2, 4 and 6 months of storage period. An overall findings showed the papaya candy prepared by mixing of 1 kg sugar syrup (50° B) per kg pieces followed by increase of 10° B TSS everyday by adding sugar into syrup up to 70° B found best with highest recovery. After completion of osmosis, candies were allowed to quick rinse with warm water and dried at 60° C temperature. Prepared candy should be packed in polypropylene bags (400 gauges) and stored for 6 months at ambient temperature remained shelf stable and found more acceptable on the basis of sensory scores and higher retention of physico-chemical composition with lower cost.

Key words: Papaya, Osmosis, Dehydration, Candy, Storage

Impact of Food additive on nutritive value of food and human nutrition

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Food processing is a pivotal aspect of the modern food industry with significant implications for human nutrition. Explore the intricate interplay between food processing and the nutritional quality of the final food products. Various processing techniques including cooking and preservation are analyzed in terms of their impact on nutrient content, bioavailability and overall nutritional value. The positive aspects such as increased food safety, extended shelf life, enhanced palatability, contributing to the availability and accessibility of a diverse range of foods. However, it also acknowledges potential challenges, including nutrient degradation, loss of bioactive compounds, and the introduction of additives that may have implications for public health. The role of fortification and enrichment strategies as tools to address nutrient deficiencies arising from processing, ensuring that processed foods contribute positively to human nutrition. Post-harvest management and value addition of fruits and vegetables is a essential aspect of agriculture that plays a pivotal role in ensuring food security, minimizing losses and maximizing the economic returns for farmers. This process involves a series of activities aimed at preserving the quality and quantity of harvested crops from the field to the consumer's

Key Words: Food Processing, Nutritional Quality, Preservation, Human Nutrition, Minimizing Losses, Economic Returns

Vase Life management of commercial cut Flowers

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Flower cut is very much popular due to its attractiveness and mostly used for the commercialization. Flowers bud which has been cutted from the flower bearing plant is called cut flower. Cut flowers are actively metabolizing organs and, therefore, highly perishable. The four major factors in production and post-harvest stages that affect vase life are water affinity, carbohydrate status, ethylene and pathogens. These factors are required for maintaining the freshness done by the help of harvesting patter, storing and packaging. For improving the base life, harvesting time must be at a morning and evening and stored in dark room having temperature between 2°C and 8°C and relative humidity ranges from 75% to 99%. On the other hand, some chemicals were used for controlling vase life such as 200 ppm 8-HQS combined with 2% sucrose solution, 300 ppm, salicylic acid, 10-200 ppm, silver nitrate and 200-300 ppm, Aluminium sulphate etc mixed with fresh water. Overall conclusion is that to highlight the some of the influential factors which affects the post-harvest flower longevity and metabolism condition. The Cut flower controlling improves the vase life bythe method of Harvesting condition and use of few chemical concentrations.

Keywords: Vase life; salicylic acid; cut-flower

Session VIII

New Tools and Techniques for Future Horticulture

Current trends in futuristic vertical farming and its challenges

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The current global agricultural system is facing problems such as inadequate land, water scarcity, soil degradation, crop failures and wastage due to poor supply chains. According to the World Economic Forum report, the global population is expected to rise by approximately 60% by 2050. So, there is a need to adopt better farming alternatives as the conventional farming system is incapable of meeting the expanding agricultural demands. Vertical farming is one of the best methods adopted by several countries worldwide, particularly in urban areas. It is an innovative agricultural technique for growing crops in vertically mounted layers in a controlled climate. It aims to use the available space efficiently, conserve resources, and produce good-quality crops with higher yields. Though vertical farming is anticipated to revolutionize the agriculture industry, it holds severe challenges including high initial set-up & operational costs, increased environmental impact and limited crop suitability. Additionally, it involves complex technology which can be difficult to manage and scale due to logistics and economic constraints. Its agricultural output is also grappling with market acceptance and affordability to consumers as the crop cost is higher than conventionally grown crops. In conclusion, while vertical farming offers sustainable food production using fewer resources than conventional farming, it is crucial to address the key pressing concerns for its extensive adoption and unceasing success. Technological advancements and ongoing research are necessary for overcoming these limitations and making a promising future in agriculture.

Keywords: Vertical farming, sustainability, controlled climate.

Export and import of fresh fruits, vegetables and flowers: Indian scenario

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To address the issues of crop resilience, low farm income, nutritional security and export earnings., horticulture has been recognized as a potential sector. Out of the overall growth rate of 3.9 per cent in agriculture during 2022-2022, fruit and vegetable accounted for 20.2%. Horticultural sector accounts for > 37% of the total exports of agricultural commodities with a rising trend in export values. India is a trade surplus country in the horticultural sector. But, the analysis of export and import trend gives a skewed picture. Despite being horticultural trade surplus, we are importing considerable volume of fruits and vegetables. During the year 2022-23, Indian fruit export remain worth 770.70 million USD and import of 148.56 million USD. The vegetables export and import value were 924.91 and 7.21 million USD respectively. Grapes, pomegranates, mangoes, bananas, and oranges account for the larger portion of fruits exported from the country while onions, snow peas, potatoes, tomatoes, and green chili contribute largely to the vegetable export basket. Major destinations for the Indian fresh fruits and vegetables are United Arab Emirates, Bangladesh, Nepal, Malaysia, Netherland, Sri Lanka, U.K, Qatar, Oman, and Iraq. Due to the concerted efforts of public and private sectors, there is increasing acceptance of horticulture produce from the country. Indian Horticulture sector needs to prepare a sustainable roadmap by focusing on country specific marketing intelligence, buyers and seller meet inputs, Agri Cells at different Embassies of India, farmer connect portal, new markets and new produce. Additionally, horticulture industry also needs to respond ever increasing consumer demand for exotic fruits and vegetables through R&D policies.

Soilless cultivation-challenges and opportunities

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Crop cultivation under suitable protected structures ensures production of quality and fresh produce, regardless of agro-climatic conditions. In addition, it also ensures efficient use of land and water resources. However, continuous cropping in soil-based protected cultivation invites some soil related issues namely buildup of rootzone salinity and soil borne pathogens and pests. Whereas, soilless culture-crop cultivation without soil (either in inert substrate medium or hydroponics or aeroponics based solution culture) helps keep such issues away. In general, depending on the systems, 5-10 times higher yield, 80 to 95% water saving and non-polluted, residue free fresh produce are possible under soilless cultivation. Depending on the scale of operation, choice of crops, and the location, different types of systems are in vogue. Small stature high value leafy greens (lettuce, celery, parsely, spinach, pakchoi, and microgreens, etc) or herbs (thyme, basil, mint etc.) and cole crops (broccoli, cabbage, cauliflower, etc.) are fitted well in close-loop hydroponics systems (e.g., NFT or DFT). The systems can be designed in horizontal (benches) or vertical (multi-tiered or tower) fashion using natural light or artificial grow lights, alone or in combination. On the other hand, vine vegetables (e.g., tomatoes, cucumber, capsicum, melon, etc), due to issues related to soil-based system, the techno savvy growers prefer their large scale cultivation in substrate based soilless culture with commonly using cocopeat (dust+chips) or other locally available and designed organic or inorganic substrates. But, a significant amount of wastage of nutrient and water is occurred in this system due to mostly relying on non-recycling of water and nutrient. The research on the use of re-circulating systems also for vine vegetables becomes promising. In this context, ICAR-CAZRI, Jodhpur is striving to standardize soilless systems for not only leafy and cole vegetables but also for vine vegetable with aim to minimize the wastage of water and nutrients through recapturing and recycling in cultivation using different designs. The varied designs can be fitted in small balcony or terrace to large scale farms. It is being cleaner cultivation system in which high economic crops are grown and most of the critical operations (nutrients delivery, climate control, etc.) are automatically controlled, youth are attracted towards this venture, especially in and around big cities. However, there are some challenges in soilless cultivation for its widespread adoption such as involvement of high investment cost, high techno-intensive, require good quality water and assured power supply, and importantly, market for produce sale as the production cost in soilless system is high so specialized crops are produced and hence premium sale price is to be ensured.

Keywords : Hydroponics, fresh vegetable, safe food, quality, sustainable cultivation

Bundel khand: vertical farming of vegetables for enhance income of farmers

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Vertical farming refers to the growing of crops, mostly vegetables and herbs on stacks of shelves indoors using artificial light and nutrient solutions, negating the need for sunshine and soil. It is often incorporates controlled-environment agriculture ruling out adverse effects of climate change, it focuses on optimizing plant growth conditions employing soilless farming techniques. If comparison with the conventional/horizontal farming by identifying the needs, constraints, implementation opportunities, possible alternative approaches and highlight the potential of vertical farming technology as possible option for food and nutritional security in India. It is an entirely new approach evolved generally ensuing indoor farming in a way employing cutting-edge technologies. In India, vertical farming is still in nascent stage but

has a potential to be speciality agriculture by growing foods such as micro greens, leafy greens and high value food crops. It is not going to replace mainstream arable agriculture but can make its place as an innovative form of growing foods. Vertical farming can become more main stream and remunerative option of growing food. A lot of new and advanced technologies will drive the vertical farming industry and with adoption of high-value crops combined with reducing capital investment, it will become more remunerative. It helps in intensive production of crops under full or partially controlled conditions.

During summer and winter season in north India in general and Bundelkhand in particular, it is extremely difficult to grow vegetables in open field conditions; however, with creation of false micro climate through modified protected structures, some high-value crops and vegetables could easily be growing continuously. In state of Uttar Pradesh at poor resourced farmers' level, the popularity of protected cultivation has not been encouraging. The increasing population day by day and shrinking of land it is necessary to take the multi vegetable crops through vertical/mixed cropping pattern in same land of piece.

In a view of above fact a demonstration on vertical/mixed farming with tomato, coloured cauliflower, broccoli, white cauliflower and cabbage transplanted on side bed/hockey area in NVPH of tomato hybrid (NS-4266), transplanted on dated 20/08/2022, white cauliflower (Bishop-RZ), coloured cauliflower (Carotena&Valentena), broccoli (Tahoe-RZ), and cabbage (Marcello-RZ, KPS 99 champ and Improved Bahar) transplanted on dated 10/11/2022 under the umbrella of indeterminate tomato. It was observed that the single plant of tomato gave 7.0 kg fruit whereas, under the tomato umbrella the white cauliflower hybrid Bishop-RZ noted compact curd and weight (0.825 kg). The coloured cauliflower such as Valentina and Carotena recorded (0.825 kg) and (0.900 kg), respectively. Regarding Broccolli hybrid Tahoe-RZ showed (0.800 kg) of compact curd. The cabbage hybrids i.e. Marcello-RZ, KPS-99 champ and Improved Bahar recorded (1.00 kg), (0.900 kg) and (0.850 kg), respectively. In Insect proof net the tomato hybrid (NS-4266), transplanted on dated 22/08/2022 and garlic variety Yamuna Safed-3 (G-282) sown between indeterminate tomato on dated 25/10/2022. The data indicated that the single plant of tomato gave 5.80 kg fruit whereas, under the tomato umbrella the good green quality of garlic plant uprooted and make a bunch of 10-15 plants and sale in the market @ 15/bunch. It is suggested to the farmers of Bundelkhand region of Uttar Pradesh they can cultivate the high values vegetable crops under the umbrella of indeterminate tomato for increases their income and also improve the socio economic status in his societies.

Biophilic architecture: pre-eminent feature of landscaping

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Biophilic Architecture stands as a paramount element within the realm of landscaping, representing a design philosophy deeply rooted in the symbiotic relationship between the built environment and the natural world. In an era marked by rapid urbanization and increasing detachment from nature, the integration of biophilic principles emerges as a pre-eminent feature in landscaping practices. This abstract explores the intrinsic connection between biophilic architecture and landscaping, emphasizing its role in fostering a harmonious coexistence between human-made structures and the natural environment. The study delves into the innovative approaches employed in biophilic design, showcasing its capacity to enhance aesthetics, promote human well-being, and contribute to the overall sustainability of our urban spaces. As we navigate the challenges of modern development, understanding and embracing biophilic architecture becomes imperative for creating landscapes that not only captivate the eye but also nurture the human spirit.

Key words: Landscape design, Living entity, Plants and Urbanization

In vitro evaluation of Zn and Cu nanoparticles effect on growth and stevioside content in stevia (*Stevia rebaudianabertoni)*

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Nanoparticles are ⩽ 100 nm in size, exhibit different properties compared to the bulk material. In most of the reported NP studies on plant reported both positive and negative impacts. Stevia (*Stevia rebaudian*) is a source of diterpenoid glycosides (stevioside and rebaudioside) which is 300 times sweeter than sugar (sucrose). The stevioside is secondary metabolites that is highly influence from physiological state of plant and media composition. So, in present study the *in vitro* experiment was conducted with Mg-Nanoparticles (125, 250, 500, 750 and 1000 mg L^{-1}) and Zinc NP (<100nm) at 100, 200, 400 and 1000 mgL^{-1} with modified MS media. The application of Mg NPs leads to improvement in stevioside content in concentration dependent manners, where the concentration of 1000 mg L^{-1} of Mg NPs showed maximum stevioside content (0.80% FW). On counterpart, the Zn NPs showed toxivity in a concentration dependant manner and significantly reduced production of stevioside. Further, in separate study with low level of Zn and Cu NP for the evaluation of optimum concentration reported that the incorporation of ZnO NP (10 µM) and CuO NP (0.05 µM) leads to stimulative effect on plant growth where fresh weight and dry weight content of NP treated plant was significantly higher compared to controls with significantly higher stevioside content (1.40%) without any toxic effect. This finding was supported with expression data of stevioside biosynthesis key gene *DXS*, *GGDPS*, *KS* and *UGT85C2*. Overall, the influence of Zn and Cu Nanoparticles on the growth, development and stevioside content of stevia is concentration depedend, and optimization leads to stimulatory effect.

Keywords: Stevia, stevioside, Zn Nanoparticles, Cu Nanoparticles, gene expression

High-efficiency-targeted irradiation induced *in vitro* mutagenesis and m_1 population recovery in kinnow mandarin

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Solid mutant induction was the prime aim of present investigation on radiation induced *in vitro* mutagenesis in Kinnow mandarin. The optimized explants subjected to ascending irradiation doses from 20-160 Gy were regenerated using two standardized novel cellular totipotency techniques *viz*., direct somatic embryogenesis (DSE) and indirect somatic embryogenesis (ISE) in Kinnow mandarin. Probit analysis showed high radiation sensitivity of the ISE system (LD_{50}=54.31 Gy) explants (suspension cells) over the *in-ovulo* nucellus explant-based DSE (LD_{50}=65.75 Gy) system. The dose rate next to LD_{50} *i.e.*, 80 Gy and 100 Gy were examined for irradiation effect on DSE and ISE systems. Theses doses were also observed to be the below embryogenesis doses in both the system. In DSE at the selected dose of80 Gy, nearly 10% more embryogenesis and 57% more embryo production were noticed over ISE at 100 Gy. Although Embryo

induction coincided in both systems, it was enhanced by one week in the ISE system at selected doses. DSE system was found superior in terms of higher embryo recovery and radiation tolerance than the ISE system. The germination %, bipolar conversion efficiency and plantlet establishment was higher in the ISE system, but the DSE system took lesser time for germination and resulted in high plantlet recovery. The histological data obtained on explant stages at the time of irradiation confirmed the induction of solid M_1 mutations. The high frequency M_1 population recovery observed in the study highlight the importance of the standardized protocol in improvement of Kinnow and related citrus species.

