10th Indian Horticulture Congress 2023

Indian HortiCulture Congress-2023

G20 भारत 2023 INDIA

UNLEASHING HORTICULURAL POTENTIAL FOR SELF-RELIANT INDIA

ABSTRACT BOOK

College of Veterinary Science Campus, Assam Agricultural University,
Khanapara, Guwahati

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Citation:

Patel V.B., Prakash J., Dey, S.S., Sharma, R.M., Singh Shrawan, Namita, Sharma Sanjib, Deka Bhabesh. 2023. *Poster Papers Abstract Book on the 10th Indian Horticulture Congress Unleashing Horticultural Potential for Self-reliant India*, held at College of Veterinary Science Campus,Assam Agricultural University, Khanapara, Guwahati, Assam, India from 06-09, November, 2023,organized by the Indian Academy of Horticultural Sciences, P.260.

Published by:

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F-1, Societies Block, NASC Complex, DPS Marg,
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Composed and designed at:

Amit Sharma, Naraina, New Delhi

FOREWORD

India is currently producing about 351.92 million tons of horticulture produce, which has surpassed the food grain production. The area under horticulture crops has increased from 12.8 million ha in 1991-92 to 28.04 million ha in 2021-22, resulting in a cumulative increase of 100 % during the last 30 years. India has emerged as a world leader in producing various fruits like mango, banana, guava, papaya, sapota, pomegranate, Lime, and aonla. However, with the rapid evolution of new technologies and tools, there is an urgent need to adopt and apply these tools for the rapid advancement of this vital sector. Rapid advancement in production technologies, improvement of crop plants, Artificial Intelligence (AI), Machine Learning (ML), Big data and next-generation sequencing and development of new pipelines for analysis of the genomics data opened several new avenues for precise cultivation and designing of new crop varieties in horticulture. The Congress will discuss the most relevant and emerging issues related to improvement, role in the food and pharma industry, precise cultivation, approaches to meet the emerging biotic and abiotic stresses, and application of AI, ML, data and genome editing tools in horticulture. Particular emphasis will be given to the potential of North-East India as a hub for horticultural production and export.

On behalf of the Indian Academy of Horticultural Sciences, I take this opportunity to profusely thank the members of the Organizing Committee, Local Organizing Committee, Office Bearers & members of the Executive Committee of the academy; faculty, students and staff members of the Assam Agricultural University, Jorhat, Assam and Veterinary College Campus, Khanapara, Guwahati, Assam, Chairmen/Co-chairmen/Conveners/Rappoteurs and the team members of different Committees who have toiled hard in organizing the 10th Indian Horticulture Congress-2023 in a befitting manner. I would also like to place

On record our gratitude to all the public and private organizations supporting the Congress, namely, Ministry of Agriculture and Farmers Welfare, GoI, Govt. of Assam, Indian Council of Agricultural Research, Assam Agricultural University, Jorhat, Assam; IPL Biologicals Limited, Coconut Development Board, National Horticulture Board, Alliance of Bioversity International and CIAT, North Eastern Council and APEDA for co-sponsoring the event. I am immensely thankful to the Ministry of Agriculture and Farmers Welfare, Dr Bidyut C. Deka, Vice Chancellor, Assam Agricultural University, Jorhat, for co-hosting the Congress. My special appreciation is for the Core team at the Secretariat of the Organizing Committee, namely, Dr V.B. Patel, Secretary, IAHS; Dr S.K. Singh and Dr D. R. Singh, Vice President; Dr Jai Prakash, Treasurer; Dr Shyam Sundar Dey, Joint Secretary, Dr Ananta Saikia, Local Organising Secretary, and several others who have made significant contributions. Sincere efforts of the Academy Secretariat staff, namely, Ms Preeti Gaba, Ms Ishita Srivastav and Mr

Sanjeev Kumar, are duly acknowledged. Thanks to the Chairmen, Conveners and members of different Local Organising sub-committees for their wholehearted support in organizing this Congress. I am equally thankful to Editorial team Dr V.B. Patel, Dr Jai Prakash, Dr S.S. Dey, Dr R.M. Sharma and Dr Shrawan Singh, Dr Namita, Dr Sanjib Sharma and Dr Bhabesh Deka and several others who have made significant contribution in preparing abstract book of the poster papers of the Congress.

The Congress would generate meaningful discussions culminating in more relevant recommendations, which can be projected to different agencies for consideration in framing policies and developmental programs to improve the productivity of horticultural crops and the income of horticultural farms.

I wish every Congress participant a pleasant stay at Guwahati, participating in fruitful discussions and good luck for their future endeavours. The IAHS family gives all delegates a Very Happy and Prosperous New Year 2024.

K.L. Chadha

(K.L. Chadha)

10th November, 2023

President IAHS & Chairman, National Organizing Committee

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10th Indian Horticulture Congress-2023

College of Veterinary Science Campus, Assam Agricultural University, Khanapara, Guwahati

Technical session	Session title	Date	Time
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I and II	Elite Germplasm and Variety Development and Trait Specific Breeding	07-11-2023	14.30-17.30 Hours
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VI	Innovation for Sustainable Horticultural Productions-I (1-50)	08-11-2023	09.30-11.30 Hours
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	Innovation for Sustainable Horticultural Productions-II (51-85)	08-11-2023	12.00-13.30 Hours
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VII	Horticulture in North-Eastern India	08-11-2023	14.30-17.30 Hours
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Technical Session - I
Elite Germplasm and Variety Development and Trait Specific Breeding

Performance of genotypes for their quality parameters in fenugreek *(Trigonella foenum graecumL.)*

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Fenugreek *(Trigonella foenum graecum L.)* is one of the oldest crops of the world and grown for its medicinal values such as antidiabetic, anticarcinogenic, hypo cholesterolemic, antioxidant, and immunological activities. It is a self-pollinated crop belonging to the family Fabaceae. Fenugreek is a legume, and it has been used as a spice throughout the world to enhance the sensory quality of foods. It is grown both for seed spice and leafy vegetable purposes as well. Seeds have carminative property, and they contain protein (20-30%), carbohydrate (45-60%) and enriched in saponins (4.8%), lipid (5-10%), diosgenin content (0.11-0.92%). The present investigation was carried out at Agricultural Research Station, Ummedganj, Agriculture University, Kota, Rajasthan to evaluate "Performance of genotypes for their quality parameters in fenugreek (Trigonella foenum graecumL.)"during Rabi 2022-2023. This consisted of 30 genotypes of fenugreek (IC 255546, IC 264840, IC 266803, IC 391327, IC 396625, IC 397447, IC 572849, IC 572875, IC 585601, IC 595312, FGK 84 (LFC-90), FGK 125, FGK 127, FGK 135, KFG 1, KFGK 4, KFG 12, KFG 17, KFGK 18, KFG 24, Afg 1, Afg 2, Afg 3, Hisar Sonali, Pusa Early Bunching, PNF 1, PNF 6, PNF 7, NDM 21 and NDM 16). Observations such as diosgenin, total phenol, protein and oil content in seed (%). The genotype viz. Afg-3(22.5 %), PNF-7(21.64%) and KFG-17(21.09%) found superior for protein content recorded in this experiment. The essential oil content found higher in genotypes viz. FGK-135(7.80%), KFG-1(7.60%) and KFGK-4 (7.20%).

Study on effect of mutagen doses on genetic variability and character association in M1 generation of *Momordica balsamina L.*

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Momordica balsamina L. commonly known as the Balsam apple is an annual to perennial, tendril-bearing herb, native to tropical regions of Africa. Since the crop is wild type in nature, the variation exists among the genotype is limited. For the improvement of plant characteristics in diverse crops, mutation breeding has been extensively applied. The treated population was evaluated to study the extent of genetic variability and character association on growth and yield parameters of Momordica balsamina L. the results revealed that fruit yield per plant showed highly significant and positive association with number of fruits per plant, fruit weight, fruit length and days to first flowering. Whereas, highly significant but negative association was revealed by number of branches per plant at harvest, stem diameter and days to 50 per cent flowering among mutant population. Whereas, vine length at harvest, number of fruits per plant, fruit weight, fruit length and fruit girth recorded highest positive direct effect on fruit yield per plant. While, number of branches per plant at harvest, stem diameter and days to 50 per cent flowering exerted negative direct effect on fruit yield per plant.

Genetic variability and character association studies in mutagen treated M2 population of *Momordica balsamina L.*

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Momordica balsamina L. is an under-exploited cucurbit vegetable occurring wild type in nature which offers various nutraceutical properties. Since the crop occurs in wild forms, the existence of genetic variability is meagre. Mutation acts as a beneficial tool to create variation among the genotypes in diverse crops. In the present study, physical (gamma rays) and chemical mutagen (EMS) treated population was evaluated to study the extent of genetic variability and character association on growth and yield parameters in M2 generation of *Momordica balsamina* L. The results revealed that high heritability was exhibited by vine length at harvest, number of branches per plant at harvest, stem diameter, leaf area, and number of fruits per plant, fruit girth, fruit thickness, lycopene content, β-carotene content and ascorbic acid content. As per the character association studies, fruit yield per plant showed highly significant and positive association with number of fruits per plant, fruit weight, fruit length and days to first flowering. Whereas highly significant but negative association was revealed by number of branches per plant at harvest, stem diameter and days to 50 per cent flowering among mutant population. Whereas vine length at harvest, number of fruits per plant, fruit weight, fruit length and fruit girth recorded highest positive direct effect on fruit yield per plant. While number of branches per plant at harvest, stem diameter and days to 50 per cent flowering exerted negative direct effect on fruit yield per plant.

Estimation of heterosis combining ability and multivariate analysis using b i-plot approach for yield and its contributing traits in bitter gourd *(Momordica charantia L.)*

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Bitter gourd (Momordica charantia L.) which is popularly known as bitter cucumber, bitter melon or karela is one of the vegetables belonging to cucurbitaceae family. A potential source of iron and popular for its anti-diabetic property due to the presence of charantin. Despite the crop potential, economic and its medicinal use the present investigation on “Estimation of heterosis, combining ability and multivariate analysis using bi-plot approach for yield and its contributing traits in bitter gourd (Momordica charantia L.)” was undertaken at Vegetable Science unit of Kittur Rani Channamma College of Horticulture, Arabhavi, Belagavi district, Karnataka. The present study was undertaken using nine lines and three testers to develop 27 F1 hybrids in L × T (Line × Tester) pattern. rosses were evaluated along with their parents and commercial check in randomized block design with three replications. Evaluation of hybrids along with their parents revealed that Jonpuri, Katahi Vaibhav and HUB-1 were found to be high general combiners for traits under study. The cross combinations HUB-1 × Co-1, HUB-1 × White Long and Katahi Vaibhav × White Long showed highest SCA effect and positive heterosis, which were supercilious for earliness, yield and quality parameters resulting as best hybrids. Based on its yield potential and favoured earliness characteristics, the gynoecious HUB-1 × Co-1 hybrid was chosen as the best hybrid out of 27 cross combinations, with a yield of 18.38 t/ha, the hybrid showed 104.40 per cent standard heterosis over commercial check. The hybrids Jonpuri × White Long and HUB-1 × Co-1 expressed superior quality parameters like beta-carotene, ascorbic acid and iron content. The gynoecious based hybrid HUB-1 × Co-1 showed resistant reactions for virus and fruit fly infestation, which further can be used in resistant breeding programme. All the characters studied exhibited non-additive gene interaction. So, hybridization, recurrent selection and marker assisted selection can be used to improve these traits. Hence the best hybrids are recommended for commercial exploitation of heterosis.