New tools and techniques for future horticulture

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Horticulture is a rapidly evolving field that is constantly developing new tools and techniques to improve productivity, sustainability and efficiency. Precision agriculture technologies, such as drones, GPS-guided tractors and sensor-based irrigation systems, allow horticulturists to monitor and manage crops with unprecedented accuracy, reducing waste and maximizing yield. Genetic engineering and gene editing have revolutionized breeding techniques, allowing for precise genetic modifications to enhance desirable traits like disease resistance, yield and nutritional content. Controlled environment agriculture (CEA) allows horticulturists to grow crops year-round, ensuring maximum productivity and significant water and resource savings. Data analytics and artificial intelligence are also playing a crucial role in the future of horticulture, providing valuable insights for decision-making and improving farm management. By embracing these advancements, horticulturists can improve productivity, sustainability and contribute to the global effort to feed a growing population. The future of horticulture is bright, with endless possibilities for innovation.

Key Words : Drones, Precision agriculture technologies, GPS-guided tractors, Sensor-based irrigation systems, Genetic engineering, CEA and Artificial intelligence.

Thermal unit accumulation of grape varieties under temperate conditions of Kashmir valley

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The present investigations were carried out on four grape varieties at Experimental Field of Division of Fruit Science, SKUAST-Kashmir, Shalimar campus during the year 2021. The varieties were evaluated on the basis of phenology, agro-meteorological indices and production parameters. The results obtained depicted that Sahebi accumulated maximum number of days, GDD, PTU and HTU to reach every phenophase (ripe - 198.40 days, 1490.15 GDD, 19885.98 PTU and 11154.68 HTU, respectively) except flowering and veraison in which Fantasy and Hussaini registered maximum values, respectively. Thompson Seedless took minimum number of days (185.20 days), GDD (1319.70), PTU (17716.34) and HTU (9777.34) to reach each phenophase. Heat use efficiency, photothermal use efficiency and heliothermal use efficiency were noticed to be maximum in Thompson Seedless (14.39, 1.07 and 1.94 kg $ha^{-1}{}^{o}C\ day^{-1}$, respectively) and minimum in Fantasy Seedless (8.22, 0.61 and 1.09 kg $ha^{-1}{}^{o}C\ day^{-1}$, respectively). Yield per vine and predicted yield per hectare were noted to be maximum in Thompson Seedless (17.10 kg/vine and 18999.98 kg/ha, respectively) and minimum in Fantasy Seedless (10.40 kg/vine and 11555.54 kg/ha, respectively).

Multi-node sensor system with mesh communication for preparing GDD model for precision horticulture

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Precision farming either in protected or open field requires concise data of abiotic factor for effective management. Erratic behaviour of weather patterns is major problem for obtaining quality production. Current systems are complex, closed source and suites only big or industrial farms. A need for simplified, open-source system for the marginal and small-scale farmers is required. Study was conducted to evaluate the potential of sensor-based systems capable of collecting, analysing and performing actions in protected structures as well as open fields, in mesh configuration. Affordability, modularity, and open-source was the primary objectives considered for its reachability to the farmers at all levels. Multi-node designs using ESP and Atmel microprocessors were considered to interface with sensors and collect real time weather parameters that included temperature, humidity, light, CO_2, air pressure, soil moisture, and soil temperature. Communication between nodes was achieved using NRF24 transceivers that operate on 2.4Ghz frequency and have an open field range of 100 meters. All the data was collected and analysing the stored data through artificial intelligence. Drone is capable of autonomous flight and geotagging of photos in open field through modified Infrared Camera. Remote monitoring and control through smartphone and computer. Above said different parameters can be controlled/ modified through remote in greenhouse, while open field parameter can be analysis, monitored and predicted upcoming problems for obtaining healthy crop growth and quality production crop. This data and photographs may helpful to prepare Growing Degree Days (GDD) model for harvesting prediction and forecasting model for upcoming the occurrence of pests and disease occurrence and decide the time when they should begin using pesticides/ fungicide to prevent pest / diseases damage. Research has shown the ability to prepare and predict the model especially at specific crop stage, relative to insect and weed cycles, permits better management with a prompt schedule / strategy for pesticide application, fertility management and crop harvesting.

Keywords: Precision Horticulture, Multi-Node Sensor System, Mesh Communication, Growing Degree Days (GDD), forecasting model for pests and disease and quality yield

Smart Irrigation Management in Tomato: FDR Soil Moisture Sensor, Evapotranspiration and Cropwat 8.0 Model - Based Deficit Irrigation to Enhance WUE

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Globally, 0.76% of Earth's total freshwater is available for human use and staggering 70% of this limited resource is allocated to agriculture. Inefficient farming practices contribute to a substantial 60% of waste, underscoring the sector's inefficient water utilization. In India, 48.8% of agriculture relies on irrigation, while the remaining 51.2% depends on rainfall. Food security is complicated by diminishing agricultural land, water scarcity and concerns related to climate change. Enhancing Water Use Efficiency (WUE) and minimizing the 60% waste in agricultural water are pivotal to tackle these issues. This study, titled "Smart Irrigation Management In Tomato: FDR Soil Moisture Sensor, Evapotranspiration and Cropwat 8.0 Model - Based Deficit Irrigation to Enhance WUE" spanned two years and featured eight treatments with

three replications under a pooled Randomized Block Design. The investigation explored Deficit Irrigation (DI), deliberately supplying less water than the full demand, as a potential solution. Utilizing three distinct irrigation scheduling approaches - Frequency Domain Reflectometry (FDR) based soil moisture sensor, Pan Evaporation Fraction (P_{EF}) and Irrigation simulation model - Cropwat 8.0 the study revealed significant influences on diverse tomato crop parameters based on varying irrigation levels. The research demonstrated that Treatment T_1 (FDR soil moisture sensor-based irrigation at 100% FC) yielded the highest values across growth parameters, yield aspects, quality metrics related to fruit morphology and economic considerations. Treatment T_2 (FDR soil moisture sensor-based irrigation at 90% FC) closely followed, exhibiting comparable data in terms of yield components and quality parameters, while demonstrating better water productivity with a 10% water savings and negligible reduction in Benefit-Cost Ratio (BCR).

3D printing technology in horticulture

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The integration of 3D printing technology in horticulture presents opportunities for customized growing structures and optimized plant containers. This paper explores the application of 3D printing in various aspects of horticulture, including vertical farming systems, greenhouse components, support structures for vining plants, hydroponic and aquaponic components, soil amendments, educational models, and prototyping. 3D printing enables the creation of modular and stackable components, integrated watering and nutrient systems, greenhouse components with built-in sensors, unique trellis systems, and customized growing trays. Moreover, it allows for the development of educational models and rapid prototyping of new growing structure designs. The use of 3D-printed materials enhances aeration, drainage, and insulation, contributing to healthier plant growth. Overall, this paper demonstrates the potential of 3D printing technology in horticulture for customizing structures, improving resource utilization, and promoting sustainability in cultivation practices.

Keywords: 3D printing, hydroponic, aeroponic, prototyping *etc.*

Floral Fusion: The Art of Preserved Nature!

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Flowers are the beautiful symbols of love, care, trust, purity and respect. However, the beauty of flowers expresses true emotions and short lived as flowers are highly perishable in nature. In the realm of dry flower based resin art, flowers emerge as silent protagonists, their delicate forms suspended in time, frozen in a perpetual bloom. Artistry, creativity, imagination and patience with meticulous skill of infusion of dry flowers in resin creates the unique floral fusion. The process of amalgam of resin and flowers is a delicate ballet of craftsmanship. Initially, flowers and petals are to be dried properly. Dried flowers and petals are needed to be carefully arranged and strategically placed to achieve a natural yet purposeful eye catching

composition. The transparent liquid, initially in a mere vessel, hardens and transforms into a canvas that captures the essence of the organic elements within. As the resin begins to set, it encapsulates the flowers in a timeless embrace. The petals become suspended in a translucent sea, their vibrant hues magnified and preserved. The once-flexible blooms yield to the rigidity of the resin, freezing a moment of beauty in perpetuity. Beyond its aesthetic allure, floral fusion is the dry flower based resin art that becomes a meditation on the transient nature of existence. Thus, the flowers, plucked from their ephemeral existence, find a new life within the resin. Their beauty now preserved, becomes a poignant reminder of the fleeting nature of time and the delicate balance between life and preservation. Floral fusion is the dry flower based resin art, it is a celebration of the union between nature's fleeting beauty and the enduring embrace of resin. It is a testament to the floriculturist's skill and vision, entrepreneurial ability, transforming the ephemeral into the eternal with the magical aesthetic preserved floral touch with multiple efficacy.

Key words: Flowers, Resin, Encapsulation, Hardening and Preservation.

"Future Farming: Hydroponics Reshaping Horticultural Crop Cultivation"

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In the present socioeconomic landscape, India finds itself in a pressing need for ensuring food security, a multifaceted goal that encompasses granting every individual both physical and economic access to safe and nutritious food to adequately meet their dietary needs. The prevailing scarcity of usable water for agricultural purposes exacerbates the situation, resulting in a diminished food production output that, in turn, fuels the specters of hunger and malnutrition, affecting a considerable portion of the populace in our country. Given this backdrop, there arises an urgent imperative for the widespread adoption of advanced agricultural technologies capable of contributing significantly to water conservation, thereby exerting a positive influence on overall food production and availability. Enter 'Hydroponics,' a pioneering methodology in the realm of soilless cultivation, distinguished by its markedly superior water utilization efficiency compared to conventional systems. At present, hydroponics cultivation is experiencing a surge in global popularity, primarily attributed to its adept management of resources and the consistent production of high-quality foods. The manifold benefits of the hydroponic technique further underscore its appeal, including a significantly reduced crop growing time in comparison to traditional soil-based methods, the potential for year-round production, and a heightened resilience to diseases and pests. Additionally, the adoption of hydroponics eliminates several labour-intensive intercultural operations, such as weeding, spraying, and watering, contributing to increased efficiency and sustainability in agricultural practices.

Keywords: Hydroponics, Water Utilization Efficiency, Nutritious Food, Soilless Cultivation

Influence of bio-fertilizers on the developmental, fruit-setting, and pomological attributes of the Winter Dawn cultivar of Strawberry (*Fragaria* X*ananasa* Duch.) within the framework of a vertical farming system

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A field experiment conducted between 2021 and 2022 aimed to investigate the impact of biofertilizers

on the development, fruit set, and pomological characteristics of Strawberry (*Fragaria Xananasa* Duch.) within a vertical farming system. The selected cultivar was Winter Dawn, and the study involved 10 treatments, including a control. These treatments comprised various combinations of organic and microbial nutrient sources, such as Vermicompost, FYM, *Azotobacter*, *Azospirillum*and PSB. The experiment was replicated three times, with three plants per replication in a Randomized Block Design.Observations were recorded for vegetative growth, fruit yield, and quality. Among the different combinations of biofertilizers and organic manure, treatment T_9 (Soil 50% + Vermicompost 50% + *Azotobacter* 2g + *Azospirillum* 2g) demonstrated the highest values for plant height, plant spread, number of leaves, and leaf area compared to T_7 (Soil 50% + FYM 50% + PSB 2g + *Azotobacter* 2g). T9 also exhibited the earliest flowering and the highest number of flowers per plant.Regarding fruit characteristics, T_9 showed the maximum fruit weight, number of fruits per plant, and overall yield, followed by T7 at 90 days after planting and T8 treatment. The Benefit: Cost ratio was highest (1:3.39) for T9, indicating a more favourable economic return compared to T_7, primarily due to its lower production cost. The combination of T_9 (Soil 50% + Vermicompost 50% + *Azotobacter* 2g + *Azospirillum* 2g) consistently yielded the highest quantity and best quality fruits among the treatments.

Tools for Controlling Smart Farms: Current Challenges and Future Outlook in Intelligent Horticulture

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Horticulture, the art and science of cultivating plants, faces pressing challenges in the 21st century. Population growth, climate change, and resource scarcity demand a paradigm shift towards sustainable and productive food systems. The fertile ground of horticulturc stands poiscd for a vibrant transformation, nurtured by a burgeoning arsenal of tools and techniques. Precision horticulture emerges as the guiding principle, wielding the power of data, automation, and biotechnology to redefine cultivation practices. Drones dance among the leaves, their multispectral eyes scanning for nutrient deficiencies and lurking pests, while robots weave through rows, their gentle claws tending to individual plants with unerring accuracy. In the realm of the microscopic, gene editing and bioprinting promise bespoke varieties crafted for enhanced resilience and flavour. Vertical farms ascend skyward, defying spatial limitations and embracing controlled environments, while smart sensors whisper tales of the soil, guiding irrigation and fertilization with unerring precision. This is not a distant utopia, but the dawning reality of future horticulture, where technology and nature intertwine to paint a landscape of abundance and sustainability. Let us step into this verdant future, where innovation blossoms alongside every leaf, every fruit and every fragrant bloom. In the Fourth Industrial Revolution, there is a growing trend in designing digitally efficient automated tools for agriculture to enhance food production speed. Consequently, it becomes imperative to cultivate a profound comprehension of digital technology and its characteristics, considering novel associations, acquired skills, and cultural economics to optimize the value derived from agricultural product consumption. Farmers assume a pivotal role in the transition from traditional agricultural methods to cutting-edge technologies within their fields. Seasoned farmers can leverage the Internet of Things (IoT) to harness the benefits of intelligent technologies, incorporating gateway data repositories for light, humidity, and pH sensors. They can consistently enhance sensor data across extensive sectors through their smart farms. This report emphasizes the synergy between smart farms and IoT, integrating new network knowledge and intelligent devices to bolster agricultural advantages. Its goal is to provide support for farmers aiming to capitalize on the latest advancements in IoT-driven smart farming, addressing current challenges, and delineating future prospects in intelligent horticulture.

Key words : Digital technology, Biotechnology, Precision farming, Farm data, IoT, Smart farm, technical application, Fourth Industrial Revolution

Influence of Bio-inoculants on Growth, Flowering and Corm Production in Gladiolus *(Gladiolus grandiflorus* L.)

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Gladiolus (*Gladiolus grandiflorus* L.) is a genus of perennial bulbous flowering plants in the iris family (Iridaceae) and is one of the most important ornamental bulbous crops, grown in many parts of the world as cut flower. It is also known as the "Queen of bulbous ornamental crops" or 'Sword lily'. In the present study, different dosages of fertilizers in combination with bio-inoculants were applied to corms at the time of planting in 12 treatment combinations viz., T_1 : Control (100 % RDF), T_2 :RDF@75%, T_3 :RDF @50%, T_4 :RDF@100% + *Pseudomonas fluorescens*, T_5 :RDF@100% +Actinomycetes, T_6 :RDF@75% + *Pseudomonas fluorescens*, T_7: RDF@75% +Actinomycetes, T_8 :RDF@50% + *Pseudomonas fluorescens*, T_9 :RDF@50% +Actinomycetes, T_{10} :RDF@100% + Consortia (*Pseudomonas fluorescens* +Actinomycetes), T_{11} :RDF@75% + Consortia (*Pseudomonas fluorescens* +Actinomycetes) and T_{12} :RDF@50% + Consortia (*Pseudomonas fluorescens* +Actinomycetes). The results revealed that among the various treatments, T_{10} i.e. RDF@100% + Consortia(*Pseudomonas fluorescens* +Actinomycetes) had the best results for floral characters like spike length (83.78cm), rachis length (61.41cm), number of florets per spike (18.85), as well as number of corms per plant (2.60), number of cormels per plant (22.58), weight of cormels per plant (8.76g) and the B:C ratio (3.88), while the parameters like plant height (121.16cm), leaf width (4.79cm), leaf area index (3.18) and diameter of floret (11.57cm) showed the best results in T_{11} (RDF@75% + Consortia). Number of leaves per plant (9.80), leaf length (64.19cm), days taken for spike emergence (60.93) and corm diameter (6.49) showed the best outcomes in the treatment T_{12}. The treatment T_6 (RDF@75% + *Pseudomonas fluorescens*) comprising of recorded maximum corm weight per plant (80.07g), corm yield per plot (2.03kg) and corm yield per hectare (72.47 q). Thus, it can be concluded that usage of these bio-inoculants has helped to improve the quality and yield of the crop, thus increasing the profit of the produce considerably.

Keywords: bio-inoculants, flowering, gladiolus, growth, plant nutrition.

Applications of 'omics technologies in fruit crops improvement

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Fruits are important components of human diet and play a critical role in providing nutrition. Thus, fruit quality affects market competitiveness and economic returns. Fruit trees are difficult to study at genetic and molecular levels because of their perennial nature which resulted in limited information on gene identity and associated functions, markers, mapping population and map-based studies. In addition, climate change is

intensifying day by day, which is severely impacting fruit crop production due to adverse weather conditions, extreme heat, frost etc. Therefore, there is a dire need of accelerating cultivar development in order to maintain the productivity of crops. The current era of omics technologies is rapidly improving our insight into gene and variants that are impacting plants in terms of tolerance to various stresses. In biological context, omics refers to study of large set of biological molecules. Major branches include genomics (mapping, sequencing, and functional analysis of genome), transcriptomics (RNA expression profile in spatial and temporal basis), proteomics (total set of proteins expressed at given time), metabolomics (qualitative and quantitative analysis of all metabolites < 1 kDa) and phenomics (acquisition of multidimensional phenotypic data in an organism as a whole). These branches can be used in combination also which is termed as multi-omics. Multiomics have emerged as successful technologies for plant system over last few decades. In totality, it can be inferred that integration of systems biology with complex omics datasets will benefit our understanding of molecular regulatory networks for crop improvement and will also benefit fruit breeding by effectively reducing the time.

High tech Horticulture

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High-tech horticulture is a dynamic and innovative approach to growing plants that leverages advanced technologies to optimize crop yields, enhance resource efficiency and address challenges in traditional farming. This modern form of agriculture integrates cutting-edge tools and techniques to create controlled environments that cater to the specific needs of plants. One of the key components of high-tech horticulture is the use of controlled environments, such as greenhouses and vertical farms. These structures provide growers with the ability to regulate temperature, humidity and light levels and creating optimal conditions for plant growth throughout the year. This level of control minimizes the impact of external factors, such as adverse weather conditions, pests, and diseases, ensuring a consistent and reliable crop supply. LED technology allows for precise control over the light environment and contributing to improved plant quality and faster growth rates. Hydroponics and aeroponics are advanced cultivation methods that eliminate the need for soil, relying instead on nutrient-rich water solutions. In hydroponics, plants are grown in a soilless medium, while aeroponics suspends plant roots in the air and delivers nutrients through a misting system. Robotics and smart sensors are employed to streamline various tasks, such as planting, harvesting and monitoring crop conditions. Automated systems can efficiently manage large-scale operations, reduce labor costs, and minimize human error. Drones equipped with sensors provide real-time data on crop health, allowing growers to identify potential issues and take preventive measures promptly. The adoption of biotechnology in high-tech horticulture has led to the development of genetically modified (GM) crops with enhanced resistance to pests and diseases or improved nutritional profiles. These genetically engineered plants contribute to increased yields and reduced dependence on chemical inputs. However, the use of GM crops also raises ethical and environmental concerns that require careful consideration and regulation. By integrating precision agriculture and biotechnology, high-tech horticulture not only boosts productivity but also promotes sustainability and resource efficiency in the face of evolving global agricultural needs.

Keywords: Technology, Controlled environment, Hydroponics, High yield and Productivity.

Moss: A Modern Approach to Gardening

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Mosses are small, non-vascular, flowerless plants that belongs to division Bryophyta. It can grow into dense green clusters or mats in damp or shaded environment, and can reproduce through spores. It is widely used in medicine, culinary purpose, cosmetics, fertilizers and planting media. Recently it started getting known for its ability to increase aesthetic appeal for both indoor and outdoor spaces. It is used to make: Moss frames (vertical walls, ceiling, floor and carpet), Terrariums, Kokedama, moss-covered pots and moss balls. Additionally, for outdoor space, it is also employed to produce a moss lawn and moss graffiti. Gardening using moss is a quick and easy approach to make a biophilic structure that is good for human health (as it reduces noise pollution and preventing air pollution), requires minimal upkeep and consumes less energy (due to its capacity to stabilize moisture level, low conduction heat transfer and low light dependence). Thus, this modern method of gardening satisfies the demands of today's hectic lifestyle.
Keywords: Moss, Bryophyta, Moss Garden, Live moss, Preserved moss

Smart Gardening with Hydrogel: Elevating Ornamental Plant Performance

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In India more than 68 % area is under dry land condition and more than 40 % of the area faces the problem of insufficient rainfall. To overcome this problem, Hydrogel may prove as a convenient and eco-friendly feasible option to achieve the goal of crop productivity under conditions of water scarcity. Hydrogels are cross-linked polymers with a hydrophilic group which have the capacity to absorb large quantities of water without dissolving in water. It is commonly known as plant gel or super absorbent polymers which can absorb 400-1500 times water by its dry weight. When its surroundings begin to dry out, the hydrogel gradually releases up to 95 % of its stored water. As it is hydrophilic in nature, it has good swelling capacity, lack of toxicity and controlled water released thus, it has an immense scope to gained popularity in various agricultural applications, include using in potting media for ornamental plant. Several beneficial effects of hydrogels include reduced fertigation requirements of the crop, improved aeration and drainage, improved physical properties of soil and soil less media like reduced water requirements, helps the plant to withstand prolonged moisture stress, better root development, increased yields, soil permeability and water infiltration which will significantly reduce surface runoff and soil erosion. Hydrogels incorporated in the growing media

of potted plants generally increased the time of wilting as demonstrated by the reduction in internal water tension under stress.

Keywords: Hydrogel, water absorption, moisture, water stress, soil properties

Nature's Ornaments: Kokedama as living decor

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This centuries-old practice involves encapsulating the roots of a plant in a mud and soil mixture, which is then covered with moss to create a living, breathing work of art. The result is a unique and aesthetically pleasing form of container gardening that has gained popularity worldwide. The art of Kokedama is deeply rooted in Japanese culture, where harmony with nature is a central theme. The technique originated from the bonsai tradition, to display miniature landscapes in a more organic manner. Over time, Kokedama has evolved into a distinct form of botanical expression and capturing the essence of wabi-sabi. The Japanese aesthetic that embraces imperfection and transience. Creating a Kokedama involves a delicate balance of soil composition and moisture control. The process begins by mixing a special soil blend, often including peat soil, akadama (a type of clay granule) and bonsai soil. This mixture provides a well-balanced environment for the plant's roots. The soil is then combined with water until it forms a sticky and clay-like consistency. Kokedama can be made with a variety of plant species, ranging from small flowering plants to tropical varieties. The choice of plant depends on the desired aesthetic and the specific care requirements of the selected species. The versatility of Kokedama allows for creative experimentation and enthusiasts often enjoy crafting these moss balls with different plants to achieve a diverse and visually appealing collection. Kokedama is not only a form of gardening but also a form of art that allows individuals to connect with nature in a unique and creative way. These living sculptures bring a touch of the outdoors inside, making them ideal for urban dwellers with limited space. The meditative process of creating Kokedama, combined with the ongoing care required, fosters a deeper appreciation for the interconnectedness of plants and people.

Keywords: Moss, Container gardening, Japanese culture, Aesthetic and Living plants

Recent advances in fruit bagging

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Fruit bagging is a technique for improving fruit production, appearance, quality and reducing diseases and pests with lesser chemical application due to increased awareness towards safe/least pesticide load on the product to confirm the safety of employees, consumer health and environment (Kumar *et al.* 2021). Bagging technique is commercially employed in various fruits *viz.* Mango, Guava, Banana, Litchi, Grapes, Pomegranate, Citrus, Apple, Peach, Dragon fruit *etc.* It improves physical appearance (skin colour)as well as chemical quality of fruits by decreasing the external damaging factors like fruit cracking, sunburn and russeting. It reduces occurrence of diseases like blackening; mechanical damages; agrochemical residues on fruit surface; bird or pests damage like fruit fly, fruit borer and mealy bug; physiological disorders like spongy tissue and cracking in mango; sun burn in banana; fruit fly damage and physical damage/disease attack in guava; fruit fly and sun burn in dragon fruit. Earlier these bags were used for export markets and processing units to improve fruit quality but nowadays it has been used for domestic consumption also. Fruit bagging brings a marked improvement in the physical and biochemical quality parameters such as fruit weight, fruit length and diameter, pulp to stone ratio, TSS, carotenoids content, flavor, taste and color in mango; fruit weight, finger length, weight, volume, firmness and harvest index in banana; fruit size, weight, skin color,

texture, TSS, sugars, early maturity, market value in guava; shelf life, maturity, fruit length, width, firmness, flesh thickness, TSS and edible fruit percentage in dragon fruit.

Revolutionizing Vegetable Production: A Focus on Hydroponics, Aeroponics, Aquaponics and Vertical Farming

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The fertility of the soil has been adversely affected by uncontrolled chemical and pesticide use, natural disasters, rapid urbanization and global warming. In addition, cultivable soil and its fertility has declined, soil productivity has drastically decreased and the amount of land available to each person decreased. By 2050, the population is expected to reach 8.9 billion and world has to produce 50% more food, thereby requiring an additional arable land that is simply not available (FAO, 2020). Traditional soil-based agricultural production systems face serious threats from these challenges, making food production a real challenge today. Soil-based farming practices need to be supplemented by more efficient and environmentally-friendly forms of modern farming. Land degradation poses a significant threat to traditional farming, with soil erosion, nutrient depletion and loss of arable land becoming critical challenges. In response, hydroponics, aeroponics and aquaponics offer innovative alternatives that minimize reliance on conventional soil-based agriculture. These soilless cultivation techniques not only conserve land but also optimize resource utilization, promoting sustainable and resource-efficient vegetable production. Furthermore, the increasing consumer preference for pesticide-free produce has sparked a craze for environmentally friendly farming practices. Hydroponics, aeroponics and aquaponics provide inherently reduced pesticide requirements, as the controlled environments limit exposure to pests and diseases. Vertical farming takes this a step further by enabling the cultivation of crops in a controlled, stacked and space-efficient manner, minimizing the need for chemical interventions. Through an analysis of case studies and success stories, this is aims to inspire a shift towards more sustainable and efficient vegetable production systems. By examining the advantages and challenges associated with each method, we can better understand how these non-conventional farming approaches contribute to food security, environmental conservation and the creation of resilient agricultural systems for the future.

Nano urea: The future Philosophy of Floriculture

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Nano urea represents a groundbreaking approach to floriculture, blending nanotechnology and sustainable practices to revolutionize the cultivation of plants. This innovative philosophy focuses on the integration of nanomaterials such as nano sensors and nano fertilizers to enhance plant growth, monitor health and optimize resource utilization. At its core, Nano urea seeks to address the challenges of traditional floriculture by introducing precision farming techniques. By employing nanoscale technologies, growers can gain real-time insights into soil conditions, plant nutrient levels and overall environmental factors. This level

of precision allows for targeted efficient application of resources, minimizing waste and environmental impact. Furthermore, nano urea embraces sustainability by promoting eco-friendly materials and practices. The philosophy encourages the use of biodegradable nanomaterials and emphasizes responsible resource management aligning with the growing global demand for environmentally conscious agriculture. The future of floriculture lies in Nano urea's ability to enhance productivity, reduce ecological footprint and create a more sustainable and resilient agricultural ecosystem. As technology continues to advance the integration of nanotechnology into floriculture holds the promise of ushering in a new era of efficient, environmentally friendly and high-yield cultivation practices. Additionally, nano fertilizers are customized based on real-time data about the soil's nutrient content. This precision application minimizes excess fertilizer usage, preventing nutrient runoff into surrounding ecosystems. The result is a more sustainable and environmentally friendly approach to flower cultivation. Consider a rose farm implementing nano urea in their operations. Nano sensors in the soil continuously monitor moisture levels, ensuring that each rose receives the optimal amount of water. This not only promotes healthier plants but also conserves water resources by avoiding unnecessary irrigation.

Keywords: Nanourea, Nano sensors, Precision Farming, Sustainability and Resilient agriculture

Potentiality of protected cultivation in fruit crops

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Due to market globalization, land scarcity, and climate change, protected high-value crop growing has become the most crucial technology. India is the world's second-largest producer of fruit crops, but due to low land holdings, rain-fed farming, insufficient use of natural resources, and excessive dependence on chemical pesticides and fertilizers, we remain significantly back in terms of fruit yield and quality for export. These chemicals also pollute the environment because of residue accumulation, fruits grown with chemicals are not recommended for export. Pests, diseases and physiological issues are also having a negative impact on the yield of high-quality fruit harvest. Protected cultivation is necessary to overcome the negative effects of the local climate, yield desirable and high-quality fruits. Additionally, it promises an excellent benefit-cost ratio along with yield and quality improvement. With its quick and widespread growth, protected fruit culture has emerged as a significant area of fruit cultivation. In addition to having some control over wind speed, humidity, temperature, atmospheric composition, mineral components, and light intensity, it has made significant advances in our understanding of the inputs and growth factor requirements needed to increase crop yield.