US characterization and evaluation of untapped French bean *(Phaseolus vulgaris L.)* genotypes

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French bean is being considered as an important legume for human diet having rich source of dietary proteins, minerals and vitamins. Being an annual legume vegetable, French bean is widely cultivated and a rich diversity in germplasm is observed in the country due to geographical separation and natural mutation over period. Substantial phenotypic and genetic characterization of untapped French bean germplasm is still needed to unlock its breeding potential. Germplasm characterization and evaluation is having great contribution in breeding and crop improvement. Purposefully, 27 diverse French bean genotypes comprising primitive, cultivars, commercial cultivars, farmers grown varieties were collected from different parts of India, characterized as per Distinct, Uniformity and Stability (DUS) and evaluated for associated morpho-phenological traits in randomized complete block design. The screened panel revealed highly significant differences among French bean genotypes for all the traits under study which witnessed the existence of sufficient variability in the French bean genotypes in which first two axis of Principal Component Analysis (PCA) explained 20.03% and 13.32% of the total morphological variability. Eigenvalue revealed growth habit, flower colour, pod shape, pod pigmentation and pod stringiness exhibited greater contribution towards total variations. The genotypes were well scattered in PCA axis forming groups with various traits as per contribution towards the variability. The genotype IC 632961 has desirable traits which could be an elite germplasm for future crop improvement.

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

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Tomatoes (*Solanum lycopersicum*) are a widely cultivated fruit that exhibit considerable genetic diversity. This diversity can be observed in various aspects of tomatoes, including their fruit size, shape, color, taste, disease resistance, and adaptation to different environmental conditions. The experiment was conducted during the Rabi season of 2020–21 at the Vegetable Research Farm of the Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi–221005. D2-statistics revealed that fruit yield per plant contributed the maximum to genetic diversity, followed by Lycopene content, seed test weight, ascorbic acid and fruit weight. Fifteen genotypes with 18 traits of tomato were assessed and based on D2 values the genotypes were grouped into five clusters. The maximum number of genotypes (6) were found in cluster II (VRT-34, ToLCV-16, Kashi Amrit, VRT-30, ToLCV-28 and Navodaya) where as cluster IV (VRT-19) and cluster V (VRT-13) were mono genotypic clusters. The inter-cluster highest distance is present in Cluster 3 and Cluster 4, while Cluster 3 has the maximum intra-cluster distance followed by Cluster 2 and Cluster 1. Cluster mean for yield per plant and number of fruits per plant were observed in Cluster 3 which demonstrated that there is sufficient scope for improving the tomato yield through hybridization and selection.

Assessment of genetic variability in segregating generation of *Lagenaria siceraria (mol.)* Standl

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Presence of genotypic and phenotypic variability is prerequisite for crop improvement. The study conducted in F3 and F4 generations of bottle gourd cross GH-28 × Pusa Santushti at CCS HAU, Hisar during spring-summer and rainy seasons of 2021–22 confirmed presence of variability in various yield and yield contributing traits. Fruit yield per hectare recorded high GCV (28.75 % and 24.63%), high PCV (33.45% and 29.42%), high heritability (73.89% and 70.10%) and high genetic advance (50.91% and 42.49%) in F3 and F4 generations, respectively. High GCV (22.53%) and high PCV (23.23%) in F3 generation and moderate GCV (16.09%) and moderate PCV (16.91%) in F4generationwith high heritability (94.06% and 90.51%) and high genetic advance (45.00% and 31.53%) in F3 and F4 generation, respectively were recorded for fruit length. Average fruit weight reported high GCV (20.09%) and PCV (22.79%) in F3, whereas moderate GCV (18.11%) and high PCV (21.05%) in F4 with high heritability (77.67% and 74.02%) along with high genetic advance (36.47% and 32.09%) in F3 and F4 generations, respectively. Progeny 4 outperformed in terms of yield contributing traits. Greater GCV values than PCV indicated negligible effect of environment on the trait expression. The fluctuation in genetic variability values across generations indicated heterozygosity, which may be fixed once homozygosity is achieved in subsequent generations.

General and specific combining ability studies for growth, yield and yield attributing traits in tomato *(Solanum lycopersicum L.)* under protected condition

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Study entitled “Heterosis and combining ability studies in tomato under protected condition” was undertaken to estimate the combining ability effects to find out the superior cross combinations for their further exploitation. The experimental material comprises of five parents viz., EC 362941, EC 15127, EC 521061, EC 521069 and VRT 13 with their twenty crosses developed by full diallel mating design. The parents and hybrids were randomized separately and sown using Randomized Block Design during 2020-21. The results revealed that the parents EC 362941 and VRT 13 were considered as good general combiners for most of the growth, yield and yield attributing characters. The most significant desirable SCA effect was observed by the cross-combination EC 362941 x EC 15127 for the traits viz., minimum days to first harvest, yield per plant, yield per hectare, average fruit weight, fruit length. GCA to SCA ratio was lesser than the unity for most of the traits indicating the predominance of non-additive gene action which can be improved through heterosis breeding.

Breeding for Fusarium wilt resistance in watermelon *(Citrullus lanatus var. Lanatus thunbmatsum. &Nakai)*

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Watermelon is believed to be domesticated over 4,000 years ago in Northeast Africa. It is a good source of minerals, nutrients and antioxidants, it is a hydrating fruit, and it promotes health and prevents health risk. Fusarium wilt is one of the most economically important disease of watermelon. The disease is widespread across worldwide, and cause yield losses about 100%,under severe conditions. Fusarium wilt biotic stress is responsible for significant crop losses in India, caused by the fungus Fusarium oxysporum f. sp. niveum (Fon). The commercial cultivars have resistance to Fusarium wilt (Fon race 0, 1& 2), race 0 is only able to infect varieties with no specific resistance genes, while race 1 can overcome the resistance gene present in most of the commercial varieties, and thus it is the most prevalent race. Race 3, which can overcome, the race 2 resistance gene, was recently detected. Resistance to F. oxysporum f. sp. niveumraces 1and 2 were discovered in the genotypes PI296341-FR, IC0523048, EC794455, and EC759804. The genetic inheritance ofFusarium wilt resistance, its nature of gene action

governed by two major complementary dominant genes with modifying genetic factors. Watermelon breeding in India will benefit from the use of Fonrace 1 and race 2 resistant accessions available at ICAR-IIHR, Bengaluru. Results suggest that it can be effectively managed through resistance breeding by introgression into the elite backgrounds.

In vitro conservation and evaluation of genetic fidelity of threatened banana cv. *Nanjanagud Rasabale (AAB)* by slow growth process

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Nanjanagud Rasabale (AAB) is a well-known cultivar mostly cultivated in the Mysore area that has been given a GI tag for its provenance, distinctive flavour, aroma, colour, fibrous texture, and nutritional value. Due to its great susceptibility to the soil-borne panama wilt disease, which is brought on by Fusarium oxysporum f.sp. cubense, this leading cultivar is currently failing to maintain its GI designation. The present investigation was carried out on in vitro conservation by media manipulation using osmotic agents through slow growth culture technique. Shoot tip explants were cultured on MS basal medium supplemented with osmotic agents (mannitol, sorbitol, sucrose and maltose). Among different osmotic agents treated media effective storage (145.66 days) was recorded on sorbitol (35 g/l) supplemented medium. Determination of genetic stability was performed by assessment of Inter Simple Sequence Repeat amplification (ISSR). All the15 primers amplified unambiguous, readable and showed monomorphic bands. The cultures were conserved by extending the subculture period and prolonged storage period without any genetic variation by using growth retardants and osmotic agents.

Mean performance and correlation analysis for yield and quality contributing traits in muskmelon *(Cucumis melo L.)* hybrids

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The present investigation on mean performance and correlation studies for growth, yield and quality attributing traits in muskmelon (*Cucumis melo* L.) hybrid was laid out in randomized complete block design (RCBD) with 3 replications of twentyF1 hybrids from across the country for different yield and quality contributing traits under temperate conditions of Kashmir valley. Analysis of variance revealed significant differences among genotypes for all the traits. The highest average fruit weight was recorded in F1-Sawarna Hybrid (1.63 kg) followed by Madhusree (1.45 kg). The highest fruit yield per plant was recorded in Madhusree (11.52 kg/plant) followed by F1-Tipu-50 (8.62 kg/plant). The highest TSS content was recorded in Madhuri-2(11.57 oBrix) followed by F1-Sawarna hybrid (10.58 oBrix) and Madhusree (10.50 oBrix). The highest Vitamin C content (mg/100g) was recorded in Madhuri-2 (91.44mg/100g) followed by Madhura Diamond (90.86mg/100g). The highest moisture content (%) was recorded in F1-Madhuraj (13.11%) followed by LHM-Madhura (12.66%) and lowest moisture content (%) was observed in Muskmelon Madhuri-2 (8.55%) followed by Madhura diamond (9.13%). The highest shelf life (days) was recorded in F1-Sawarna Hybrid (10.86 days) followed by Madhusree (10.27 days). Correlation coefficient disclosed that the economically important trait i.e., fruit yield per plant exhibited significant positive association with days from last fruit harvest, number of primary branches per plant, number of nodes per vine, node number at which first branched tendril appeared, flesh thickness, fruit length, average fruit weight, number of fruits per plant, fruit yield per plant, vitamin C and shelf life at both genotypic and phenotypic levels. Days to first male flower anthesis, node number at which first male flower appeared and node number at which first female flower appeared exhibited negative and significant association with fruit yield per plant. Based on overall mean performance Madhusree hybrid followed by F1-Tipu-50 and Punjab hybrid had shown highest fruit yield per plant or fruit yield per hectare and significantly superior in quality attributes therefore these hybrids were found suitable to grow in Kashmir conditions.