Keywords: Protected cultivation, green house, fruit crops, yield, quality, economics

Advances in Biotechnology for Improving Floral Attributes in Ornamental Plants

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One of the main objectives in floriculture is the development of new ornamental cultivars with enhanced floral attributes. Combining biotechnological techniques with traditional breeding methods has allowed for the modification of floral color and appearance in addition to increased disease resistance. The use of transgenic techniques holds great promise for creating unique flower phenotypes not seen in the natural

world. The concept of floral trait modification has been supported by the use of genetic engineering. Through genetic engineering, ornamental plant characteristics such as fragrance, disease resistance, floral color, and vase life can be enhanced. Transgenic plant varieties with significant aesthetic and commercial value are thus what we see. Moreover, the augmentation of disease resistance via genetic engineering and RNA interference methodologies guarantees the well-being and durability of ornamental plants, thereby augmenting their overall visual attractiveness. The diversity and allure of ornamental plant varieties have been enhanced by the development of novel floral structures made possible by biotechnological methods, such as double petals and altered inflorescences. The development of transgenic varieties and the introduction of stress-responsive genes have addressed environmental stress tolerance, an important factor in the cultivation of ornamental plants. Furthermore, biotechnological techniques have been used to make ornamental plants seedless, which removes the need for seed removal and improves the aesthetic appeal of flowers even more.

Keyword : Biotechnology, Improving, Ornamental plant, RNA, Floriculture

Silicon: A key component for ornamental plants

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Silicon is the most abundant element in the earth's crust region next to oxygen and it is classified as a beneficial nutrient for plants. Despite the fact that it is classified as a non-essential element, numerous studies have revealed its beneficial impact on plants such as improvement in growth and yield, especially under abiotic and biotic stress conditions. Silicon is one of the best solutions toward sustainability as it is a well-known anti-stress agent, with its ability to defend against a variety of environmental stresses (drought, frost, salt, high temperature, and heavy metal toxicity) and biotic stresses (diseases and insect pests). It is reported to boosts crop yields and enhances crop quality. One of the major contributions of silicon in plants is cell wall reinforcement, which is due to the deposition of solid silica. In flower crops, silicon can be applied in the form of silicates (potassium silicate and sodium silicate) through drenching or foliar applications or can also be directly added to medium. Application of silicon results in more upright growth and plant rigidity that directly stimulates plant growth and yield. It can improve plant abilities to withstand edaphic climatic and/ or biological adversities by acting as a "natural antistress" mechanism that enables higher yield and better quality.

Keywords: Silicon, biotic and abiotic stress, natural antistress

Precision farming: Innovative Production Technologies in Indian Agriculture

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In the dynamic landscape of Indian agriculture, the imperative adoption of innovative production technologies is reshaping traditional farming practices. Precision farming, also known as precision agriculture, it is an advanced farming approach that utilizes technology, data and information to optimize various aspects of crop production. The goal is to enhance efficiency, sustainability and overall yield by applying precise inputs as, where and when they are needed. Precision farming relies on data-driven decision-making, integrating technologies like GPS, sensors and remote sensing to meticulously monitor and manage agricultural processes. Global Positioning System (GPS) technology is integral, enabling precise mapping

and tracking of field activities to facilitates accurate navigation of farm equipment, leading to the creation of detailed spatial maps to enhance overall operational efficiency. Sensor technologies including those for soil moisture and weather monitoring, furnish real-time data which is crucial for fine-tuning inputs like water and fertilizers. Variable Rate Technology (VRT) stands out as key feature, allowing us customized application of inputs based on specific field requirements. This optimization minimizes resource usage and reduces environmental impact. The machinery automation, GPS guiding, ensures precise and efficient field operations from planting to harvesting. Satellite imagery and remote sensing technologies provide farmers with actionable insights into crop health. This early detection mechanism enables targeted interventions, minimizing the diseases and pest impact. Precision farming not only enhances productivity and resource efficiency but also champions sustainability. By minimizing input wastage and reducing the environmental footprint of agriculture, precision farming stands as an ideal of innovation in a changing Indian agricultural landscape.

Key words: Precision farming, GPS, VRT, Sensor technologies and Innovative production

Urban landscaping: human and ecological interaction

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Plants in cities provide valuable ecosystem services such as carbon sequestration and storage, wildlife habitat, cycling of water and pollutants, and as climate modifiers, in addition to creating more pleasant urban environments for humans. Urban landscaping maintained the urban environment through different application such as Stabilize and develop urban ecosystem services, planning approaches for sustainable urban environment, conservation of urban nature/ biodiversity and climate change and adaptation. Gardens are lungs of the urban areas and urban landscaping is a place where healthy food is being grown and people are reconnecting with nature. In recent time, our earth is suffering from many critical conditions due to pollution, which are created by human beings. Development has been continuously made as the population is concentrated into the cities and green spaces are disappearing in this process. So, urban landscaping importance is being emphasized as restorative environment and the focus of modern urban landscaping models tends to be on beautifying and enriching life in our cities and strengthening community rather than subsistence farming. So, one can developed urban areas with proper planning through landscaping in the form of green roof, avenue plantation, vertical gardening therapeutic gardening, indoor gardening, *etc*. to overcome the pollution and other problems.

Keywords: Urban landscape, indoor pollution.

Prospect of Hydrogel polymer in Horticulture

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Hydrogel/hydrophilic gels/super absorbent are crosslinked polymers like acrylamide: sodium polyacrylates, swellable starch, potassium polyacrylates, starch: acrylate copolymers, and acrylonitrile. Hydrogel polymers are synthetic in nature high molecular weight and water-absorbing monomer which absorb water at extraordinarily high rates. water availability is one of the principal ecological constraints that hinder agriculture's sustainability. Hydrogel polymer is a new innovative approach to water management

under water-stressed conditions to conserve soil moisture in the active rooting zone of crops by reducing the evaporation, deep percolation, and runoff losses so it enhances water use efficiency. polymers when it added to soil, they preserve enormous amounts of water and nutrients, retaining up to 100 times their original weight and conserving about 95 per cent of the water that is kept available for plant when the roots of the plants begins to dry out, hydrogel supplies water and nutrients to the plants. Initial use of polymers was reported in greenhouse production in the late 1970s, hydrophilic polymers have a wide range of applications, both in the nursery and on the out-planting site. As it absorbs and hold to water which lost via evaporation or leaching along with increasing water holding properties of soil and growing media the addition to favors seed germination, root development, plant growth, and contribute to improving aeration and soil drainage, decreasing irrigation frequency, minimize nutrient losses by leaching. So, for enhancing water use efficiency, reduced drought impact and increased nutrient use efficiency of horticultural crops increased hydrogel technique can beneficial.

Keyword: Hydrogel, Water and Nutrient, Horticulture

Aromatherapy: A holistic healing treatment through flowers – A review

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Aromatherapy uses aromatic essential oils medicinally to improve the health of the body, mind, and spirit. It enhances both physical and emotional health. This review explores the information available in the literature regarding therapeutic, medical, cosmetic, psychological, olfactory, massage aromatherapy, safety issues and different plants used in aromatherapy. There are various methods by which they are administered in small quantity like inhalation, massage or simple applications on the skin surface and rarely, they are taken internally. Inhalation and the external application of these oils for the treatment of mental and physical balance are the very basics of aromatherapy. Olfactory nerves from nose to the brain are the site of action for these essential oils. There is an increased trend nowadays to use this therapy in the treatment of cancer, reduce post-operative caesarean pain in pregnant women as well as decrease the anxiety level and improve sleep quality in patients having burn injury and dental problems. and sleep disorder. Their organic character and to act in a supportive manner with the body, provide a feeling of well-beingness.

Key words: Aromatherapy, Essential oil, Flowers, Massage

Navigating the Future of Horticulture in India: Sensor Technology and other Sustainable Strategies

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The new technologies for innovative and sustainable horticulture comprises sensors, IoT, AI, cloud computing, production technology and robotics. The latest techniques from medical and industrial research

are being utilized to introduce sensors in horticulture which can measure temperature, light, soil moisture, RH, temperature, photosynthetic capacity of plants, and maturity indices. It can also distinguish target features from their agricultural surroundings and ability to identify plant stress and diseases. The photosynthetic capacity can be measured using spectral cameras, fluorescence techniques, and X-ray. Computer vision is typically used to recognize plant parameters such as number of flowers, volume, generative and vegetative height and width, colour of leaf and flower etc. The artificial LED lighting play crucial role for quality and productivity of horticulture produce in protected cultivation which can enhance the photosynthesis in plants. Self-learning algorithms, opensource robotic software and generic mechatronic solutions are used to maintain the favourable environment condition in automated greenhouses. Crops from horticulture play a significant role in boosting the Indian economy. They enhance farm output, create employment opportunities, and supply raw materials to a variety of food-processing industries. This demonstrates the integral role of horticulture in India's agricultural sector and its broader economic landscape. It has also been observed that the export rate of India has increased in the past few years. Adopting sustainable practices is crucial to meet demands. Different strategies such as technology promotion, research, post-harvest management, and marketing is the key vision of India for the promotion of holistic horticulture growth.

Keywords: Robotics, Sensors, Mechatronic, AI, IoT, Fluorescence, X-Ray, Technology

Permaculture: A holistic and innovative approach for self-sufficiency

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A growing world population and increase in food and energy consumption have placed production agriculture in difficult situation. However, modern industrial agriculture such as monoculture is largely responsible for environmental problems such as biodiversity loss, soil degradation, and alteration of biogeochemical cycles or greenhouse gas emission. An innovative approach of permaculture, a design system based on design principles, as well as framework for the methods of ecosystem mimicry and complex system optimisation, has emerged. This approach involves sustainable use of natural resources without adverse environmental impacts by relying less on production inputs such as agrochemicals. It's central concept focuses on reduction or replacement of energy and pollution-intensive technologies in agriculture through intensive use of biological resources and thoughtful, holistic, design, patterned after natural ecosystem. To create autonomous and resilient living spaces, a permaculture proposes pragmatic methodological principles informed by scientific ecology, traditional indigenous knowledge, observation and experimentation. Beyond scientifically-informed ecological design, permaculture encourages practitioners to develop emotional and subjective link with earth, and develop their imagination and creativity as valuable parts of design process.

Miniature water reservoirs: Hydrogel

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Agriculture is the backbone of Indian Economy. We have nearly 143 mha land available for cultivation from 329 mha land. From that cultivated land nearly 64% is dry land where production is low. The major problem of low production is variability in rainfall which sometime ends up in drought. To overcome this problem hydrogel is used. It is great innovation to solve problem of water stress/ drought condition. As it is easily available in market as well as friendly to farmer may be become boon to dry land agriculture. It is recommended by IARI that 2.5 to 3 kg/ha increase that water holding capacity when it is applied to the field at the time of sowing. This hydrogel able to absorb water up to 500-600 times their weight in pure water and form gel. From the research carried out by scientist, it is applicable to all primary crops like groundnut, wheat, paddy vegetables like potato, onion, tomato, carrot, cauliflower, flowers like chrysanthemum, gerbera, marigold and also used for seedlings in nursery and many others. Hydrogel also used because it enhance soil permeability and infiltration rates, reduce irrigation frequency, reduce fertilizer leaching, reduce water runoff and soil erosion as well. It is also proven from world wide research that it is environmental friendly by little or no consistent adverse effect on soil microbial population and does not contain any traceable residual unreacted monomer. Based on its characters, its efficient use and environmental safely usage it will be problem solving product of dry land agriculture.

Ascending Harvests: Maximizing Vegetable Crop Yields through Vertical Farming

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The introduction of vertical farming, a developing approach that is changing vegetable crop cultivation is leading to an innovation in agriculture. Vertical farming is an emerging method for increasing vegetable crop yields. Vertical farming is a sustainable and efficient alternative to traditional agricultural processes utilizing vertically stacked layers within regulated indoor settings to cultivate crops. This technique, developed specifically for vegetable crops reduces the constraint of limited arable area while overcoming the unpredictability of weather patterns. Vertical farms maximize crop yields by employing cutting-edge technology such as hydroponics, aeroponics, and innovative vertical stacking systems. Particularly, this technology provides year-round production irrespectivc of cxtcrnal climatc variablcs cnsuring a stcady and stable supply of fresh vegetable produce. The controlled indoor environment allows for precise control of critical growth parameters such as temperature, humidity, and light exposure, resulting in optimum growing conditions that significantly improve plant development and productivity. Also, through the use of closed-loop irrigation techniques vertical farming systems substantially minimize water usage when compared to traditional agriculture, effectively reducing waste. These systems, which promote a sustainable mindset, minimize reliance on pesticides and herbicides, supporting eco-friendly practices and producing healthier produce. Despite these impressive benefits, difficulties remain, particularly the initial investment in capital necessary for infrastructure and specialized technologies.

Keywords: Vertical farming, Vegetable crops, Crop yields, Hydroponics, Aeroponics, Technology advancements

"Winged bean: A miracle crop"

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Psophocarpus tetragonolobus (L.) DC., called as winged bean, Asparagus pea or Goa bean orVegetable of 20th century.The winged bean is believed to have originated inAfrica's eastern region. This is a self-pollinated leguminous crop grown in tropical regions tropical legume being catagorised within the phaseoloid clade of Leguminosae (Fabaceae). Twining habit, tuberous roots, longitudinally winged pods, and annual and perennial growth types all are features of thewinged bean. It contains a diploid genome with 9 pairs of chromosomes (2n = 2 = 18) and a 1.22 Gigabase pair genomic size. The winged bean has enormous economic and ecological potential in tropical areas of the world, where soybean farming appears to be challenging. In hot, humid equatorial countries like Indonesia, Malaysia, Thailand, Philippines, India, Bangladesh, Myanmar, and Sri Lanka, the plant thrives. The fact that the plant's most parts are edible at all stages of its life cycle, combined with its exceptional nutritional quality, makes it a promising candidate for increased, wide - spread use in protein-deficient areas of the world, earning it nicknames like "one species supermarket" and "supermarket on a stalk." Ruminants, poultry, fish, and other livestock may eat winged bean as a source of food. It can also be used as a cover crop, green manure, and soil reclamation. Winged bean outperforms several tropical crop legumes when seed and tuber yields are combined. It also nodulates more than most other legumes, which helps to improve soil quality.

Indoor Plants as a Filtration of Indoor Air Pollution

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As we navigate the challenges of modern living, the inclusion of indoor plants addresses a myriad of issues, fostering a connection with nature that is essential for our physical, mental and emotional health. One significant aspect of indoor plants is their ability to improve indoor air quality. In contemporary societies, where individuals spend most of their time indoors, pollutants from various sources such as furniture, carpets and electronic devices can accumulate. Indoor plants act as natural air purifiers by absorbing harmful toxins and releasing oxygen during photosynthesis. This process not only improves air quality but also promotes respiratory health, reducing the risk of respiratory illnesses and creating a more comfortable indoor atmosphere. Beyond their functional benefits, the presence of greenery adds a touch of natural beauty to indoor spaces. In an era characterized by concrete jungles and technological advancements, the introduction of plants into living and working areas provides a refreshing contrast. The visual appeal of indoor plants contributes to a more pleasant and aesthetically pleasing environment, positively impacting mood and overall well-being. Indoor plants also play a vital role in stress reduction and mental well-being. The act of caring for plants and observing their growth can be therapeutic, offering a reprieve from the demands of daily life. Studies have shown that the presence of indoor plants can reduce stress levels, anxiety and even symptoms of depression. The calming effect of nature within the confines of indoor spaces underscores the importance of incorporating greenery into our surroundings for mental health benefits. The significance of indoor plants transcends mere decoration; it extends to addressing a spectrum of contemporary challenges. From improving air quality and enhancing aesthetics to promoting mental and physical well-being, indoor plants offer a holistic solution to the demands of modern living.

Keywords: Indoor plants, Health, Indoor air, Air Pollution, Greenery and Clean atmosphere

From Drain to Resource: Greywater Reuse in Innovative Green Infrastructures

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Greywater reuse in green infrastructures is a sustainable and innovative approach that addresses water scarcity challenges and promotes eco-friendly urban development. Greywater, which includes wastewater from household activities such as bathing, laundryand dishwashing, can be treated and reused in green infrastructure systems, contributing to water conservation and reducing the demand on traditional water sources.Green infrastructures encompass a variety of sustainable practices, such as green roofs, rain gardens and permeable pavements, designed to manage stormwater and enhance environmental quality. Integrating greywater reuse into these systems not only conserves water but also enhances the overall efficiency of urban water management. Greywater, after proper treatment, can supplement irrigation needs for green spaces, providing nutrients that support plant growth while reducing the reliance on potable water for landscaping.This approach contributes to the creation of water-sensitive cities, where urban areas actively manage water resources to achieve environmental sustainability. The implementation of greywater reuse in green infrastructures aligns with the principles of circular economy and resource efficiency, promoting a closed-loop system that minimizes water wastage and fosters a more resilient urban ecosystem.However, challenges such as public acceptance, regulatory frameworks and technological advancements need careful consideration for widespread adoption. Research and development in greywater treatment technologies, along with educational initiatives, are crucial to overcoming barriers and ensuring the successful integration of greywater reuse in green infrastructures. Ultimately, embracing this approach can lead to more sustainable and resilient urban environments that balance water conservation, ecological healthand community well-being.

Keywords: Grey water, Green infrastructure, Sustainable approach

Pooktre Wonders: Crafting a Green Aesthetic

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Pooktre, an innovative form of arborsculpture, blends artistry with horticulture to shape living trees into functional and aesthetic structures. The term, derived from the Australian aboriginal word "pook" meaning tree, encapsulates a method where young trees are precisely pruned, bent and grafted to guide their growth into predetermined forms. As these trees mature, they seamlessly fuse and evolve into unique, living sculptures. This sustainable practice stands out for its ecological consciousness, as it avoids the need to cut down trees. Instead, pooktre artists coax trees into becoming integral components of their designs, creating

chairs, tables, archways and other imaginative structures. The artistry lies not only in the final product but in the patience and vision required to work with the organic growth patterns of trees.Pooktre reflects a harmonious synergy between nature and human creativity, challenging traditional notions of woodworking and sculpting. The resulting structures are not only aesthetically pleasing but also serve as a testament to the adaptability and resilience of living organisms. Beyond the physical manifestation of art, pooktre encourages a re-evaluation of our relationship with the environment, showcasing a sustainable approach to design that embraces the inherent beauty and functionality of trees. As an evolving art form, pooktre invites us to explore the boundless possibilities of co-creating with nature, fostering a deeper appreciation for the interconnectedness of art, humanity and the natural world.

Keywords: Pooktre, Arborsculpture, Sustainable approach

Colourful purslane's multifaceted contributions to horticulture and aesthetic landscapes

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Portulaca (*Portulaca oleracea* L.), commonly known as moss rose or purslane, is a popular ornamental plant valued for its vibrant and colourful flowers. It's low-growing, trailing habit makes it suitable for ground cover, hanging baskets, or as an edging plant. Portulaca blooms in various shades, including pink, red, yellow, orange, and white. One of its notable features is its ability to thrive in hot and dry conditions, making it an excellent choice for gardens with well-drained soil and full sunlight. It's also known for attracting butterflies and bees, contributing to pollinator-friendly landscapes. Portulaca plants exhibit vibrant and attractive pigments in their flowers, contributing to their ornamental appeal. The primary pigments responsible for the various colours in Portulaca flowers are betalains, carotenoids, anthocyanins and chlorophylls. In which betalains are responsible for colours such as red and pink while carotenoids produce yellow, orange and sometimes red colour, which are usually prominent colours found in portulaca plant, these can be used in pigment extraction and natural colour industry. Apart from that *Portulaca oleracea* L. and *Portulaca umbraticola* is used traditionally as an edible plant around the world in different cultures. Utilizing Portulaca in edible landscaping not only adds aesthetic value but also provides an opportunity for sustainable food production. Harvesting purslane for culinary use can be integrated into the garden, creating a multi-functional and productive space. Purslane's adaptability, nutritional richness, and genetic diversity underscore its significance in promoting sustainable practices and addressing the evolving demands of horticultural and environmental landscapes.

New Techniques for Future Sustainable Horticulture

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Smart horticulture is expected to greatly improve land output rates, resource-use efficiency, and productivity, all of which should facilitate the sustainable development of the horticulture industry. The establishment of this intensive but integrated management approach paved the way for technological improvements that automated and optimized the farm operations that were previously performed manually, introducing more precision and reliability. Emerging technologies, such as artificial intelligence,

geographical information systems (GIS), remote sensing, Internet of Things, and cloud computing, play an important role in future horticulture. Many new tools and techniques are adopted in the field of horticulture to produce better quality produce. These techniques are aeroponics, hydroponics, aquaculture, vertical farming, high-tech horticulture, meadow orcharding systems, and high-density plantations. Soilless cultivation is possible with hydroponics and aeroponics. Over the years, horticulturists have developed asexual propagation methods that use vegetative plant parts. Innovation in plant propagation has supported breeding programs and allowed the production of high-quality nursery plants with the same genetic characteristics as the mother plant, and disease, pests, and virus-free planting materials.

Keywords: High-tech Horticulture, Aeroponics, Hydroponics, GIS and Remote Sensing

Innovation in fruit crops for livelihood security

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Fruit crops play a vital role in ensuring livelihood security by contributing to food and nutritional diversity, income generation and employment opportunities for millions of people globally. The advent of advanced breeding techniques has led to the development of high-yielding and disease-resistant fruit varieties, ensuring sustainable production and reducing yield losses. Additionally, precision agriculture technologies such as remote sensing and data analytics are being employed to optimize resource use, increase efficiency, and reduce environmental impact in fruit farming. In the field of farming practices, innovations like integrated pest management, organic farming are being used. Agroforestry is being adopted to promote sustainable and environment-friendly fruit production. Post-harvest technologies, including improved storage facilities, cold chain management and value addition processes, play an important role in reducing post-harvest losses and increasing the shelf life of fruit crops. Innovations in marketing and distribution channels, facilitated by digital technologies and e-commerce platforms, are connecting farmers directly to consumers, eliminating middlemen and ensuring fair returns to producers. This direct engagement contributes to the empowerment of small-scale farmers and strengthens their economic position in the value chain. Building skills and awareness of farmers regarding modern agricultural practices and technologies Integration of technological, agricultural and social innovations is important for successful implementation of these innovations and creating a holistic approach to enhance livelihood security.

Keywords : Nutritional diversity, livelihood, Agroforestry, Building skills and e-commerce platforms

Future Farms: Doubling Income Through Hi -Tech Vegetable Cultivation

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Horticulture is the branch of agriculture concerned with the cultivation, production, and sale of fruits, vegetables, flowers, herbs, ornamental or decorative plants. It forms a major share of agriculture. Hi-tech vegetable cultivation is a technology that is trendy, less environment-dependent, and capital intensive however with a capability to boost productivity and farmer's financial gain. With the increasing population and climate change, food insecurity is increasing day by day. In the present scenario, the increasing population is to be fed from declining land and water due to climate change. The effect of climate change is likely to increase in terms of high temperatures, weather instability, the emergence of new pests and diseases so that need double production. strategies for doubling production and income in hi- tech vegetable cultivation by hi-tech nursery production, protected/ greenhouse cultivation, precision farming, integrated nutrient management(INM) for improving soil health, integrated disease management (IDM) by soil solarisation & soil sterilization, drip irrigation/fertigation technology for high water/nutrient use efficiency,

mulching strategies helpful in weed management, use of drones for spraying, use of robots for different purpose like grafting etc, Vertical farming, Hydroponics/ Aeroponics, cold storage for long term storage purpose, technologies tools like global positioning system (GPS), geographic information systems (GIS), Artificial intelligence (AI), Block chain etc. used for data collection, supply management etc. Hi-tech vegetable cultivation is beneficial not just for raising vegetables crops however conjointly for conservation, plant protection, and post-harvest management together with value – addition which ultimately increased the yield and income.

Keywords : Horticulture, Vegetable, Hi-tech cultivation, Strategies, Income

Hydroponic technology for mint (*Mentha sp*) cultivation in the Trans-Himalayan range.

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Food security has been an issue of worldwide concern for many decades. The present research aimed to examine an efficient technique for planting system i.e. hydroponic or soil less system of farming. The statistical experimental design approach was used to compare the growth between hydroponic cultivation and traditional cultivation of Mint in Cold Desert Region of Trans Himalaya in Designed hydroponic system. The mint crops grown exhibited ($P < 0.05$)significant improvement growth and production in NFT system with greenhouse.Average production of leafy vegetable inhydroponic system mint 2.8±0.08 kg m^{-2}. The increase in crops yield recorded were:mint 237%higher yield in hydroponics systemcompared to traditional system. Hydroponics can be used to grow fruits and vegetables with less resources and contribute to a global food system that is self-sufficient. The results showedleafy vegetable variety exhibited significant differences in above attributes grown in NFT system. BC ratio of nutrient solution was found as four time higher.

Key words: Trans-Himalayan, Hydroponic, Mint

Sky-High Insights: Harnessing Drones for Fruit Crop Analysis

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This poster examines how precision agriculture is using drone technology to advance the subject of fruit science. Drones with high-definition cameras and sensors have become indispensable instruments for orchardists and researchers alike. The graphic explores the many uses of drones in fruit science, from yield estimation and environmental evaluation to crop monitoring and disease detection. Drone integration into fruit science procedures allows for the real-time collection of data across large orchard landscapes, giving researchers a thorough grasp of the variables affecting fruit development. The poster presents case studies and cutting-edge methods that show how drones can improve resource management, lessen their negative effects on the environment, and increase crop output overall. Through the display of the most recent developments and effective uses of drone technology in fruit science, this poster hopes to stimulate additional research and use of these innovative instruments. In the end, the combination of fruit science and drone technology looks set to bring in a new era of precision, sustainability, and efficiency in fruit growing and orchard management.

Sensing the future: arduino's impact on precision agriculture in horticulture

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An important advancement in agricultural technology has been made by Arduino's contribution to horticulture, especially considering the changing problems posed by climate change. Microcontrollers from Arduino have become essential instruments that can drastically alter horticulture methods. This technology plays a key role in improving agricultural domain measurement and monitoring systems. The accuracy, cost-effectiveness, and responsiveness of data collecting procedures are significantly improved by including Arduino-based sensors. Thanks to this invention, farmers may now access exact information about important climatic variables like temperature and soil moisture. Their ability to make educated judgments is enhanced by their newfound knowledge, which promotes sustainable crop management. The process is further streamlined by Arduino's ability to provide seamless connection between sensors and central monitoring units. Farmers can access actionable findings through simple interfaces. The numerous advantages of Arduino in horticulture are highlighted by its optimization of resource consumption, which it combines with its contributions to climate resilience through water efficiency and decreased carbon footprints. This abstract's main goal is to demonstrate the Arduino-based solutions' development, application, and results to demonstrate how revolutionary they could be for horticulture. This research highlights the critical role that agricultural plays in mitigating the effects of climate change and calls for the broad use of Arduino technology as the cornerstone of horticulture's transition to a more resilient and sustainable industry.

Phenology studies: A tool to fine tune horticultural practices for better yield and quality of tropical fruits

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Phenology deals with the seasonal timing of recurrent biological events that are intimately linked to the developmental phases of plant species. The timing of switch between vegetative and reproductive phases that occurs in concert with flowering is crucial for the reproductive success of plants. Every crop and its varieties have a unique phenology. The performance and preference of crop and variety may differ from region to region based on agroclimatic condition of the area. So, the stage of phenology performance varies by agroclimatic condition and cultivar. In developing nations, like India which is one of the world's biggest and most diverse fruit-producing country; it has a special impact on people's income and nutritional status in both the social and economic spheres. Especially, Tropical fruits account for nearly 70 percent of all fruit production in India. The major tropical fruits grown in India include mango, banana, pineapple, papaya, sapota *etc.* The study of the phenology of tropical fruit is a tool used to elucidate plant growth and development, provide precise and standardized characterization of different developmental stages of a plant and improve the effectiveness and efficiency of scientific experiments, crop breeding and the evaluation of specific varieties under specific agroclimatic conditions.

Keywords: Banana, Mango, Phenology, Pineapple, Sapota

Session IX

Technology Transfer, Hortibusiness and Policy issues

Success For Indian Wine Industry Through Value Addition In Fruits

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The grape industry in India has traditionally faced challenges due to climatic conditions, leading to crop losses and limited processing demand, primarily for raisin production. Recognizing the potential of wine-making as an alternative, the introduction of grape wine in the 1980s marked a turning point, with significant growth in Maharashtra and Nashik, earning the region the title of the Wine Capital of India. This initiative not only transformed the grape sector but also contributed to rural development through green operations, employment generation, and agro & wine tourism. Maharashtra, with 45 wineries, emerged as a hub, and the success prompted the expansion of the industry to other states, including Himachal Pradesh, where fruit wines are gaining popularity. The modernization of wine production, coupled with government incentives, has led to a 10-12% average growth over the past two decades, with women, the middle class, and youth driving the wine culture. Despite challenges, Indian wines are gaining recognition globally, and initiatives like fruit-based wines and mead are further diversifying the market. The industry, evolving from zero to a 1.5-billion-liter wine production, showcases the potential for rural economic growth, aligning with the vision of doubling farmers' income and promoting local products. Resvera wine's innovation, such as the world's first Jamun wine, exemplifies the commitment to value addition in agriculture, contributing to the success of the Indian wine industry.

Improved version of lukoskin anti-leucoderma herbal product (mark-ii) :a very effective treatment of incurable skin disease leucoderma

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Leucoderma, is a skin disorder, in which skin looses its normal colouration resulting white lesions on the skin. Presently it has affected 1% of the population worldwide. In India, its incidence is about 3-4%, but in some pockets of Gujarat and Rajasthan it is as high as 8.8%.Leucoderma is a big social stigma in our country. The affected individuals are always remains in constant depression with feeling of being socially outcast. There is no satisfactory cure of leucoderma. Keeping all etiological of this skin disorder in view a herbal product for the treatment leucoderma (Lukoskin) has developed by DIBER, Haldwani which has shown good efficacy against leucoderma. The T o T of this herbal product has been done with AIMIL pharmaceuticals, New Delhi, the company has launched this product into the market by the trade name of LUKOSKIN. The effective cure of leucoderma has been developed by the institute the clinical efficacy of the product was 65-70%. Still there was scope to enhance its efficacy of the product and to reduce recovery time. Hence, a project was sanctioned and an improved version 'Anti-leucoderma Herbal Product Mark –II' has been developed. This product contains furanocourmarins as main bio-molecules. The toxicological studies of this herbal formulation has been carried out at for presence of Heavy metals, Acute oral & dermal toxicity, sub-acute oral & dermal toxicity (28 Days), sub-chronic oral & dermal toxicity (90 Days), chronic oral toxicity (180 Days) etc. The clinicaltrails of this herbal product has been carried out from Govt. Ayurvedic College & Hospital , Lukonow and clinical efficacy was found more than 90%. The patent on this herbal

product has been granted. The technology of this advance version of Lukoskin has been transferred to AIMIL Pharmaceuticals India Ltd, New Delhi for its commercialization.