Combating fusarium wilt and gummy stem blight in watermelon [*Citrullus lanatus* (Thunb.) Matsum & Nakai] through rootstock breeding

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Among the cultivated vegetable crops, Cucurbitaceae forms the largest group. Watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai is one of the most important cucurbitaceous vegetables of the tropics and sub-tropics. Soil-borne pathogens are major production constraints in watermelon, of which fusarium wilt and gummy stem blight are of major importance. Fusarium wilt, caused by *Fusarium oxysporum* f. sp. *niveum* (E.F. Sm.) Synd. & Hans., or FON is the most serious disease globally, causing 100% yield loss. Gummy stem blight (GSB) is an emerging and devastating disease caused by Stagonosporopsis cucurbitacearum (syn. *Didymella bryoniae*), poses a serious threat to its cultivation. It is reported to be seed-borne, air-borneand soil-borne, causing up to 15-50% yield losses. Management of these diseases has strongly relied on the use of chemical soil disinfestation. However, a shift from chemical to non-chemical means of control is underway to ensure environmentally safer measures to accomplish international regulations. Disease-resistant cultivars were developed to limit damages incited by soilborne fungi. However, so far, no commercial hybrids have shown complete resistant to the race 1, 2 of FON and to GSB. But only sources of partially effective quantitative resistances have been reported in watermelon. So, rootstock breeding is one of the best strategies we can opt for securing yield stability under disease conditions in a sustainable manner. Apart from providing resistance to diseases, grafting is said to increase vegetative growth, plant height and fruit quality compared to the non-grafted ones. Providing resistant rootstocks to susceptible scions prevent primary source of infection, resulting in reduced incidence of disease. Globally, to manage soil borne pathogens through non-host resistance, Lagenaria and interspecific Cucurbita hybrid rootstocks are mostly used for grafting watermelon. Grafting onto former resulted in early flowering while the latter was found to be more vigorous with increased fruit weight, 40% increase in fruit lycopene content and increase in total yield was observed. However, the above-mentioned rootstocks have been reported to have undesirable effect on quality parameters. Thus, to eliminate the problems of incompatibility and the detrimental effects on fruit quality, great efforts have been devoted to find or breed watermelon rootstocks, mainly of *Citrullus* species, as a result, *Citrullus amarus* and *Citrullus lanatus* var. citroides possessing resistance to FON and GSB have been identified. But, till date there are no reports of *Citrullus* sp. rootstocks showing combined resistance for fusarium wilt and gummy stem blight in watermelon. Therefore, rootstock breeding programs could address the need to develop new hybrid varieties by combining the desirable characteristics such as disease resistance, fruit quality and adaptability to environmental stress.

Amelioration in economically important traits in spine gourd *(Momordica dioica roxb.)* through applied mutagenesis

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Mutation breeding can sometimes be endeavored along with the conventional breeding efforts, resulting in discovery of some economically useful genetic changes. Genetic and variability evaluation of 96 first generation mutant germplasm lines of Spine gourd (Momordica dioica Roxb.) were evaluated through morphological descriptors and molecular makers. Correlation coefficient analysis, path analysis and cluster analysis supplemented by molecular marker based population structure analysis helped in understanding the population behavior and identification of high yielding lines. Yield was found to be highly positively correlated with days to first flowering, leaf width, single fruit weight and number of fruit per plant. Also, the maximum positive direct effect on yield was shown by single fruit weight followed by number of fruits per plant and leaf width. The population structure analysis revealed 4 clusters of population. Few high yielding lines were identified which approximately yielded 1.5 times more than the checks. Further refinement in these mutant lines through breeding programs coupled with in-depth molecular analysis can lay the foundation of release of some excellent spine gourd varieties in future.

Variability and character associationship study in Faba bean *(Vicia faba L.)* genotypes of Manipur

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Faba bean (Vicia faba L.) is an under-exploited legume vegetable grown on marginal lands in hilly regions of India. It also provides feed and fodder for the livestock and also affects positively on soil productivity. Only the local collections are being grown which yield potential are yet to be properly explored. Considering the above in fact, the present investigation was carried out to study the genetic variability of 21 faba bean genotypes of Manipur. To screen out the best genotype, 18 morphological characters, estimation of coefficients of variability at phenotypic (PCV) and genotypic (GCV) level, heritability (broad sense) and genetic advance were studied. The genetic diversity among twenty-one faba bean genotypes was measured by using D2 statistics (Mahalanobis). The highest estimates of phenotypic (PCV) and genotypic (GCV) coefficients of variation was observed for number of stems per plant (PCV=40.93%, GCV= 37.13%) followed by yield per plant (PCV=35.09%, GCV=33.55%). Higher heritability estimates were recorded for number of stem per plant (99.39%) followed by leaf area (99.31%) and 100 seed weight (99.10%). In the present investigation, genetic advance was high for yield per plant (47.45) followed by 100 seed weight (42.78) and leaf area (25.98). The genetic advance (GA) expressed as % of population mean is genetic gain in which it was high for number of stems per plant (69.38%) followed by yield per plant (66.20%) and leaf area (64.60%). Out of eighteen (18) characters studied 100 seed weight contributed maximum percent towards genetic divergence (44.29%) followed by leaf area (37.14%), plant height (8.57%), leaf length (4.77), pod length (1.43%).

Flower and pollen morphological variations different mango varieties under the Chhattisgarh plains condition

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The success of fertilization and fruit set for higher production in mango crops depends on mostly co-relation on flower biology, pollen morphology, and pollen viability. Mango is most importance tropical fruit crop not only in India but all over the world. In this study, flower biology and palenology among selected ten varieties of mango (Mangifera indica L.) were evaluated to determine the barriers and effective pollination habit for increased productivity while retaining the important traits. It was observed under mango fruit productionis directly co-relation, with flower biology, flower regulatory,numbersofbisexualflowers, pollen viability, that it examination in stereo binocular microscope (Model Nikon- SMZ 745T). The results obtained from the experiment depict that Chhattisgarh Raj was early in flowering while Amrapali was late. Highest number of hermaphrodite flowers (518.00), male flowers (1265.16), total numbers of flowers (1780.16), per cent of hermaphrodite flower (39.52 %) and male flowers (92.76 %) and sex ratio of panicle-1 (14.21) were recorded was Dashehari, Chhattisgarh Gaurav, Chhattisgarh Gaurav, Langra, Chhattisgarh Raj and Chhattisgarh Raj, respectively. Pollen shape was noted in most varieties is sub- prolate group, maximum pollen length (926.79 m) Chhattisgarh Pawan, pollen breadth (752 m) and pollen grain diameter (34.56 m) was in Chhattisgarh Swarnprabha. In case of pollen viability (%) highest viable in Chhattisgarh Gaurav (93.08 %) and maximum fertile pollen was found in Chhattisgarh Gaurav. The results give us important background information for understanding the flower morphology, pollen quality, and intra - specific interaction among local mango varieties, which are national varieties accessions in Chhattisgarh condition to improve production and hybridization.

Phule haridra: a potential variety of turmeric in Maharashtra

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Turmeric is an important spice cash crop of Maharashtra. It is grown in almost all climatic zones of Maharashtra. The area under this crop is increased tremendously in last decades. It was 10086 ha during 2011-12 which was increased to 102162 ha during 2021-22. Even though there is increase in the area 80 % of the farmers are growing traditional Salem variety. This variety is having less curcumin percentage (3.5 to 4.0 %) which is medicinally important and one of the important quality parameter for getting better returns to the farmers. As turmeric is triploid in nature the hybridization is a limiting factor for improvement of the variety. Hence the attempt of mutation breeding is done for development of the new variety. The eighty mother rhizomes of 'Salem' and 'Phule Swarupa' were irradiated with gamma radiation at 1.5 Gy, 2.0 Gy, 2.5 Gy, 5 Gy, 7.5 Gy and 10 Gy. The irradiation dose of gamma radiations at 5 Gy is LD50 for these rhizomes. The promising mutants were selected and grown upto M11 generation for stability as it is a vegetative propagated crop. Among the promising mutants, the mutant KDT-3 is released as 'Phule Haridra' during 2022. It is erect type having average height of 120.71 cm, average number of tillers 3.22, and average number of leaves 11.23 and matures within 8.5 months. This promising variety is having 104.43 g average weight of mother rhizome, 42.56 g average weight of finger and having 7 to 8 fingers per clump with deep orange core colour. The fingers are long thick with shining luster. The curcumin content is 5.35 %, curing recovery is 23 %, Fresh rhizome yield is 406.72 q/ha and dry turmeric yield is 93.56 q/ha. It is tolerant to leaf spot, leaf blotch and rhizomes fly at western Maharashtra condition. It will fetch better price than other ruling varieties in Maharashtra.

Performance of elite genotypes of Fennel *(Foeniculum vulgare mill.)* under Akola conditions

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During the rabi season of 2021-2022, a field experiment was carried out at the Chilli and Vegetable Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola with the objective to study the performance of different fennel genotypes for growth, seed yield, quality parameters and to find out promising genotypes of fennel with higher seed yield and quality under Akola conditions. The experiment was laid out in Randomized Block Design (RBD) with fourteen treatments and three replications. The treatments included twelve genotypes and two check varieties. It was observed that, for growth parameters, the genotype IC-530571 was found to be significantly superior in respect to plant height at 60, 90 and 120 DAS (63.93 cm, 134.23 cm and 170.80 cm respectively) and number of primary branches per plant at 60, 90 and 120 DAS (5.60, 6.67 and 6.90 respectively).For flowering and fruiting parameters, the genotype IC-589328 was found to be significantly earlier in respect to first flowering (66.33 DAS), 50% flowering (90.33 DAS), 75% maturity (101.33 DAS) and 100% maturity (124.67 DAS).As regards to quality parameters, genotype IC-598499 was found to be significantly superior in respect to test weight (5.87 g). Whereas, genotype IC-589328 was found to be significantly superior with respect to weight of seeds per umbel (1.33 g). In respect of yield and yield contributing parameters, genotype IC-598510 was found to be significantly superior in respect to number of seeds per umbel (276.86). Whereas, genotype IC-530571 was found to be significantly superior in respect to number of umbels per plant (17.79), number of umbellates per umbel (24.03), seed yield per plant (20.60 g), seed yield per plot (927 g) and seed yield per hectare (10.30 q/ha).

Study of morpho-molecular diversity in Snake gourd *(Trichosanthes anguina l.)*

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The present investigation entitled “Study of morpho- molecular diversity in snake gourd (*Trichosanthes anguina*L.)” was conducted at College of Horticulture,Venkataramannagudem during late kharif season of 2021-22 with two replications in Randomized Block Design. Total thirty two snake gourd genotypes were evaluated for growth, yield and quality attributes. The results of analysis of variance indicated that mean sum of squares due to genotypes were highly significant for all the characters under study which shows much variation existed among genotypes. Hence, selection can be done for further crop improvement programme. Mean performance among snake gourd genotypes revealed significant differences for all the characters under study, which indicates a great scope for crop improvement through selection. In crop improvement major emphasis was given for high yield and earliness. High magnitude of genotypic coefficient of variation and phenotypic coefficient of variation were recorded for average fruit weight, fruit yield per vine, number of seeds per fruit, node to first female flower, fruit length, fibre content, acidity content and potassium content which suggests the existence of high variation among genotypes and improvement can be done by selection. High heritability accompanied with high genetic advance recorded in traits which indicated that heritability might be due to additive gene effects and selection may be effective. Fruit yield per vine had highly significant positive association with number of fruits per vine, flesh thickness, fruit set percentage, fruit length, average fruit weight, number of female flowers per vine, number of seeds per fruit, and TSS. Thus, the improvement of these traits will be useful for selection in snake gourd. Mahalanobis D2 analysis grouped the genotypes into four major clusters. Out of four clusters, cluster I was the largest, comprising seventeen genotypes followed by cluster II with ten genotypes, cluster III with four genotypes, and cluster IV with only one genotype, suggesting the existence of divergence. The highest inter-cluster distance was found in clusters III and IV followed by clusters I and III. Genetic divergence using Expressed Sequence Tags Simple Sequence Repeats (EST-SSR) markers revealed that a high level of genetic diversity was observed with a total of 21 alleles with a mean of 2.33 alleles per locus. Polymorphic Information Content (PIC) varied from 0.94 to 0.97 with an average of 0.96. The polymorphic EST-SSR markers will be highly useful in genetic fingerprinting and association analysis of yield and yield-related characters in snake gourd.

Morphological characterization of vegetable amaranth *(Amaranthus spp. L.)* accessions and advanced lines for quality and productivity traits

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Sixty diverse Vegetable amaranth genotypes were evaluated in augmented block design (non-replicated RCBD) to study the variability, correlation and genetic diversity for vegetable purpose for quality and productivity traits at the department of vegetable science, COH, Bengaluru during the year 2021-22. The analysis of variance revealed existence of highly significant differences (at p = 0.05) among the genotypes for the characters studied, indicating the higher magnitude of variability in the germplasm. The phenotypic coefficient of variation and genotypic coefficient of variation was maximum for number of leaves, stem weight (g), Stem to leaf ratio, herbage yield per plant (g), herbage yield per plot (kg), leaf area per plant (cm2), leaf size (cm2) and quality traits like vitamin C (mg/100g), leaf fiber (%), stem fiber, magnesium (%), Iron (%) and phenols (%) minimum in case of plant height, stem thickness and leaf moisture (%). High heritability was observed for all the traits, except plant height and stem thickness maximum was recorded for Herbage yield per hectare (99.45 %) and minimum was observed for stem thickness (1.07%) with respect to quality traits maximum in magnesium (%), iron (%) and phenols (mg/100g) of 100 per cent minimum in case of leaf moisture (%). High heritability (h2 = 99.45%) with high genetic advance (GA=92.47%) as percentage of mean was observed for herbage yield per hectare (t) which indicated that additive gene effects were more important for that trait. High genetic advance as per cent of mean was observed for magnesium (%) followed by herbage yield per plant (g) however, lowest for stem thickness (0.27) which indicates the preponderance of additive genes and selection will be effective for improvement of these traits having high heritability with genetic advance as percent of mean. Many of these yield contributing characters are interacted in desirable and undesirable direction, the herbage yield (tonnes) per hectare showed highly positive correlation (p=0.01) with herbage yield/plot (0.999) and dry weight (0.811). Negative (p=0.05) correlation was observed with the days to horticulture maturity (-0.311). Positive but non-significant correlation was observed with number of leaves (0.157), whereas negative but non-significant correlation with stem weight (-0.109) and plant height (-0.081).The K-means Clustering revealed that the 60 amaranthus genotypes along with four checks were grouped into four clusters, based on distance between the clusters i.e., inter-cluster distances, the highest inter cluster distance was noticed in between cluster-III and cluster-II (335.58) followed by the inter cluster distance between cluster-III and cluster-I (234.60), cluster-III and cluster-IV (190.001), cluster-II and cluster-I (173.37), cluster-IV and cluster-II (167.79) and the least inter cluster distance was in between the cluster-I and cluster-IV (125.31). Based on per se performance of genotypes for leaf yield and leaf quality genotypes viz., BVA-10, BVA-38, BVA-37, BVA-27, BVA-21, BVA-30, BVA-A-7, BVA-A-9, BVA-6, BVA-A-8, BVA-41, BVA-17 and BVA-1 were identified as the superior genotypes, which can be further assessed for stability so as to exploit them in commercial cultivation as best vegetable amaranth genotypes.

Genetic diversity studies for morphological and horticultural traits in strawberry *(Fragaria ×ananassa Duch.)*

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Breeding programmes are mainly dependent on the variability present in the cultivars. In order to select superior genotypes on the basis of their phenotypic and genotypic characters and to assess the variability present in them, genetic variability studies have become more important. The level of genetic diversity in strawberry germplasm is of critical consideration in breeding of new strawberry cultivars. Strawberry (Fragaria × ananassa Duch.) is highly heterozygous and suffers rapid loss in vigour, fruit size and yield due to inbreeding. Utilization of the diverse species, regionally adapted cultivars, exotic sources and commercially released varieties is essential for advances in breeding. Study of variability its inheritance, correlation between traits helps to identify the major traits that are responsible for improvement of quality as well as yield of the crop. Evaluation studies performed on different strawberry cultivars showed that cultivars such as Nabila, Camarosa and Douglas performed better than others in terms of vegetative, fruiting and quality parameters under mid hill conditions of Himachal Pradesh. Cluster analysis using D2 statistics, helped in grouping of the cultivars into five groups where it was observed that the best performing cultivars namely Nabila, Camarosa and Douglas clustered into one group. Further, variability studies on different cultivars showed that phenotypic coefficient of variation was more than genotypic coefficient of variation for most of the characters under study indicating towards more impact of environment on the phenotype of the cultivars.

Variability studies in valan kakri (Cucumis sativus var. utilissimus l.) Germplasm

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Valan Kakri is one of the indigenous cucurbit, grown locally in various parts of Udaipur district. It has got tremendous potential for improvement through systematic approach. It is also a native of northern India. As it belongs to the cucumber group, it is having the same genus and species as cucumber. Valan kakri differs from the common cucumber with respect to size, length and keeping quality. The tender fruits can be consumed as a vegetable and also as salad ingredient. Mash cakes can be prepared from the pulp of the fruits. The fruit provides a number of benefits like it helps in weight loss, rehydration as it produces low calories and more fiber content. Different genotypes of Valan kakri were collected from various parts of Udaipur district. All the morphological data were analyzed by ANOVA using Completely Randomized Design. Variation in fruit length ranged from 11.31 cm to 47.48 cm. Fruit weight varied from 532.69 gto 1972.34 g among various Valan kakri genotypes. High magnitude of genotypic as well as phenotypic coefficient of variation were recorded for fruit weight, 100 seed weight, seed cavity length, fruit length, dry matter content, acidity of fruit, ascorbic acid content rind thickness and seed length. Selection would be useful for traits like fruit weight, fruit length, acidity of fruit and ascorbic acid in bringing out the improvement in the Valan Kakri because these traits showed high value of GCV, PCV, heritability and genetic gain.

Studies on morphological and floral traits in different Jasminum genotypes under northern dry zone of Karnataka

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A study was carried out to assess the morphological and floral traits in 12 Jasminum genotypes by using Randomized block design (RBD) at the College of Horticulture, University of Horticultural Sciences, Bagalkote, Karnataka during the year 2019-2020. The results of the quantitative morphological characters revealed that, the plant height at flowering stage was highest in J. rigidum-TNAU (121.40 cm) whereas, Maximum plant spread East-West (123.66 cm), No. of primary and secondary branches (9.33, 31.46), Internodal length (1.28 cm) was noticed in J. grandiflorum-TNAU genotype. Among the quantitative floral traits, J. nitidum-TNAU reported highest corolla length (2.28 cm) and number of petals (9.86). Highest flower bud diameter (0.79 cm) and no. of calyx lobe (8.20) were recorded in J. sambac-Mysore Mallige and J. sambac-TNAU, respectively. However, maximum number of inflorescences per plant (30.07) and total number of flowers per inflorescence (46.06) was found in J. calophyllum-TNAU and J. auriculatum-Bagalkote respectively.There was a wide variation among the genotypes for qualitative characters like leaf anthocyanin colouration, boldness of flower bud, flower bud shape, flower bud colour, tinge on flower bud, flower bearing habit, flower bearing position, flower colour on opening etc.

Characterization of Mango *(Mangifera indica l.)* Cultivars based on yield and quality parameters in bihar condition

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Characterization of different genotypes on the basis of yield and quality parameter of mango is a traditional and easy method to identify desired genotype for breeding programme. Thus, keeping in view, the investigation was conducted in experimental area of BAU, Sabour with objective of characterization of some leading mango cultivars in Bihar agro-climatic condition on the basis of yield and quality parameters. The total twenty mango cultivars were characterized with using yield and chemical quality characters during the year 2021-22. The cultivars significantly varied in respect of fruit set per panicle (12.66 to 72.58 fruits per panicle), number of fruits per tree (284.15 to 784.41 fruits per tree), fruit weight (105.45 to 488.15g), fruit yield (39.67 to 343.68 kg), TSS (15.60 to 21.96 0Brix), total sugar (13.25 to 24.15 per cent), reducing sugar (2.20 to 6.92 per cent), acidity (0.23 to 0.43 per cent) and ascorbic acid (11.49 to 55.22 mg). Among the mentioned cultivars here Mallika produced higher yield and Langra performed better in respect of fruit quality parameter in Bihar agro-climatic condition.

Genetic variability studies in Wood apple *(Feronia limonia l.)*

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The experiment entitled "Genetic Variability Studies in Wood Apple (*Feronia limonia* L.)." was carried out on thirty-two years old Wood apple orchard during the year 2017-2018 at Main Garden Department of Horticulture, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola. The flowering and duration of flowering of studied available germplasm varied from first week of February to first week of March and Three weeks to Nine weeks from date of flowering respectively. The various morphological characters like, fruit weight, range of pulp weight, pulp percentage, fruit length, fruit diameter, skull weigh, skull thickness, pulp: skull ratio, number of seeds, weight of seeds, seed size, TSS, acidity, TSS: acid ratio, total sugar, reducing sugars, non-reducing sugars and pectin was observed. The highest genotypic coefficient of variation was observed for TSS: acid ratio, acidity, and pulp weight. High GCV is an indication of greater range of variability among the population and the scope of improvement of these characters through simple selection. During this study characters like TSS: acid ratio, acidity, pectin content, number of seeds per 100g pulp, weight of pulp and fruit weight had high heritability values along with the high genetic advance. The correlation among the yield contributing characters weight of pulp, pulp: skull ratio, fruit length and fruit diameter was highly significant. The genotypes AKWa2, AKWa6, AKWa1, and AKWa15 were found promising for future improvement programme.