Role of APMC in technological interventions in horticultural marketing in India: new initiatives and challenges

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Horticultural produce is currently marketed through the "open market transactions system" under the conventional APMC regulations. Market yards set up under the APMC Acts are playing a vital role in terms of price discovery, as well as product aggregation and disaggregation along the chain. However, the present marketing system of horticultural produce in India, lacks system approach. Producers have often failed to realize expenses incurred on transportation to markets, let alone the cost of production and capital investment, during the period of glut. Fruit and vegetable growers are receiving only a small part of price paid by the consumers as lion's share is being taken by chain of middlemen. The high profit margin of intermediaries is quite disproportionate to their services. In order to increase the income of farmers and promote the role of private sector in the agriculture marketing there is need to improve existing APMC's for better realization of producers share in consumer's rupee. Thus, it is imperative to make our APMC more vibrant and stronger in terms of infrastructure, management and transparency. It is essential to facilitate development of marketing infrastructure through private sector investments and create avenues for alternate marketing channels for farmers for sales transactions of their produce where prices are remunerative to them. Both public and private retail markets have to adopt the new marketing models to enhance the distributional efficiency of the marketing system. Therefore, there is an immediate need to replicate such models in a much larger scale to cover not only the cities but also the interior villages in the country.

Keywords: APMC, middlemen, marketing channel, price

Challenges and opportunities of turfgrass industry in India

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Turfgrasses are ubiquitous in urban landscape and works as the primary vegetative cover on home lawns, athletic fields, cemeteries, churches, commercial buildings, golf courses, airports, schools, parks, roadsides, etc. An increasing awareness about the sports, degrading environment and the increase in real estate value of the property has effectively increased the area under aesthetic and utility turfs. Globally turfgrass and turf solution market was USD 11.80 billion in 2020 and it is expecting USD 18.11 billion with CAGR of 0.055 in 2028. In India, Turfgrass industry covers more than 30,000 acres, in which around 6000

acres is under turfgrass cultivation and sod production in India and rest under functional turfs. The total number of international cricket grounds in India is 52 (out of which 28 are active) which are highest in the world and around 8 under construction, more than 520 domestic cricket grounds and athletic fields are also in operation. In India, there are more than 255 golf courses and 25 per cent of them come under defence. Indian turfgrass industry is growing around 10 per cent annually. Landscape business contributes 2-3 per cent of total construction and turf has around 50-70 per cent of landscape business.

Adenium: a novel approach for horti-business

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Adenium obesum, commonly known as Desert rose and Impala lily, with its unique plant shape, sculpted caudex and beautiful flowering behaviour is an excellent ornamental plant for pot culture. With the recent increase in domestic as well as international trade of ornamental plants, pot plant industry is gaining popularity. Adenium is not only an excellent pot plant but also a wonderful plant for rock gardens and roof top gardens. It is well adapted to warm and humid conditions besides, dry climate and thus seen as a potential nursery plant for export. Specific breeding approach along with special cultural practices and quality planting material can result into maintained compact profuse flowering pot plant that can further increase its market demand with high income. Research on different aspects like breeding, varietal evaluation, propagation techniques, soilless growing system in adenium as pot plant is being conducted in the department of Floriculture and Landscape architecture at Navsari Agricultural University, Navsari. Further, two varieties *viz.*, Gujarat Adenium 1 which bears unique dark red coloured flowers having triple whorl of petals and Gujarat Adenium 2 bearing purplish red double whorl of petals have been developed through hybridization followed by clonal selection and released at CVRC. Other two varieties Aabha bearing pink coloured dual whorl of petals and Shobhita bearing pink coloured profuse flowers have also been released at SVRC, Gujarat. Besides, an innovative method to produce more plants with limited scion comprising of flat grafting using short scion of 2 to 4 cm length as compared to regular wedge grafting method have also been standardized. Considering the economic view point, adenium in pot plant industry has shown high income generating horti-business potential.

Key Words : *Adenium obesum*, pot plant, breeding, varieties, flat grafting, soilless growing system, hortibusiness

Consumer behavior and influencing factors in the purchase of exotic vegetables in south Gujarat

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The market for exotic vegetables has been a dynamic and growing sector in the global food industry. Exotic vegetables, which often include non-native or less common varieties, have gained popularity due to increasing consumer interest in diverse and unique culinary experiences, health and wellness trends, and a growing awareness of the nutritional benefits of different vegetables. This study, aiming to understand consumer purchasing behavior towards exotic vegetables, surveyed 300 respondents of the selected cities of South Gujarat through a structured questionnaire. The key findings revealed a preference among consumers for colored capsicum, broccoli, Lollo Rosso, and cucumber etc. The factors influencing consumers in favor of purchasing exotic vegetables included considerations such as nutritional value, affordability, quantity, quality, and hygiene. On the other side, consumers encountered challenges like the shorter shelf life of exotic vegetables, lack of traceability, and concerns about poor quality, with not all family members expressing a liking for these vegetables. To stimulate greater demand for exotic vegetables, it is crucial to raise awareness among consumers. Additionally, ensuring the timely availability of certain exotic vegetable varieties could further contribute to meeting the consumer preferences. This proactive approach can address constraints, enhance consumer satisfaction, and promote the sustained growth of the exotic vegetable market.

Keywords : Consumers purchase behaviour, exotic vegetables, factors influencing, constraints

Using contemporary technology in horticulture

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It is currently predicted that frequent droughts would become more likely due to global climate change. Worldwide, horticulture is going through a significant transition and is facing several challenges. In the future, traditional agriculture will not be able to provide fresh, wholesome food to a rapidly growing population. Soilless culture is an alternate technology that can be used in these situations to effectively change. The above ground system links to hydroponics and aeroponics systems. In an aeroponic system, plant roots are suspended in artificially supplied plastic supports and porous materials displace the soil under controlled conditions. The roots are given room to spread out and hang open in the atmosphere. However, nutrient-rich water comes with atomizing nozzles. The nozzles can spray a fine mist with different sized droplets intermittently or constantly. The aeroponic system is most dependable and sustainable growing method. This aeroponic farming is superior in terms of excellent aeration, water use efficiency, less time and space requirement, seasonal independence, disease free plant propagation and effective crop cultivation system without using any other land.

Sustainable Hydroponic Vegetable Farming in the Face of Climate Change for Profitable Enterprises

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Survival for humans relies on limited resources such as food, water, and living space necessitating the optimization of land use due to their scarcity. With the global population expected to reach 9 billion by 2050, ensuring food security emerges as a paramount challenge for the agricultural sector in the new millennium. The current cultivation system's productivity and water harvesting methods are major concerns. The decline in fertile soil and water quality is a consequence of global climate change, environmental pollution, and urbanization, adding complexity to the agricultural landscape. Pathogenic infestations in traditional farming further constrain potential crop production. To meet these challenges, farming must evolve, becoming not only more productive but also protective, especially in the face of changing climates. Advanced growing techniques are imperative, particularly in difficult-to-cultivate areas. Hydroponics, specifically in the form of vertical farming, stands out as a remarkable option. It enables cultivation virtually anywhere while minimizing land and water usage, free from concerns about insects, pests, diseases, and natural disasters. Given the evolving global economic scenario, obtaining public sector jobs is challenging, making private entrepreneurship an attractive alternative. Vegetables, vital cash crops, offer the potential to enhance both farmer income and nutrition. The escalating demand for vegetables necessitates exploring diverse cultivation methods across various locations. In conclusion, addressing the urgent challenge of food security requires a shift to more advanced and protective farming practices, with hydroponics and vertical farming offering sustainable solutions. This evolution aligns with the changing economic landscape, emphasizing the importance of private entrepreneurship and strategic vegetable cultivation to meet the demands of the future.

Key words: Soilless agriculture, Hydroponics, Climate change, Vegetable crops.

Cultivating success: a comprehensive guide to business management in horticulture"

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Horticultural business management encompasses various aspects of managing businesses related to the cultivation, production, distribution, and sale of plants, flowers, fruits, vegetables, and other related products. Here's an overview covering key areas. Cultivation techniques by Understanding different plant species, their growth requirements, propagation methods, and cultivation techniques. This includes knowledge of soil types, fertilization, irrigation, pest control, and sustainable growing practices. Market analysis and trends: Conducting market research to identify consumer demands, trends, and preferences in the horticultural industry. Analyzing market dynamics helps in making informed decisions about what to grow and how to market products effectively. Business planning: Developing comprehensive business plans that encompass financial projections, marketing strategies, production schedules, and resource allocation. Effective planning ensures efficient operations and helps in securing financing or investment. Operations Management:

Overseeing day-to-day operations, including crop scheduling, labor management, inventory control, and quality assurance. Implementing efficient systems and processes optimizes production and reduces costs. sales and distribution: Creating effective sales and distribution channels, which may involve direct sales to consumers, wholesale to retailers, or partnerships with distributors. Understanding retail trends and establishing relationships with buyers is crucial in this aspect. Financial management: Managing finances, budgeting, and accounting specifically tailored to horticultural businesses. This includes cost analysis, pricing strategies, managing cash flow, and assessing profitability. Regulatory Compliance: Understanding and adhering to local, national, and international regulations related to horticulture, including environmental regulations, pesticide use, labor laws, and food safety standards. Technology Integration: Implementing technology and innovation in horticulture, such as greenhouse automation, precision agriculture, use of specialized software for inventory management or market analysis, and adopting sustainable practices. Risk management: Identifying and mitigating risks associated with weather conditions, crop diseases, market fluctuations, and other potential threats to the business. Sustainability and environmental concern: Embracing sustainable practices and addressing environmental concerns by adopting eco-friendly growing methods, reducing waste, and promoting biodiversity. Successful horticultural business management involves a combination of agricultural knowledge, business acumen, strategic planning, and staying updated with industry trends to navigate challenges and capitalize on opportunities in this diverse and evolving field.

Over a decade of teaching: A personal viewpoint on the competency of Indian horticulture curricula to meet future R&D and industrial requirements

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One of the United Nations sustainable development goals is well-being and health for all, is dependent on the availability and affordability of fruits and vegetables for all. Furthermore, growth and development in horticulture and allied sectors are critical to the country's livelihood security and economy. However, the growth of the industry dependent on skilled human capital, which will keep up with the changing world. Despite the fact that these human resources are primarily trained and produced by state agricultural universities, there is a need to critically review whether our current horticulture curriculum and training at the undergraduate and postgraduate levels are prepared to meet discipline-centered knowledge and skills, as well as professional skills, required in future research and development of the horticulture sector and industry demand. This review is an individual viewpoint developed after teaching horticulture undergraduate and postgraduate students for more than a decade of horticulture sciences. This review discusses the relevance of the courses, teachers, and students' adaptability to a changing world, and strategies for attracting bright minds in horticulture, and the training of futuristic horticultural human resources to align their skills and knowledge with industry demand.

Session X

Farmers and Industry Issues

Farmer participatory demonstrations of GS-385 hybrid of cauliflower advanced profitability and sustainability as an off-season vegetable in uttarakhand

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Cauliflower (*Brassica oleracea*L. var. *botrytis*) is one of the principal vegetable crops belonging to the family Brassicaceae. Cauliflower is grown between March-April to October-November in hills of Uttarakhand as off season vegetable. It is an important cash gcncrating off-scason vcgctablc crop suitablc mainly for hill farmers. Being an off season, its demand in the plains of Northern India is very high because during this period availability of cauliflower is almost negligible. Thus, farmers get very premium price of their cauliflower because of the off season (Thakur, 2014). Hence, there is the great possibility to commercialize off-season cauliflower in the hills of Uttarakhand. It is true that cauliflower is important off season vegetable widely grown in hills of Uttarakhand. The technological demonstrations were carried out in Billekh, Shitlakhet, MahatGaon, Dhamas, Matela, Satrashi, Musoli,Sion villages and KVK farm of Almora district in Uttarakhand by G.B. Pant University of Agriculture and Technology, KrishiVigyan Kendra, Matela, Almora during summer season of 2020 and 2021. Before conducting the demonstrations, we have identified the villages in various locations and altitudes and selected the farmers during field visit and survey of the villages. The training programme and farmer scientist interaction were also organized time to time in selected villages during demonstrations. Farmers were trained on various aspects of production and protection technologies of cauliflower particularly GS-385 hybrid. The nursery was raised by the farmers in first fortnight of March during both the years and transplanting was done in first fortnight of April during 2020 and 2021. The seeds of GS-385 were given to the identificd farmcrs in various sclcctcd villagcs in thc month of February in 2020 and 2021. The demonstrations were laid out in farmer participatory mode as for taking the observations on various parameters like days of curd formation, days of maturity, weight of curd, average yield, average sale price etc. farmers have been educated at regular interval. The data recorded on various aspects have been compiled and converted into hectare. The incidence of various pests and diseases was also monitored at frequent interval and when crop is damaged by any biotic factors, the management practices have been followed with the help of farmers. The summary of field demonstrations carried out in eight villages and KVK farm revealed that introduction of GS-385 hybrid of cauliflower as an off season gave maximum yield 375.70 q/ha in Shitlakhet village followed by 369.25 q/ha in Billekh village and 363.43 q/ha in Sion village while in farmer practice it was only 172.88 q/ha. The pattern of yield showed that it was 117.31 % higher in Shitlakhet, 113.58 % in Billekh and 110.22 % in Sion village over farmer practice during 2020. The highest net income of Rs. 982850/ha was observed in Shitlakhet followed by Rs. 964770/ha in Billekh and Rs. 942920/ha in Sion village while, in farmer practice only net income of Rs. 226990/ha received which was very low from the demonstrations laid out in various altitudes of Almora district in Uttarakhand. The observations taken on different parameters including yield and net income indicated almost same trend in 2021.The findings suggest that identification and introduction of GS-385 hybrid of cauliflower demonstrated as an off season during summer, 2020 and 2021 in various locations of Almora district in Uttarakhand may be adopted by the farmers in hills of Uttarakhand for maximizing their production and income from cauliflower.