Superiority of F1hybrids over parents for fruit yield and its component traits in okra *(Abelmoschus esculentus (l.) Moench)*

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The present investigation was conducted on heterosis for earliness related traits and fruit yield per plant in okra. Thirty-six F1 hybrids were generated by half diallel (excluding reciprocals) mating design. TheseF1 hybrids along with nine parents were evaluated in randomized block design with three replications during three seasons viz., Early kharif 2021 (E1), Kharif 2021 (E2) and Late kharif 2021 (E3) at Instructional farm, Junagadh Agricultural University, Junagadh (Gujarat). The observations were recorded on five randomly selected plants from each plot for growth and fruit yield parameters viz., days to first flowering, days to first picking, days to last picking, number of pickings and fruit yield per plant (g). The highest standard heterosis was observed in AOL-12-59 x GO-2 in E1, EC 169513 x GO-2 in E2and AOL-12-59 x VRO-6 in E3for days to first flowering; HRB-55 x GO-2 in E1, EC 169513 x GO-2 in E2; and HRB 108-2 x GO-2 in E3 for days to first picking; IC 90107 x VRO-6 in E1, IC 90107 x EC 169513 in E2 and E3 for days to last picking; HRB 108-2 x JOL-11-1 and EC 169513 x AOL-12-59 in E1, IC 90107 x EC 169513 and IC 90107 x GO-2 in E2 and IC 90107 x JOL-11-1 in E3 for number of pickings and EC 169513 x GO-2 in E1, HRB 108-2 x AOL-12-59 in E2 for fruit yield per plant. The top five heterotic cross combinations viz., HRB 108-2 x AOL-12-59, HRB 108-2 x HRB-55, EC 169513 x GO-2, IC 90107 x EC169513 and HRB 108-2 x EC 16[illegible] identified as desirable heterosis for fru[illegible]ield and other earliness related traits i[illegible]

Performance of elite walnut genotypes under mid hill conditions of Himachal Pradesh

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Walnut (*Juglans regia* L.) is one of the important nut crop among temperate fruits belongs to family Juglandaceae and can be grown up to900 to 3000 meter above mean sea level. There is no systematic plantation and developed orchards of walnut in mid hill conditions of Himachal Pradesh, therefore, there was a need to evaluate the elite germplasm of walnut for quality parameters. The present investigations were conducted at the experimental farm of the Regional Horticultural Research and Training Station, Bajaura, experiences 38 °C maximum temperature in summer and -5 °C minimum temperature in winters, with average rainfall 166 cm. Promising walnut cultivars viz. CITH Walnut-1, CITH Walnut-2, CITH Walnut-4, CITH Walnut-8, CITH Walnut-9, CITH Walnut-10 and Bajaura Selection (6m x 6m) were taken for evaluation and to find out ideal cultivar for the commercial cultivation in mid hill conditions of Himachal Pradesh. Comparative studies showed that, CITH Walnut -1 gave superior results in term of plant growth and quality parameters. The maximum plant height (3.4m), plant spread (4.5m E-W and 3.7 m N-S) and girth (32.4 cm) was recorded in CITH walnut-1. The maximum nut length (4.5 cm), nut breadth (4.3 cm) and nut weight (25.3gm) with maximum kernal weight (14.9 gm) was also observed in CITH walnut-1. However, minimum kernal weight (6.8 gm) was observed with CITH Walnut-8. The maximum kernal percentage (61.24 percent) was recorded with CITH Walnut -3 and minimum kernal percentage (45.84 percent) was recorded in CITH Walnut-1. From the study, it was concluded that CITH walnut-1 was better for cultivation under mid hill condition of Himachal Pradesh.

Suitability of plum cultivars for Kullu valley conditions of Himachal Pradesh

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A study was conducted during 2020 to 2021 at Regional Horticultural Research and Training Station Bajaura, Himachal Pradesh, India to evaluate various attributes of plum under the mid-hill temperate zone. Twelve plum cultivars Red Beaut, Au Rosa, Au Amber, Satluj Purple, Kala Amritsari, Shiro, Frontier, Mariposa, Black Amber, Queen Rosa, and Angeleno grafted on wild apricot were evaluated with Santa Rosa as check planted under high density experimental orchard. According to the findings, Red Beaut ripened first, whereas the cultivar Mariposa took 150 days from flowering to harvest, making it the last to be picked. The cultivar Mariposa found maximum shoot length measuring 180 cm, while, Frontier had the highest fruit yield per tree (145 kg), closely followed by the cv. Black Amber (140 kg) with the maximum fruit size (5.4 x 4.8 cm) and weight (85 g). The cv. Frontier (14.10B) showed the highest total soluble solids (TSS), followed by the cv. Mariposa (14.0°B), while the cv. Kala Amritsari showed the lowest TSS. The plum cultivar Kala Amritsari displayed the highest fruit acidity (2.3%). Due to the variation in maturity period, these cultivars started repining from May to August. On the basis of fruit size, yield, quality parameters with longer maturity periods it was concluded that the Red Beaut, Frontier, Mariposa, and Black Amber cultivars of plum were found better for commercial cultivation in Himachal Pradesh.

Inheritances of resistance to anthracnose fruit rot in *Capsicum baccatum* L.

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Anthracnose fruit rot caused by Colletotrichum spp. is major threat to chilli production globally. Wide strainal variability in pathogen is major bottleneck in breeding for resistance. The inheritance of resistance against local isolates of the pathogen is very crucial and will help in designing suitable breeding strategies. Two F2 populations were developed viz.,PBC81xIHR4491 and PBC80x IHR4491. Individual plants fruits were subjected to artificial challenge inoculation through pin prick method for virulent local isolates of C. Truncatum 'IIHR Ct-1' and C. gloeosporioides 'IIHR Cg-1'. The pattern of frequency distribution for anthracnose fruit rot 'IIHR Ct-1' isolate in F2 population showed a continuous distribution pattern indicating that C. truncatum resistance is controlled by more than two genes. At least a pair of major inhibitory dominant genes are involved for resistance to isolate 'IIHR Ct-1' and recessive supplementary genes for isolate 'IIHR Cg-1' in both populations. Dominant-recessive epistasis in PBC80 and PBC81 against 'IIHR Ct-1' isolate of Colletotrichum truncatum and supplementary epistasis against 'IIHR Cg-1' in PBC81.This information on gene action against local virulent isolates will help in adoption of suitable breeding methods to incorporate in to different genetic backgrounds.

Anand komal, a promising variety and donor parent for subsequent breeding aimed for tolerance to viral diseases.

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Okra (*Abelmoschus esculentus* (L.) Moench) belonging to malvaceae family is fast growing annual herb and the tender seed capsules are used for vegetable purpose. One of the main okra production constraints is high incidence of the destructive YVMV and ELCV diseases which infects crop at all growth stages and causes production loss of 50–90%. The YVMV resistant varieties developed through inter-specific hybridization have becomes susceptible, probably due to pathogenic variability, use of symptomless carrier parents and Biotypes of whitefly which has a wide host range. It is necessary to find diverse sources of resistance to YVMV as well as ELCV and evolve resistant varieties by suitable gene introgression. This variety was developed from the cross GP-OK-292 x AOL 08-5 by pedigree method. It was tested in PETII during 2016 and on wards in different trials over location sin the state from the year 2017 to 2020 in kharif as well as summer season. The proposed variety perceived 125.0q/ha average fruit yield in middle Gujarat,while it manifested129.45and 113.89 q/ha fruit yield during kharif and summer season, respectively. This variety depicted21.49, 44.82 and 42.05 per cent higher fruit yield in middle Gujarat over the checks GAO 5,GO6 and Pusa Sawani, respectively. The genotype was tested in AICRP(VC) during 2019-20 in IETYVMV and advanced in AVT-IYVMV&AVT-IIYVMV during 2020-21 to2021-22. The fruits of this variety are dark green in colour, tender, smooth, medium long having narrow acute shape of apex. It has strong serration of leaf blade margin and deep depth oflobbing . Tall plant statue with more number of node sand short internodes. The variety contains higher phenol (0.13%), total soluble sugars (2.50%) and total chlorophyll (0.55 mg/g) as compared to the checks GAO 5, GO 6 and Pusa Sawani. It showed highly resistant reaction against YVMV and ELCV diseases with lower jassids population as well as shoot damage as compared to the checks GAO 5, GO 6 and Pusa Sawani. The traders and consumers have appreciated this variety due to good marketable quality. It was recommended to release as Gujarat Anand Okra 8: Anand Komal in Kharif and summer seasons under irrigated condition for middle Gujarat.

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.

Development of bio-fortified pomegranate var. solapur lal & solapur anardana

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Pomegranate (*Punica granatum* L.) is an important fruit crop of arid and semi-arid regions of the world. It is one of the first five fruit crops to be domesticated by mankind. India is the largest producer and consumer of pomegranate. In India, pomegranate is cultivated over 2.76 lakh ha with an annual production of 31.48 lakh tonnes and productivity of 11.4 t/ha. India is the only country in the world, where pomegranate fruits are available throughout the year. Iron deficiency causes anemia whereas zinc deficiency results in stunted growth. Deficiency of vitamin C causes scurvy. Development of biofortified varieties having nutrients and vitamin could help to overcomesuch health issues.Crop improvement through hybridization has been attempted with the objective to develop bio-fortified pomegranate varieties in 2008. The hybrid progenies were evaluated for yield, quality and nutritionalvalue. This has led to the identification and release of pomegranate varieties Solapur Lal for table purpose and Solapur Anardana for anardana purpose, respectively. Solapur Lal is a bio-fortified high yielding, hybrid variety for table purpose; It has early maturity (160 days) compared to the ruling variety Bhagawa (Check variety). It has higher TSS (17.60 Brix), ascorbic acid (19.6 mg/100g), and anthocyanins (390mg/100g). It has about 60% higher iron and 25% higher zinc over Bhagawa. SVRC notified variety in Aug, 2022 by the Government of Maharashtra & under consideration of CVRC-2023. This has been commercialized to 8 firms (including 2 tissue culture firms & 6 nurseries) with a distribution of about 12 lakh QPM covering about 4000 acres in 10 states of India. This has a protection period of 18 years since 2021.PPV&FRA /Reg/2016/1747. Solapur Anardana is a high yielding variety variety for anardana purpose. It has higher titrable acidity (4.8%), ascorbic acid (19.0 mg/100g) and anthocyanin content (456 mg/100g) with better anardana recovery from arils (> 21%) compared to Amlidana. This variety has been recommended / released by Joint Agresco-2023 of SAUsin Maharashtra. (PPV&FRA /Reg/2016/1747). It's under consideration of SVRC-2023, Maharashtra. It is an ideal alternative to 'Daru', a naturally growing wild variety which is a source of livelihood security to the tribal community in Jammu-Kashmir

Genetic diversity analysis and characterization of elite pomegranate germplasm in western Himalayas

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The present investigation was carried out in different locations of Kullu Valley of Himachal Pradesh during the year 2021-2022, for characterizing and evaluating the genetic diversity for various morphological and biochemical traits. A total of 30 tree accessions were evaluated to ascertain the growth, foliage, flower, fruit and biochemical characters. The genetic divergence analysis divulged considerable genetic diversity among the 30 tree accessions studied. Mahalanobis D2 statistics divided 30 accessions into four different clusters with maximum accession in cluster IV. Cluster II and cluster III were more divergent and thus, indicating presence of variability and better chances of getting superior segregants by hybridization among the accessions. The result of the investigation revealed that maximum tree height (5.36 m), trunk diameter (32.96 cm), leaf blade length (57.85 mm), leaf blade width (19.33 mm), calyx length (31.11 mm), calyx width (13.44 mm), petal length (26.97 mm) and petal width (16.80 mm), correspondingly. Fruit morphological parameters docketed maximum values for fruit length (57.59 mm), fruit width (59.09 mm), fruit crown length (21.48 mm), aril length (11.01 mm) and aril width (7.93 mm). Result of biochemical analysis depicted maximum values for TSS (18.34° B), titratable acidity (6.35 %), total sugars (10.45 %), reducing sugars (8.24 %), non-reducing sugars (2.47 %) and TSS/Acid ratio (5.47). As a result, the tree accessions demonstrated notable variations induced by various climatological factors, and this may be utilized to take advantage of the variability present and create superior elite hybrids for use in the subsequent breeding programmes.

Evaluation of heterosis and combining ability in Tomato *(Solanum lycopersicum l.)*, under mid hill conditions of Himachal Pradesh

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Tomato (*Solanum lycopersicum* L.) a staple vegetable with global distribution, exhibits heterosis, with respect to early maturity and yield. Analyzing heterosis and combining ability is very important in the utilization of heterosis and it is the first step in breeding for development of commercial hybrids. Combining ability is useful for successful prediction of the genetic capabilities of parental lines and crosses. Therefore, the heterosis and combining ability of nine (9) different elite lines was evaluated under mid hill conditions in Kullu valley of Himachal Pradesh. These high yielding hybrids so developed will be suitable for cultivation during the summers so called offseason cultivation in the mid hills. High heterosis over better parent and standard check was observed for most of the traits. The two cross combinations viz., Arka Abha × H-7998 and Solan Lalima × Baj T-10 exhibited maximum heterosis over better parent as well as over standard check for earliness. Solan Lalima × Baj T-4, Solan Lalima × Arka Meghali and H-7998 × Baj T-4 were the top three heterotic crosses for fruit yield per plant. The lines viz.,Solan Lalima and Baj T-4 were the most promising general combiners for fruit yield per plant. Baj T-4 was also the best general combiner for yield contributing traits; number of fruits per plant, number of fruits per cluster and average fruit weight. The crosses viz., Solan Lalima × Baj T-4, Solan Lalima × Arka Meghali and H-7998 × Baj T-4 were observed to be the best specific combinations for marketable fruit yield per plant. The estimates of predictability ratio were also found < 1 for almost all the traits included in this study indicated predominance of non additive gene action.

Marker-assisted transfer of powdery mildew resistance genes (er1 and er2) in the elite background of garden pea *(Pisum sativum l.)*.

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The two single recessive genes er1 and er2 and one dominant gene (Er3) have been reported to provide resistance against powdery mildew in peas. The current study was conducted with the objective of transferring both powdery mildew-resistant genes (er1 ander2) into the commercial cultivar 'Punjab-89'. In this experiment, pea genotypes viz. JI-2302 and Him Palam Matar-2 contain powdery mildew-resistant genes er1-2 and er2, respectively were used as the donor (male) parents and variety 'Punjab 89' was used as the recipient (female) parent. Two individual F1were developed by crossing Punjab-89 × JI-2302 and Punjab-89 × Him Palam Matar-2 in November – December (2020) at PAU, Ludhiana. Thereafter, these individual F1 were backcrossed with recipient parent Punjab-89 in May- June (2021) at Keylong, H.P. to develop two different BC1F1 populations. The individual BC1F1population was screened for their respective genes (er1 and er2) with the help of previously reported linked markers AA374 (11.6 cM) and A5 (14.9 cM) for er1 gene while AD141 (9.3cM) and AC30(30.6 cM) forer2 gene .Thereafter, selected plants carrying er1 and er2 genes individually from the BC1F1population were inter-crossed to develop Super F1carrying both genes. The developed super F1plantswere screened for the presence/ absence of both genes using already validated molecular markers. The reaction to Powdery mildew disease was also recorded on the selected Super F1plants in the field through artificial inoculation.

Evaluation and diversity analysis of chilli genotypes (Capsicum spp.)

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In the current study, 31 chilli genotypes were evaluated in a randomized block design at Experimental Farm, Department of Horticulture, Assam Agricultural University during Rabi, 2022-23 to assess the genetic variability parameters, correlation, cause-effect relationships and diversity based on the existing variation. Analysis of variance revealed presence of significant variation among all the genotypes for the traits studied. Based on mean performance, the genotypes Chilli Sel-1, Krishna Selection, Kashi Abha, Mem chilli, Kharika Selection, Local Collection-5 and 2021/CHIVAR-4 were superior in terms of fruit yield per plant.

Genotypic coefficient of variation and Phenotypic Coefficient of Variation were high for total chlorophyll content, ascorbic acid content, fruit length, fruit diameter, and average fruit weight indicating high variation among the genotypes. Total chlorophyll content, ascorbic acid content, fruit length, fruit diameter, plant height and average fruit weight showed high heritability coupled with high genetic advance specifying role of additive gene action. Fruit yield per plant was positively correlated with relative leaf water content, fruit length and average fruit weight. Days to first red ripe fruit harvest followed by relative water content and average fruit weight exhibited positive direct effect on yield. Thus selection for these characters might be fruitful for improvement in yield. Mahalanobis D2 statistics divided the 31 genotypes into eight clusters among which cluster I was the largest with 10 genotypes. The inter-cluster distance was maximum between cluster II and cluster V. Hence hybridization among promising genotypes from these two clusters can result in transgressive segregants in future breeding programmes.

Diversity studies for morphological, yield and biochemical traits in hot pepper *(Capsicum spp.)*.

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Hot pepper is an important vegetable crop of India for domestic as well as export market, having high level of genetic diversity for fruit and vegetative traits. A total of 54 hot pepper genotypes were evaluated during the present study along with 4 checks for morphological, yield and biochemical parameters during Kharif, 2022. Significant differences were observed for various qualitative and quantitative parameters studied. DUS characterization for different traits revealed high stem pubescence intensity in Bydagi-2, erect fruit habit in ten genotypes. Yellowish green corolla colour was observed in 3 genotypes while purple flower colour was observed in one of the local selection. Among all the genotypes Backcheri (472.40 g) gave highest yield followed by Al Selection-3 (462.01 g) and Malathalli Local (385.6 g). Fruit length varied from 2.18 cm to 11.22 cm, while the fruit diameter ranged from 0.534 cm to 2.922 cm. The total chlorophyll content was found highest in genotype Bydagi-2 (1.36 mg/100g), ascorbic acid content in BCA-6 (392.36 mg/100g) and capsaicin was highest in the genotype Tz-37-1 (1.063 %). Diversity analysis following K mean clustering grouped the 54 genotypes in seven clusters, where all the genotypes originating from North- East Indian region appeared in separate cluster distinguishing themselves from other collections.

Genetic variability and d2 analysis for yield and quality traits in Tomato *(Solanum lycopersicuml.)*

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Forty-two genotypes of tomato including four check cultivar (GT-2, GT-6, JT-3 and Pusa Ruby) were planted in Randomized Block Design, during rabi 2018 and were assessed to know nature and magnitude of variability and genetic divergence for twelve traits. The experimental results revealed a wide range of variability for all the traits under study. High heritability coupled with high genetic advance was observed for no. of fruits per plant, plant height, fruit length, fruit girth, shelf life of fruits, tomato leaf curl virus incidence, average fruit weight, fruit borer damage and number of locules per fruit which offers the better scope for improvement through selection. Based on Mahalanobsis D2 statistics, 42 genotypes of tomato were grouped into three clusters. Highest inter cluster distance of 273.83 was recorded between cluster I and III, hence crossing between the genotypes of these cluster is expected to yield more heterotic hybrid. On the other hand, six genotypes viz., NTL-72, NTL-81, NTL-84, NTL-53 NTL-65 and NTL-31 performed better for important traits under study. These can be crossed with diverse genotypes of other clusters for the development of superior hybrids in tomato.

Studies on floral biology of caigua (Cyclanthera pedata l. Schrad.)

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The ability to comprehend and predict the pollination and breeding behaviour of a given plant species is necessary for the effective execution of a plant breeding effort. The creation of intra specific or inter specific hybrids between various and desirable plants depends on it. Floral biology of Cyclanthera pedata L. Schrad. Genotypes were studied in an investigation conducted at College of Horticulture, VCSG, UUHF, Bharsar, and Uttarakhand. Six genotypes were collected from areas of Uttarakhand varying in altitudes viz. 'L.C. Bharsar' (2012 m), 'L.C. Sainji' (1572 m), 'L.C. Buransi' (1482 m), 'L.C. Dooni Pak' (1015 m), 'L.C. Pauri' (1689 m), and 'L.C. Pabau' (980 m). The experiment was conducted in a randomized complete block design (RCBD) design. Anthesis was observed from 4.00 a.m. till 9 a.m. and peak period of anther dehiscence was recorded between 5.00 a.m. to 7.00 a.m. in all the genotypes. The best male to female sex ratio (17.25:1) was recorded in the genotype 'L.C. Dooni Pak'. The genotype 'L.C. Bharsar' showed maximum pollen viability (94.370%) compared to the other genotypes. Maximum percentage of fruit set was observed during full bloom stage in all six genotypes indicating highest stigmatic receptivity at this stage.

Investigations on stability of monoecious inbred lines of muskmelon *(Cucumis melo L.)* and their evaluation for horticultural traits

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Heterosis breeding is preferred in muskmelon since hybrids are uniform, stable, high yielding, and early maturing. Breeding F1 hybrids involving andromonoecious inbreds requires manual labour for hybridization. Thus, producing F1 hybrids becomes a costly and time-consuming venture. Therefore, monoecious lines can potentially exploited to replace maternal andromonoecious lines in hybrid production. However, in muskmelon the linkage of the monoecious trait with oval fruit shape and sourness limited its extensive utilization in hybrid breeding. Modern breeding approaches have made it possible to develop monoecious muskmelon inbreds with round shape and free from sourness along with high TSS, a small bottom scar, high shelf-life and appropriate fruit size. Thus, the present investigation was carried out to investigate a set of melon inbred lines for stability of monoecious trait and their evaluation for morphological and biochemical characteristics, such as average fruit weight (g), polar diameter (cm), equatorial diameter (cm), flesh thickness (cm), rind thickness (mm), fruit shape index, total soluble solids (TSS), ascorbic acid, acidity, β-carotene, firmness (lb/inch2) and acidity. Through assessment of the andromonoecy index, ten stable monoecious lines have been identified. The monoecious line, Mono-1621/CTS, exhibited the highest β-carotene (2.73mg/100g), while Mono1426/S-1 recorded the highest TSS (14.9°Brix). Thus, identified stable monoecious lines possessing horticulturally desirable traits can further be utilized in heterosis breeding through identification appropriate parental combinations.

Estimation of combining ability and heterobeltosis of gynoecious and parthenocarpic hybrids for yield and quality traits in Cucumber *(Cucumis sativus L.)*

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The present study was conducted with the objective to find out high yielding and superior quality cucumber hybrids so that these can be released for cultivation in the state, therefore, we used parthenocarpic and gynoecious lines as female parent in the present study. To achieve this objective 5 female lines and 11 male testers were crossed using a line × tester mating design to create 55 F1 hybrids. All of the 11 testers were monoecious, however, from the five lines (female), two were gynoecious, one was predominately gynoecious, one was parthenocarpic & gynoecious, and the last one was predominantly gynoecious & parthenocarpic. Based on general combining ability and mean performance, the predominantly gynoecious line '25-16-VNR' showed the best performance for fruit yield, number of fruits per plant, fruit weight, fruit length, days to first fruit picking, and ascorbic acid content. The gynoecious and parthenocarpic line 'PK-1' performed best for node at which first female flower appears and fleshes to seed cavity ratio. Among testers, 'Punjab Naveen' performed best for fruit yield, number of fruits and ascorbic acid while 'CMVR-1' was the top performer for fruit length, water content and fruit weight and 'AVCU-1203' performed the best for days to first fruit picking, node at which first female flower appears and flesh to seed cavity ratio. The positive and significant correlation between mean value of parents and GCA was observed for fruit yield, number of fruits per plant, fruit length and days to first fruit picking. The extent of heterobeltosis varied across traits, with values ranging from -53.54 to 108.82% for fruit yield, -39.83 to 51.32% for number fruits per plant, -45.58 to 55.39% for fruit weight, -23.60 to 25.06% for fruit diameter, -37.52 to 19.63% for fruit length, -16.61 to 1.47% for days to first fruit picking and -62.83 to 40.58% for node at which first female flower appears. Best performing hybrids are PK-1 × AVCU-1205, PK-1 × Swarna Ageti, PK-1 × PMC-1, and PBRK11 × Punjab Naveen based on heterobeltosis and specific combining ability (SCA) are advised for examination at multiple locations before being taken into consideration for commercial release.