Intervention of farmer's centric technologies on production and profitability for off season vegetables in Uttarakhand

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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. Realizing the significance of off season vegetables, we have made technological interventions pertaining to high yielding hybrids and varieties, proper nutrient management throughout the crop duration along with pest and disease management by judicious and need based use of chemical pesticides on farmer's field in selected villages of Almora district of Uttarakhand during 2019 to 2022.The field demonstrations on front line technology were carried out by G. B. Pant University of Agriculture and Technology, Krishi Vigyan Kendra, Matela, Almora, Uttarakhand during 2020 and 2021 at village Billekh of Tarikhet block and KVK farm of Hawalbagh block of Almora. Before conducting the demonstrations, survey, field visit and interaction with farmers were organized at village Billekh. The 60 farmers were selected for organizing demonstrations in the selected village. All critical inputs like seed of mentioned varieties and hybrids, nutrients, pesticides were given during time to time visit. The trainings of the farmers at regular interval were conducted to mobilize them towards technological interventions. The data on vegetative and reproductive growth, yield, incidence of pests and diseases were taken at regular interval and accordingly pesticides were applied on need basis after monitoring the crop. The sale price was also noted in each sale and after totaling all the sale, average sale price was calculated which helped us in calculation of gross income, net income and B: C ratio. Similarly, cost of cultivation was also worked out in which all the operations right from land preparation to final harvesting of the crop including cost of all the critical inputs given from time to time to the farmers. The impact of farmer's friendly technologies revealed that introduction and demonstration of high yielding hybrids and varieties, proper nutrient and pest management resulted in enhancement of production and profitability. The results of the demonstrations indicated that Indra hybrid of capsicum fetched 135q/ha average yield, GS-385 hybrid of cauliflower gave 263.40q/ha, Shivay hybrid of tomato obtained 316.00 q/ha, GS-10 variety of vegetable pea recorded 142.00 q/ha and Falguni variety of French bean received 134.50 q/ha average yield when they grew under proper nutrient and pest management. They resulted in 55.81 to 85.51 % higher in yield in the demonstrations over farmer's field. Similarly, the net income of capsicum was Rs 367735/ha, cauliflower manifested Rs. 368390/ha, tomato exhibited Rs. 315195/ha, vegetable pea resulted Rs. 174220/ha and French bean received Rs. 231680/ha. The field demonstrations conducted during 2020 and 2021 in capsicum, cauliflower, tomato, vegetable pea and French bean clearly indicated their tremendous impact on production and profitability as compared to farmer's field. The enhancement on production and profitability was observed only due to timely adoption of improved integrated crop management practices at different stages of

the crops. If these practices are followed by the farmers in true letter and spirit, the additional income of Rs. 337200/ha in capsicum, Rs. 312000/ha in cauliflower, Rs. 329100/ha in tomato, Rs. 159600/ha in vegetable pea and Rs. 173250/ha in French bean can be obtained. According to an estimate, capsicum is cultivated in about 2456.19 ha area in hills of Uttarakhand. Similarly, cauliflower occupied 2556.25 ha area, tomato is grown in 7613.10 ha area, farming of vegetable pea is done in 9441.85 ha area and French bean cultivated in 5880.95 ha area. The results of the field demonstrations manifested that additional income observed is multiplied in the existing area of all the five vegetables, total additional income of Rs. 82.82 crores may be earned from capsicum cultivation. Similarly, total additional income of Rs. 79.75 crores in cauliflower, Rs 250.54 crores in tomato, Rs. 150.69 crores in vegetable pea and Rs 101.88 crores in French bean may be realized. The summary of field demonstrations indicated that the total of about Rs. 665.68 crores additional income may be earned from commercial cultivation of these five vegetables as an off season in hills of Uttarakhand.

Urban horticulture: A boon for self reliance

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India, with a population estimated at 1.42 billion, recently outstripped China to become the most populous nation on the globe. With the rapid urbanization accompanying this population explosion, challenges pertaining to food, nutrition, and environmental security have surged. Almost 40% of the population now resides in urban areas, a proportion projected to balloon to 60% by 2050. Problems affecting many urban and peri-urban areas are not just about human health, but about the interconnections between individual human health, human psyche, community health, and the health and sustainability of the environment. With these growing challenges of urban life, urban horticulture has been assuming significance for food, nutrition, and environmental services and above all, the economic development and thus a promising option for self-reliance. Urban horticulture provides an array of benefits, from contributing to food and nutrition security to bolstering economic development and enhancing environmental services. It encompasses a broad range of activities, including green-scaping in urban pockets, interior scaping with plants, kitchen and home gardening, and the development of public parks. Urban horticulture is not merely an Indian phenomenon. The "Food for the Cities" initiative by the Food and Agriculture Organization (FAO) aims to ensure urban populations' access to safe food and a secure environment. Other notable international collaborations include the Global Horticulture Initiative (GlobalHort), International Society for Horticultural Science (ISHS), and Resource Centres on Urban Agriculture and Food Security (RUAF). To encourage urban horticulture in India, the government has rolled out various schemes like Atal Mission for Rejuvenation and Urban Transformation (AMRUT), National Urban Livelihoods Mission (NULM), and Pradhan MantriFasalBimaYojana (PMFBY). National Horticulture Mission (NHM), through Mission for Integrated Development in Horticulture (MIDH), has also been influential in supporting horticulture practices in both rural and urban environments.Cities like Bangalore, Pune, Hyderabad, and Kolkata have seen an upswing in greenscapes, with vertical gardens, traffic green islands, and beautiful landscapes at airports and residential areas becoming more common. Sustainable practices such as rooftop and balcony gardening, are becoming popular across the country. Besides, projects protected cultivation of high value vegetables and flower crops, organic farming and soilless cultivation systems are also been taken up and in great demand in urban areas. Urban horticulture in India is gradually gaining popularity, with increasing community engagement and the adoption of sustainable practices. By mitigating urban heat islands, improving air quality, providing green spaces for recreation, and supplying locally sourced fresh produce, UPH holds great promise for Indian cities. Given the recent trend towards urban farming, horti-tourism, edible landscaping, community gardening, and

urban greening initiatives, there's significant potential for the further development and expansion of urban horticulture towards cultivating of self-reliance in the youth and ultimately building of self-reliant country. In conclusion, urban horticulture is a powerful tool that can significantly improve India's environment, food, and nutritional security. By supporting the sustainable development of urban spaces and enhancing the bio-aesthetic outlook, UPH can play a crucial role in shaping India's future urban landscapes. It's time to recognize its potential towards building of a self-reliant nation and integrate it into our strategies for sustainable urban development that can significantly contribute in improving the status of environment, food and nutritional security along with maintaining bio-aesthetic outlook.

Key words: Urban horticulture, self-reliance, pollution, environment, horti-tourism, , nutrition security

Design and validation of a micro-greenhouse for consistent microgreen production in bunkers for soldiers posted in Ladakh

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Ladakh is a high-altitude cold arid region with rugged topography, limited cropping season and high snowfall. Soldiers posted in forward posts remain dependent on packaged foods and providing fresh vegetables is a challenging task. Microgreens can be considered as a good source of fresh food which can be consumed raw, easy to grow and harvested within 10-15 days. Thus, a study was conducted to simulate a micro greenhouse design and evaluate its efficiency to maintain suitable environment for growing of microgreens in bunkers or far-flung locations. The various framing materials like stainless steel, yellow pinewood and cardboard with two vertical tiers were evaluated for the structure along with the trans-illusion transparent material. The design of compact, light-weight cabinet of size 60cm x 50cm x 55cm with two tiers made up of yellow pinewoodwas found be durable and efficient in maintaining the desired temperature (18-25°C), light intensity (10,000-16,000 Lux), and relative humidity (60-75%) for growing microgreens and was suitable for bunkers. Trials on growing of different microgreens were conducted with this microgreen cabinet. Poly-propylene material trays with size 20 cm length, 12 cm width and 5 cm depth were found light weight and suitable for utilizing the maximum capacity of the microgreen cabinet. Combination of different soilless growing media were studies and cocopeat, vermiculite and perlite in the ratio 5:2:1 were found suitable for maximum yield. This media has a reuse efficiency of up to 10 cycles (4months). 24 different types of crops were studied and 6 vegetable crops were found most suitable for growing in the microgreen cabinet on the basis of yield, sensory acceptability by soldiers and nutritional profiling.These 200 microgreens production cabinets, a complete package of growing kit including trays, growing media, seeds etc and a training manual has been transferred to the troops/local farmers in Ladakh for self production this year.

Assessing farmers perception on farm diversification as a profitable enterprise in Uttarakhand Himalaya

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Uttarakhand Himalaya shares over 600 km of its border with China and Nepal through 05 districts like Pithoragarh, Champawat, Udham Singh Nagar, Chamoli and Uttarkashi which make it more strategic part of our country. This region situated between 400 m to 8000 m above mean sea level which creates large diversity

and variability in vegetation. The distinct altitudinal and harsh climatic conditions creates a temporary phase of local migration in the various regions od state. Similarly, horticultural and agricultural practices also keep changing with the temporary migration. DIBER has been supporting society/ farming community for several years and providing seeds/ seedlings, technical know-how on protected cultivation technology, improving farm income through farm diversification, entrepreneurship development through cash crops like turmeric and support to FPO for export on Berinag tea including training and on-farm demonstration of DIBER developed technologies with a aim of curtailing migration from these border villages. Recently, DIBER has taken up an ambitious step to provide 50 lakhs seedlings of high yield varieties of vegetables, high curcumin content turmeric and onion seedlings, long with chain link fencing of villagers farm in selected of 05 bordering districts of Uttarakhand. This drive has led to change in pattern of villagers perception from sustenance farming to agri-entreprenuership. Keeping in view the above facts DIBER has taken up a study to assess the farmer's perception towards farm diversification and making it as a profitable enterprise in Uttarakhand Himalaya. Enquiry was made to those provided with good quality seeds, planting materials, technical know-how and protection measures from wild animals were started changing their perception in diversification of crop production and making the farming as a profitable enterprise for them. The study is being conducted through a semi-structured feed-back questionnaire which revealed that beneficiary farmers under the present assessment have came up with changed perception in adoption of new technologies with increased quality and quantity of produce with further diversification requirements. Initially there were only 10-25% farmers of each village have changes their mind set-up and slowly other farmers also adopting the similar trends in the selected village. It has also been observed that farmers now demanding high quantity of planting materials, seeds and seedlings, fruit plants and protection measures from wild animals for increasing their productivity. Such association with farmers also develops direct and indirect benefit for national security by decreasing migration from border areas.

Key Words: Uttarakhand, farmers, perception, diversification, assessment.

TECHNOLOGIES FOR MAJOR PROBLEMS FACED BY FARMERS IN POMEGRANATE

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Pomegranate (*Punica granatum* L.) is an important livelihood earning horticultural crop among the farmers of arid and semi-arid regions of India. With constant increase in area and production of this crop and changing climatic scenario and unpredicted rainfall patterns farmers are facing several issues. The major issues are - problems in defoliation, no flowering, flower/fruit drop, healthy planting material, diseases insect pests and abiotic problems and handling over production/low grade fruits. The Centre has several technologies for all major problems as well as success stories.

The Centre developed IDIPM and INM Schedule for successful management of bacterial blight- and other diseases. Based on wide spread demonstrations (53 nos. in 3 states Maharashtra, Karnataka and Andhra Pradesh) and adoption of technology all over India- (i) Blight reduction was 86 to 100 % in different orchards

(ii) Marketable Yield increased by 25- to 486.66% (iii) Saved on cost up to 25%; and Average Benefit: Cost:: 1: 4.19 (Max up to 1:20). Stem solarization technology to manage bacterial blight – developed by ICAR-NRCP is economical, ecofriendly and most effective methodology even in organic orchard with 100% blight control if done in community approach. Management schedule for wilt using promising market bioformulations having *Aspergillus niger* AN 27 or chemical drenching with tebuconazole, fosetyl- Al or propiconazzole successfully checks wilt. technology for mass production of tissue culture plants along with bio-hardening developed and disseminated. technologies for value added products of pomegranate juice, ready–to-serve (rts) beverage, technology for minimal processing of pomegranate arils, technology for sparkling pomegranate wine & pomegranate seed oil have been developed and commercialized. Technology for mass production of *Penicillium pinofillum* – a novel Potash and phosphorous solubilizer- commercialized and patented. New promising varieties for processing 'Solapur Lal' and 'Solapur Anardana also have been released.' Apart from these some technologies are in the pipeline. The Centre transferred developed technologies to stakeholders in Maharashtra and other pomegranate growing states. ICAR-NRCP has developed Mobile App called 'Solapur Anar'. The app provides information on all aspects of pomegranate production and value addition, in six languages *viz* English, Hindi, Marathi, Kannada, Telagu, and Gujarati. Also started '*Dalimb Mitra'* platform for farmer scientist interactions and inputs in 4 languages. Detailed advisories and schedules are available on our website link https://nrcpomegranate.icar.gov.in/files/Advisory

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Dr. P.L. Saroj, PS, ICAR-CISH, Lucknow, UP
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PHC Coordinator

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NAU Coordinators

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Dr. N. M. Chauhan - Dte. of Extension Education, NAU, Navsari

Organizing Secretary

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Dr. Dev Raj - Prof. and Head, PHT, NAU, Navsari

Dr. C. G. Intwala – Prof. and Head, Veg. Sci., NAU, Navsari

Dr. V. K. Parmar – Prof., Head of Fruit Sci., NAU, Navsari Co-Coordinators

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Dr. Lalit Mahatma - ADR, NAU, Navsari

Dr. C. R. Naik - Comptroller NAU, Navsari

Dr. Amit Lathiya, Planning Officer

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Dr. Parag Pandit - Deptt. of PHT, NAU, Navsari

Dr. H.P. Shah - Deptt. of Floriculture NAU, Navsari

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Dr. P. R. Pandey - Executives Engineer, NAU, Navsari

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Dr. D. R. Bhanderi - Prof., Deptt of Veg. Sci., NAU, Navsari

Dr. A. R. Kaswala - Head, NRM, NAU, Navsari

Dr. Alpesh Leua - Head, Deptt. of Economics, NAU, Navsari

Dr. Rehana - Head, Deptt. of Basic Science, NAU, Navsari

Dr. S. L. Chawla - Deptt. of Floriculture NAU, Navsari

Dr, R. V. Tank, Assoc. Prof., Deptt. of Fruit Sci., NAU, Navsari

Dr. Y. N. Tandel - Assoc. Prof., Deptt. of Fruit Sci., NAU, Navsari

Dr. Ajay Narvade - Assoc. Professor, NAU, Navsari

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Dr. Shivam Bhatt- Deptt. of Floriculture NAU, Navsari