Evaluation of coloured wine varieties of grapes grafted on dogridge and 110rrootstocks

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A n experiment was conducted in order to study the performance of different wine varieties grafted on Dogridge rootstock carried out during the year 2019-20 at Research farm, College of Horticulture, Mandsaur, Madhya Pradesh. The experiment conducted in Factorial Randomized Block Design with three replications. Grapes grafted of ten red wine varieties on Dogridge and 110R rootstocks. Ten red wine varieties i.e., Cinsault, Convent Large Black, Grenache, Tempranillo, Cabernet France, Cabernet Sauvingnon, Shiraz, Sangiovese, Carignane, Tsimlasky Chernyi. Evaluation of the variety, Shiraz the highest value for pruning weight (2.22kg), period of panicle appearance (25.59 days). The variety Cabernet Large Black had observed highest berry weight (2.33 gm), berry length (19.42 mm), berry diameter (18.75). The variety Grenache had found maximum girth of rootstock (6.31). The variety Tempranillo observed for highest bunch weight (101.41 gm). Maximum number of fruitful canes per vine (23.55), number of bunches per vine (49.00), TSS (21.16), TSS acidity ratio (32.08) were recorded.

Estimation of correlation-coefficient in gladiolus based on different quantitative characters

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Gladiolus is a high value bulbous ornamental crop with extensive potential for cultivation in Terai region of West Bengal. Twenty-three promising Gladiolus cultivars were assessed using three replications in randomized block design in Uttar Banga Krishi Viswavidyalaya, Pundibari during 2021 to 2022, based on twenty-nine important quantitative characteristics: spike length, number of spikes/corm, number of florets/spike, vase life, days to first flower opening, number of corm/clump, diameter of corm etc. In the present study genotypic and phenotypic correlation coefficients were estimated to trace the direction and intensity of association among twenty-nine quantitative characters under study. Estimation of genotypic correlation values were found higher than corresponding phenotypic correlations for all the quantitative characters studied, that suggested presence of high inherent association between the parameters and influence of environment reduction of expression at the phenotypic level. Under the present trial, it was found that plant height, leaf length, leaf width, spike length, rachis length, flower width, perianth tube length, tepal width, number of open flowers/spike at a time, weight of clump, number of cormels/clump, diameter of corm, weight of corm and duration of flowering had positive significant genotypic correlations with all other parameters under study. Hence these parameters may be emphasized for selection in future crop improvement programs.

Inheritance of gynoecious trait in Cucumber (Cucumis sativus L.)

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To determine the genetics of gynoecious trait in cucumber the gynoecious inbred lines Gy-14 and AVCU-1303 were crossed with monoecious cultivars CMVR-1 and Punjab Naveen to develop F1, F2, BC1 and BC2. The observations were recorded in each plant for gynoecious, sub-gynoecious and monoecious traits. F1 generation, segregating F2 population and backcrosses for gynoecious trait suggested that it is under incomplete dominant gene control with additional minor genes. To check the impact of the environment on sex expression, F2 population of Gy-14 x CMVR-1 was sown during off season which led to greater number of gynoecious plants thus advocating impact of cool and short-day conditions on gynoecious sex expression. Gynoecy-based cucumber hybrids are gaining popularity among vegetable growers due to their top-notch yield because of more female flowers and earliness. Study of inheritance of gynoecious trait will help employ breeding procedures for transferring gynoecious genes into desirable cucumber genotypes.

Studies on physico- chemical characters on diversity of some local jamun *(Syzygium cumini skeels)* genotypes

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The experiment was conducted by selecting 20 different jamun genotypes from Kumarganj and adjoining villages (Sidhauna, Xorium and Milkipur etc.) and jamun fruit were brought to record their physical as well as bio-chemical character at laboratory of Department of Horticulture & post-harvest technology. Present study reveals a wide and significant variation in physical and bio-chemical characters of fruit has been observed among 20 different jamun genotypes. Among all genotypes G-12 was superior on the basis of fruit weight (4.15g), fruit diameter (16.34mm), and greater pulp content (2.14g) and average total sugar (15.14%) content. Owing to moderate fruit size (20.14mm in length and 14.10mm in diameter) G-7 genotype is also superior on the basis of higher TSS (24.09 0B), total sugar (12.46%) and reducing sugar (7.12%). So, the overall finding of the present study concludes that genotypes G-12 and G-7 are superior over the 20 local jamun genotypes.

Extent of genetic variation in segregating generations of french bean for yield and mosaic disease resistance

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French bean (Phaseolus vulgaris L.) is an important cool season legume vegetable crop. Raikia is a locally available popular French bean grown in Odisha. It has average yields and susceptible to viral diseases. Hence, a breeding programme was initiated by crossing it with the high yielding common bean mosaic disease resistant cultivar Arka Arjun. Higher genotypic and phenotypic co-efficient of variation values were obtained for number of pods per plant and pod yield per plant for the cross Arka Arjun X Raikia and its reciprocal Raikia X Arka Arjun in F3 generation. High heritability for number of pods per plant (90.98%; 86.69%) and pod yield per plant (95.38%, 91.23%) for both the crosses respectively. High heritability coupled with high genetic advance revealed that these traits under the influence of additive gene action, hence, selection in the segregating generations would be effective. These findings were corroborated by generation mean analysis which confirmed the lacking of non-additive genetic variation in these two populations for these traits. When compared with the F2 generation, the realized genetic gain was high as 19.22% for number of pods per plant and 40.46% for pod yield per plant in F3 generation for Arka Arjun X Raikia while it was low as 7.16 and 1.33% for Raikia X Arka Arjun suggesting that there was a little improvement in these traits over F2 generation.In F3 generation, a selection differential of 63.73 and 56.20 for number of pods per plant was observed after selecting the top 10% individuals in both the crosses respectively. Similarly, after selecting the top 10% individuals, a selection differential of 889.15 and 680.23 g pod yield per plant was realized in both the crosses respectively. The individuals AR 1-12-6 had maximum number of pods per plant (217) and AR 1-16-2 had the highest yield per plant (2700 g) among the progenies of Arka Arjun X Raikiawhile RA 1-14-4 had maximum number of pods per plant (173) and the highest yield per plant (1663.46 g) among the progenies of Raikia X Arka Arjun. When screened for disease resistance at 45 days after sowing among the progenies of both the crosses, 15 individuals were observed as resistant (PDI: 0), 150 were as highly tolerant (PDI: 1) and 5 were as susceptible to common bean mosaic virus. Fourty-one individuals were identified for earliness character.

Preserving horticultural crop diversity: Ensuring sustainable agriculture for the future

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Horticultural crop productivity faces notable challenges due to the mounting impact of global climate change. However, by making efficient use of genetic resources, it is possible to cultivate resilient horticultural varieties that can flourish in the constantly shifting environmental conditions. To achieve this, it becomes imperative to implement strategies focused on conserving and exploiting the genetic resources of horticultural crops. Enhancing nutritional security and ensuring food safety for human health are crucial objectives that can be accomplished by identifying, collecting, conserving, documenting, and utilizing these valuable genetic resources. Horticultural crops display extensive diversity, often confined to particular regions, resulting from human cultivation efforts. By introducing and conserving local germplasms, we can develop new varieties with broader genetic foundations, enabling them to flourish under diverse conditions and display heightened stress resistance. A fundamental prerequisite for advancing horticultural crop production lies in the identification and evaluation of genetic resources. Traditional approaches involve direct utilization of these resources in breeding programs, while recent biotechnological advancements have introduced specialized tools and assets like next-generation sequencing (NGS), high-throughput genotyping platforms (SNP genotyping array and genotyping by sequencing), as well as genomics-based techniques such as genome-wide association studies (GWAS), marker-assisted selection (MAS), and genomic selection (GS). Additionally, relevant Omics approaches like transcriptomics, proteomics, and metabolomics are incorporated to develop novel cultivars with heightened adaptability to varying environmental conditions.

Quality and shelflife improvement through TILLING- Based mutagenesis in Papaya cv. ArkaPrabhath

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Papaya is an important tropical fruit crop of the family Caricaceae which is significant both commercially as well as back yard crop. One of the main drawbacks for papaya cultivation has been the incidence of papaya ringspot virus (PRSV) and being climacteric fruit it is highly perishable in nature with low shelf life. In this regard mutation breeding technique has been considered as an efficient tool adapted by plant breeders to broaden the genetic diversity and achieve rapid crop improvement in papaya. Mutation coupled with potential screening methods like TILLING (Targeting Induced Local Lesions IN Genome) a reverse genetic strategy which allows the easy screening of induced point mutations in mutagenesis. Accordingly, the TILLING-based mutant populations of papaya cv. Arka Prabhath were generated through irradiation of different doses of gamma rays ranging from 50 to 500 Gy. Further, an advanced mutant population (M3) was developed and were evaluated and characterized for improved yield, quality and shelf life. Ultra-dwarf and dwarf mutants with reduced plant height were recorded in K family (91cm). Non-lobed broad leaves with mild or no indentations were observed in H family. A sequence variation such as SNPs and INDELS was detected in gene amplicons of ACC-synthase and ACC-oxidase genes of M3mutant lines. The lycopene rich mutant R1P9 (6.05 mg/100g) was identified. Reduction in physiological loss in weight, respiration rate and ethylene evolution rate were observed with improved quality in R19P8, R14P7 and R17P6 mutant lines. This resulted in the extended shelf life up to 17 days.

Genetic variability studies for morphological traits in Gladiolus

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The Gladiolus is an important bulbous crop belonging to family iridaceae and occupies prime position among cut flowers in domestic as well as international trade. Forty genotypes of gladiolus were assessed to estimate the coefficient of variability, correlation, heritability and genetic advance on the basis of 16 morphological traits. The magnitude of phenotypic coefficient of variation (PCV) was greater than the genotypic coefficient of variation (GCV) for all the character. High PCV and GCV respectively were recorded for number of cormels per plant, size of cormels, florets opened at one time and weight of corm per plant. The lowest expressions of phenotypic coefficients of variation were observed for spike weight (17.54) followed by plant height (16.18), the magnitude of heritability ranged from (51.69) for days from bud initiation to flowering to duration of flowering (98.16). High heritability (>80%) estimates were obtained for duration of flowering, vase life, size of cormels per plant, floret size, plant height, spike weight, size of corm, weight of corm per plant, number of florets per spike and cormels per plant, while the observation on days to corm sprouting and bud initiation presented moderate heritability (>50%). The size of corm and number of cormels per plant showed the highest genetic advance as per cent of mean (>20%) and highest heritability (>80%).