Dr. G.D. Patel- Deptt. of Floriculture NAU, Navsari

Dr. Jimi Vashi - Deptt. of Vegetable Science NAU, Navsari

Dr. N. K. Patel - Deptt. of Vegetable Science NAU, Navsari

Dr. Swati Sharma - ABM, NAU, Navsari

Dr. D.S. Mishra - CHES, ICAR- CIAH, Godhra

Dr. Manjushree Singh - Deptt. of Agri. Engineering, NMCA

Dr. Pankaj Bhalerao - Deptt. of Fruit Science, NAU, Navsari

Dr. Pramod Dubey - NRM, NAU, Navsari

Dr. Vipul Shinde - NAU, Navsari

LOCAL ORGANISING COMMITTEE

1. Central Committee:

Dr. T. R. Ahlawat	**DR & Dean PGs, NAU**	**Convener**	**Responsibility**
Dr. H. V. Pandya	Registrar, NAU, Navsari	Co-Convener	• To supervise the overall activity of the event.
Dr. N. M. Chauhan	Director of Extension Education	Co-Convener	
Dr. Alka Singh	Dean & Principal, ACH	Co-Convener	• To provide guidance to various committees for smooth and hazel free event.
Dr. R. M. Naik	Dean & Principal, NMCA	Member	
Dr. P. R. Pandey	Executive Engineer, NAU	Member	
Dr. V. R. Naik	ADR, NAU, Navsari	Member	
Dr. Lalit Mahatma	ADR, NAU, Navsari	Member	
Mr. C. B. Naik	Comptroller NAU	Member	
Dr. Dev Raj	Professor & Head, PHT, ACH	Member	
Dr. C. G. Intwala	Professor & Head, Veg.Sci.ACH	Member	
Dr. V. K. Parmar	Professor & Head of Fruit Sci.ACH	Member	
Dr. Amit Lathiya	Planning Officer, NAU	Member	
Dr. A. K. Pandey	Department of Fruit sci.	Member	
Dr. Parag Pandit	Department of PHTC	Member	
Dr. H. P. Shah	Department of FLA	Member	

2. Finance Committee:

Dr. Alka Singh	**Dean & Principal, ACH**	**Convener**	**Responsibility**
Dr. C. G. Intwala	Professor & Head, Veg.Sci.,ACH	Co-Convener	• Financial collection and expenditure for the conclave
Dr. Dev Raj	Professor & Head, PHT, ACH	Member	
Dr. S. Y. Patel	Asso. Prof. ACH	Member	• Maintaining of record
Dr. B. M. Tandel	Asso. Prof. ACH	Member	
Dr. Y. N. Tandel	Asso. Prof. ACH	Member	
Dr. N. K. Patel	Asst. Prof., ACH	Member	
Dr. J. M. Vashi	Asst. Prof., ACH	Member	
Dr. A. K. Pandey	Asst. Prof., ACH	Member	
Ms. Swati Ganvit	Asst. Prof., ACH	Member	

3. Welcome and Invitation Committee:

Dr. Alka Singh	**Dean & Principal, ACH**	**Convener**	**Responsibility**
Dr. C. G. Intwala	Professor & Head, Veg.Sci.ACH	Co-Convener	• To invite dignitaries & guests for event.
Dr. Dev Raj	Professor & Head, PHT, ACH	Member	
Dr. Rehana Niyaria	Asso. Prof. & Head, Basic Sci.,ACH	Member	• To Prepare invitation card
Dr. R. V. Tank	Asso. Prof, ACH	Member	
Dr. A.K. Pandey	Asst. Prof., ACH	Member	
Dr. A. I. Patel	Asst. Prof., ACH	Member	
Dr. Shivam Bhatt	Asst. Prof., ACH	Member	
Dr. Vipul Shinde	Asst. Prof., NMCA	Member	

4. Registration Committee:

Dr. Anand Kaswala	**Asso. Prof & Head, NRM, ACH**	**Convener**	**Responsibility**
Dr. Rehana Niyaria	Asso. Prof. & Head, Basic Sci., ACH	Co-Convener	• Registration of participants, Kit preparation and distribution.
Dr. Niketa Patel	Asst. Prof., ACH	Member	
Dr. Nilam V. Patel	Asst. Prof., ACH	Member	
Dr. Dixita Prajapati	Asst. Prof., ACH	Member	
Dr. Smita Gupta	Asst. Prof., ACH	Member	
Dr. M. P. Ahir	Asst. Prof., ACH	Member	

5. Farmer's Interaction Committee:

Dr. B. M .Tandel	**Asso. Prof. ACH**	**Convener**	**Responsibility**
Dr. K. I. Shah	Senior Scientist & Head, KVK	Co-Convener	• To arrange for the farmers Interaction session
Dr. A. R. Kaswala	Asso. Prof., ACH	Member	
Dr. B. M. Tandel	Asso. Prof., ACH	Member	
Dr. Hemant Sharma	Asso. Prof., ACH	Member	
Dr. J. M. Vashi	Asst. Prof., ACH	Member	
Dr. Rashmikant Gurjar	Scientist, KVK, NAU	Member	
Dr. M. A. Patel	Asst. Prof., ACH	Member	
Dr. Snehal Patel	Asst. Prof., ACH	Member	
Dr. H. M. Patel	Asst. Prof., ACH	Member	

6. Registration Committee:

Dr. Alka Singh	**Dean & Principal, ACH**	**Convener**	**Responsibility**
Dr. Dev Raj	Professor & Head, PHT, ACH	Co-Convener	• To Prepare abstract book & compendium.
Dr. Parag Pandit	Asst. Prof., ACH	Member	
Dr. H. P. Shah	Asst. Prof., ACH	Member	
Dr. A. K. Pandey	Asst. Prof., ACH	Member	

7. Technical Committee for Oral Presentation:

Dr. K. D. Desai	**Asso. Prof. ACH**	**Convener (Hall-1)**	**Responsibility**
Dr. J. M. Vashi	Asst. Prof., ACH	Co- Convener	• To Organize / arrange oral presentation in all sessions
Dr. Dixita Prajapati	Asst. Prof., ACH	Member	
Dr. Kiran Suthar	Asst. Prof., ACH	Member	
Dr. A. K. Leua	Asso. Prof. ACH	**Convener (Hall-2)**	
Dr. Sudha Patil	Asst. Prof., ACH	Co- Convener	
Dr. Smita Gupta	Asst. Prof., ACH	Member	
Ms. Parmeshwari Chaudhari	Asst. Prof., ACH	Member	
Dr. A. R. Kaswala	Asso. Prof. ACH	**Convener (Hall-3)**	
Dr. G. D. Patel	Asst. Prof., ACH	Co- Convener	
Dr. Nilam Patel	Asst. Prof., ACH	Member	
Mr. Kunjal Chauhan (for all hall)	Ag Ast., ACH	Member	

8. Technical Committee for Poster Presentation:

Dr. Parag Pandit	**Asst. Prof. ACH**	**Convener**	**Responsibility**
Dr. A. I. Patel	Asst. Prof., ACH	Co-Convener	• To organize / arrange poster presentation activity
Dr. Rajesh Ardeshna	Asst. Prof., ACH	Member	
Dr. A. P. Chaudhary	Asst. Prof., ACH	Member	
Dr. F. M. Sahu	Asst. Prof., ACH	Member	
Dr. Himani Patel	Asst. Prof., ACH	Member	
Dr. Hetal Rathod	Asst. Prof., ACH	Member	

9. Stage and Inaugural Committee:

Dr. Alka Singh	**Dean & Principal, ACH**	**Convener**	**Responsibility**
Dr. S. L. Chawla	Asso. Prof. ACH	Co-Convener	• Stage setup, setting of inaugural & Valedictory ceremony, arrangement of flower bouquet, dais table, during inaugural and valedictory session.
Dr. H. P. Shah	Asst. Prof. ACH	Member	
Dr. M. A. Patel	Asst. Prof., ACH	Member	
Dr. G. D. Patel	Asst. Prof., ACH	Member	
Dr. Shivam Bhatt	Asst. Prof., ACH	Member	
Dr. Dipal Bhatt	Asst. Prof., ACH	Member	• To arrange flower bouquet, session table decorum in technical sessions etc
Ms. P. Chaudhari	Asst. Prof., ACH	Member	
Dr. Sudha Patil	Asst. Prof., ACH	Member	
Dr. Tejas Ahir	A.O., ACH	Member	

10. Stage and Inaugural Committee:

Dr. Alpesh Leua	**Asso. Prof., ACH**	**Convener**	**Responsibility**
Dr. Manjushree Singh	Asst. Prof., NMCA	Co-Convener	• To make arrangements for accommodation
Dr. P. D. Solanki	Asst. Prof., ACH	Member	
Dr. Arvind Chaudhari	Asst. Prof., ACH	Member	

11. Food and Refreshment Committee:

Dr. Dev Raj	**Professor, ACH**	**Convener**	**Responsibility**
Prof. O. U. Vadaviya	Asst. Prof., NMCA	Co-Convener	• To make arrangements of lunch, dinner and tea-Snacks, water, *etc*. during the conclave tea-Snacks, water, *etc*. during the conclave
Dr. Ajay Narwade	Asso. Prof., NMCA	Member	
Dr. H. P. Shah	Asst. Prof., ACH	Member	
Dr. Shivam Bhatt	Asst. Prof., ACH	Member	
Dr. Vipul B. Patel	Asst. Prof., COF	Member	
Dr. Niketa B. Patel	Asst. Prof., ACH	Member	
Dr. Viral Prajapati	Asst. Prof., ACH	Member	

12. Exhibition cum Stall Committee:

Dr. Narendra Singh	**Professor & Head, Ag. Eco., NMCA**	**Convener**	**Responsibility**
Dr. Alpesh Leua	Asso. Prof., ACH	Co-Convener	• To set the exhibition and stalls
Dr. Nilam Patel	Asst. Prof., ACH	Member	
Dr. H. P. Shah	Asst. Prof., ACH	Member	
Dr. A. K. Senapati	Asst. Prof., ACH	Member	
Dr. N. K. Patel	Asst. Prof., ACH	Member	
Dr. G. D. Patel	Asst. Prof., ACH	Member	

13. IT Support Committee:

Dr. H. V. Pandya	**Registrar, NAU**	**Convener**	**Responsibility**
Mr. Chirag Nayak	Comptroller, NAU	Co-Convener	• To maintain non-interrupted internet connection.
Dr. Bhavesh Chaudhary	IT Cell, NAU	Member	• To control the unwanted disturbance during presentations
Mr. Sunil Patel	IT Cell, NAU	Member	
Mr. Manan Bhatt	IT Cell, NAU	Member	
Mr. Chetan Lad	IT Cell, NAU	Member	
Mr. Mayur Bhathera	IT Cell, NAU	Member	

14. Accommodation Committee:

Dr. D. R. Bhanderi	**Professor & Head, Veg. Sci., ACH**	**Convener**	**Responsibility**
Dr. Dev Raj	Professor & Head, PHT, ACH	Co-Convener	• To make arrangements for accommodation
Dr. A. I. Patel	Asst. Prof., ACH	Member	
Dr. Jilen M. Mayani	Asst. Prof., ACH	Member	
Dr. Pankaj Bhalerao	Asst. Prof., ACH	Member	
Dr. Kiran Suthar	Asst. Prof., ACH	Member	
Dr. P. Dubey	Asst. Prof., ACH	Member	
Dr. P. D. Solanki	Asst. Prof., ACH	Member	
Dr. V. P. Prajapati	Asst. Prof., ACH	Member	
Dr. Sudha Patil	Asst. Prof., ACH	Member	
Shri. Sanjay Rabari	Senior Clerk, EE	Member	

15. Transport Committee:

Dr. S. L. Chawla	**Asso. Prof., ACH**	**Convener**	**Responsibility**
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Dr. P. Dubey	Asst. Prof., ACH	Member	
Dr. A. K. Senapati	Asst. Prof., ACH	Member	
Dr. H. G. Suthar	Asst. Prof., ACH	Member	
Dr. A. K. Pandey	Asst. Prof., ACH	Member	
Dr. K.B. Patel	Asst. Prof., ACH	Member	
Dr. Rajesh Ardeshna	Asst. Prof., ACH	Member	

16. Press and Media Committee:

Shri G. V. Savani	**Asso. Prof., ACH**	**Convener**	**Responsibility**
Dr. Sumit Salunkhe	Scientist, KVK. Navsari	Co-Convener	• To Arrange press & media,photography and videography of event
Dr. Pushpraj Solanki	Asst. Prof., ACH	Member	
Dr. D. J. Chaudhary	Asst. Prof., ACH	Member	
Dr. Dixita Prajapati	Asst. Prof., ACH	Member	
Dr. Tulsi Gurjar	Asst. Prof., ACH	Member	
MS. Swati Ganvit	Asst. Prof., ACH	Member	

17. Cultural Committee:

Dr. V. K. Parmar	**Professor, ACH**	**Convener**	**Responsibility**
Dr. Sudha Patil	Asst. Prof., ACH	Co-Convener	• To arrange for cultural program and musical event
Dr. Manish Ahir	Asst. Prof., ACH	Member	
Dr. Tulsi Gurjar	Asst. Prof., ACH	Member	
Dr. Priyanka Patel	Asst. Prof., ACH	Member	

18. Student Award Committee:

Dr. R.V. Tank	**Asso. Prof., ACH**	**Convener**	**Responsibility**
Dr. Parag Pandit	Asst. Prof., ACH	Co-Convener	• To make arrangement for the screening of students award
Dr.Tulsi Gurjar	Asst. Prof., ACH	Member	
Dr. Smita Gupta	Asst. Prof., ACH	Member	

19. Masters of Ceremony:

Dr. Mehul Thakkar	**Asso. Prof. AABMI**	**Convener**	**Responsibility**
Dr. Swati Sharma	Asst. Prof. AABMI	Co-Convener	• Anchoring during the inaugural and valedictory function
Prof. Jaimin Naik	Asst. Prof., NMCA	Member	

NOTES

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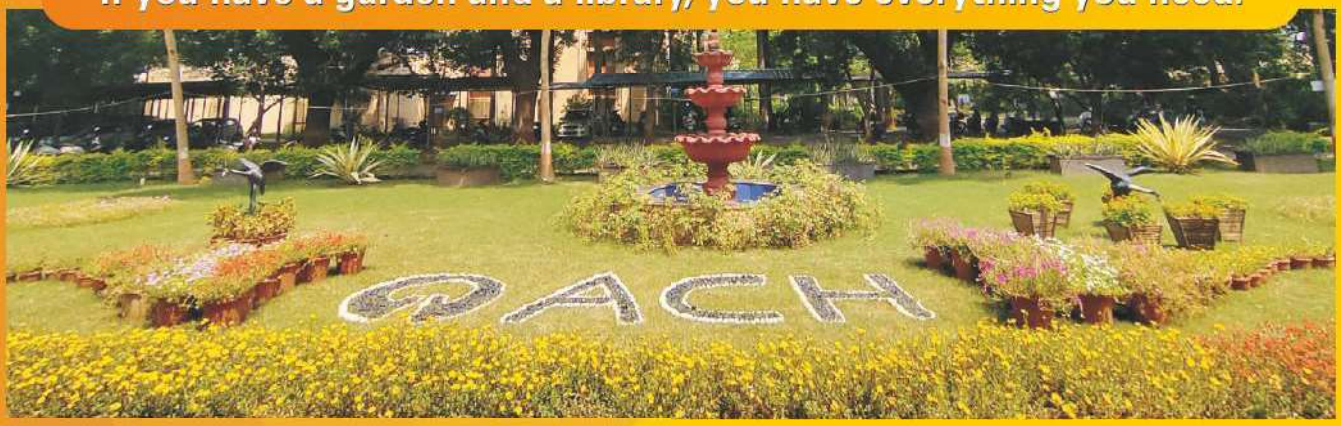

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