Evaluation of phytoremediation potential of calendula officinalis and chrysanthemum coronarium in cadmium contaminated soils

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Evaluation of phytoremediation potential of Calendula officinalis and Chrysanthemum coronarium in cadmium contaminated soils ornamentals besides beautifying the environment have potent role as hyper accumulator that add to their significance. With this rationale, the present investigation was conducted to evaluate the growth response and phytoremediation potential of two ornamental plants viz., Calendula officinalis and Chrysanthemum coronariumin cadmium contaminated soils. Growth parameters viz. plant height, number of leaves, leaf area per plant, leaf dry weight, number of flowers, flower diameter, of both the ornamentals were affected with increase in Cd concentration but at 20 ppm there was no adverse effect on growth of Calendula. Cadmium retarded plant growth as

weight of Chrysanthemum roots declined by 22% , stem by 34% and leaves by 18% under 100 ppm Cd application and the corresponding values for Calendula were 19, 29 and 15% respectively. There was increase in Cd content in roots, stem, leaves and flowers of both ornamentals, being higher in Calendula than Chrysanthemum. DTPA-extractable Cd in soil decreased from initial to harvest stage and decline was highest under 60 ppm, 47% in Calendula and 36% in Chrysanthemum. This showed greater Cd uptake by roots of Calendula and high mobility of Cd from soil to root in Calendula than Chrysanthemum. Both enrichment factor (EF) and remediation factor (RF) were more than 1 for Calendula and Chrysanthemum ascertaining their role as hyperaccumulators. Thus, both Calendula and Chrysanthemum can be used for phytoremediation of Cd contaminated soils.

Evaluation of Mango (Mangifera indica L.) hybrids for physico-chemical attributes under subtropical condition.

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Mango (*Mangifera indica* L.) is one of the important and popular fruit of our country as well as world and referred to as the "King of Fruits" owing to its excellent quality. Quality mango is a complex of traits contributed by physical, chemical and organoleptic features. Physical features include hue of skin and size and shape of the fruit. They are also rich in vitamins i.e., vitamin C, thiamine, riboflavin, niacin, and ß-carotenes well as phytonutrients and poly-phenolic compounds that have been proven to be a powerful antioxidant. A total of sixteen mango hybrids were assessed for physico- chemical attributes. The mango hybrids revealed large variations for fruit weight, fruit thickness, peel weight, stone weight and yield as appeared from the value of coefficient of variation. The minimum fruit weight was H-4208 (178.53 g) while the maximum fruit weight was recorded in H-4252 (572.0 g). Fruit thickness ranged from 5.27cm to 7.83 cm, pulp weight varied from 111.33g to 395.67g. Variation was observed for all the physical traits with CV ranging from 5% for pulp percent to 32% for stone weight. The variation for pulp weight was also recorded which ranged from 111.33g to 395.67 g with mean value 216.52g. There was a significant variation in fruit yield within the hybrids. The maximum yields were recorded in H-4252 (50.34 kg/tree) and H-4208 (26.42 kg/tree), respectively. Assessing various promising mango hybrids/varieties for a particular ecosystem is essential for successful mango cultivation. Mango breeding initiatives have aimed to widen the diversity of mango cultivars to cater the need of farmers, consumer and industries for various purposes.

Varietal performance of strawberry varieties in agro-ecological situation II (AES II) of Lakhimpur district of Assam

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Strawberry is among the world's most important soft fruit because of its high nutritional value (rich source of vitamins and minerals), alluring aroma, aesthetic appeal, and refreshing taste. The fruit being essentially a temperate food crop acclimatized well in different parts of India after its introduction in early 1960s. A study was carried out through various demonstration programme of Krishi Vigyan Kendra Lakhimpur during the period from 2019 to 2021 to analyse the varietal performance of two different strawberry varieties in Agro-ecological Situation II (AES - II) of Lakhimpur district of Assam. Two varieties namely, Sweet Charlie and Early Dawn were selected with a net area of 160 sqm. for the experiment. Healthy saplings were planted by following a good agricultural practice; in a raised bed of 10m x 1m size for each replication with a spacing of 30cm x 30cm. In case of Sweet Charlie variety, the maximum plant height (cm), numbers of runner, length of runner (cm) and no. of leaves were found to be 23.5, 5.42, 62.03 and 30-34, respectively. On the other hand, in early dawn variety the maximum plant height (cm), numbers of runner (nos.), length of runner (cm) and no. of leaves were found to be 20.6, 4.2, 53.4 and 30-31, respectively. Maximum number of flowering (40) with a greater number of fruit per plant (1121.6gm) was recorded in variety Sweet Charlie in comparison to both Early Dawn and local farmer's variety. The highest individual fruit weight (34.76 g) and fruit length (3.5-4.2cm) was obtained in Sweet Charlie followed by Early Dawn and local farmer's variety.

Inheritance offlower colour in Periwinkle*(CatharanthusroseusL.)*

Inheritanceofflower colour inPeriwinkle(CatharanthusroseusL.)
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Periwinkle (*Catharanthus roseus* L.) is an important perennial herbaceous plant that is renowned among gardeners with varied colourful flowers. Knowledge on the inheritance pattern of flower colour in periwinkle can greatly reduce thebreeders' time and assumptions. The present investigation was carried out at the Floriculture Research Farm of Punjab Agricultural University, Ludhiana. Six inbred lines of periwinkle viz., Magenta with white centre (Vi-15-1),White with red spot (Vi-13-2), Purple dark (Vi-16), Purple light (Vi-15-2), White (Vi-29) and Dark pink (Vi-14-3) were utilized in the present study. Four crossings were

performed among selected inbred lines to develop F1 plants, and F2 plants were generated from selfing of F1 plants. The chi-square analysis was applied to compare actual outcomes with predictions. (i) Vi-15-1 ×Vi-13-2 of F2 generation, out of 89 plants raised, magenta with white centre, white with red spot and peach exhibited in the ratio of 9:6:1. The chi-square test against 9:6:1 ratio was non-significant (X2=3.537).(ii) Vi-13-2 × Vi-14-3 cross produced white with red spot(62) to pink (22) colour flower approximated of 13:3 ratio with inhibitory gene action in the F2 generation. The respective chi-square value was2.779 while p-value was0.095.(iii) The ratio of purple dark (40)to white (8) colour approximated of 3:1 typical monohybrid segregation in the cross Vi-15-2 × Vi-29 of F2 generation.(iv) Vi-15-2×Vi-29 of F2 generation produced purple light (21) to white (12) colour flowers possibly 3:1 typical monohybrid. The respective chi-square value was 2.272 while p- value was 0.132. The results indicated that purple dark and purple light flowers completely dominance over white colour flowers. The non-significance of the chi-square test indicates close agreement between the observed and expected ratios and considered as good fit.

Evaluation and DUS characterization in Strawberry *(Fragaria X Ananassa Duch.)* germplasm under temperate conditions of NW Himalayas

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The present investigation was carried out for the evaluation and morphological characterization of strawberry as per DUS guidelines of PPV&FRA. The experiment was laid in RCBD with three replications at a spacing 30 x 30 m2 for thirty cultivars viz., Larson, Henna, Majestic, Blakemore, Okra, Nabila, Senga Sengana, Oso Grande, Red Coat, Red Cross, Chandler, Winter Dawn, Catskill, Honeoye, Katrain sweet, Gorella, Confectura, Isoguard, Anthena, Addie, Florida, Bangalore, Dilpasand, Festival, Sweet Charlie, Missionary, Curaltar, Kimberly, Brighton and Camarosa. Observations were recorded for various qualitative and quantitative traits. The results revealed that maximum plant height (34.60 cm) was recorded in cv. Henna while as minimum plant height (23.65 cm) was recorded in cv. Larson. The average plant spread ranged from 45.17 cm in cv. Addie to 29.16 cm in cv. Larson. Maximum numbers of runners were found in cv. Blakemore (12.65) while cv. Catskill recorded maximum leaf area (46.94 cm2). The number of flowers per plant ranged from 10.12 (Oso Grande) to 26.33 (Henna). Highest per cent berry set was recorded in cv. Chandler (94.39%) followed by cv. Camarosa (93.57%). Highest yield (312.06 g/ plant) was recorded in cv. Chandler and least (107.51 g/plant) in cv. Missionary. The cultivars were assessed for 20 quantitative traits based on DUS guidelines, out of which 8 of

the descriptor traits were pertaining to plant and leaf morphology, 5 were pertaining to the flower and 7 pertaining to the fruit. Plant vigour varied between weak, medium and strong. All cultivars showed strong and medium vigour except Katrain Sweet and Isoguard which were weak in vigour. The variation was recorded in thirty strawberry cultivars for position of inflorescence. Out of thirty strawberry cultivars under study, majority of cultivars registered position of inflorescence below the foliage while, four cultivars recorded inflorescence above the foliage namely Majestic, Okra, Nabila and Winter Dawn. Petals were free in Blakemore, Chandler, Winter Dawn, Brighton, Camarosa and Isoguard. Fruit size was large in all the cultivars under study except Henna with medium size. Fruit shape ranged from obloid, globose, conical, rhomboid, ovoid, cylindrical, wedged and cordiform. Most the cultivars had conical fruits. . In total, out of 27 standard characters assessed, the cultivars showed variations for only 26 characters. These genotypes can be successfully used as reference for protection of other varieties under PPV&FRA, identification and grouping of strawberry varieties and for development of elite varieties/hybrids.

Correlation study for physico-chemical characters in jamun genotypes

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Jamun possesses commercial importance as a minor fruit in tropical and subtropical conditions. It is an important under-exploited indigenous fruit tree of India. But majority of jamun trees in India are of seedling origin, they show a large variation in their morphology and physicochemical attributes. A survey was conducted to assess the variability of flowering characters of some jamun genotypes (randomly selected 60) located in various places over Western dry tract of West Bengal, namely four districts (Birbhum, Bankura, West Burdwan and Purulia). The correlation study between the physical and chemical characters are very useful in understanding the selection procedure for high yielding clones in jamun. As per correlation matrix the parameter fruit volume showed high positive correlation with fruit weight (0.962), fruit length (0.916) and seed length (0.871), all three correlations are significant at 5% level. Fruit volume showed fairly high positive association (with respect to correlation matrix) with fruit diameter (0.598), pulp-seed ratio (0.566), TSS-acid ratio (0.536), TSS (0.436) and total sugar (0.353).High positive significant correlation of TSS content was observed with TSS acid ratio (0.857) followed by total sugar (0.820) and reducing sugar content (0.639).TSS, acid ratio shows moderate positive significant correlation with total sugar (0.795) and reducing sugar content (0.511).Reducing sugar has low negative significant correlation with ascorbic acid (-0.278) followed by fruit firmness (-0.260).

Diversity studies in gomphrena for qualitative traits

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Estimation of diversity among seventeen genotypes of Gomphrena globosa, a traditional loose flower crop was observed using different qualitative traits under Northern dry zone of Karnataka, India. Qualitative traits like growth habit, growth type, inflorescence shape, stalk length and flower colour shown a highly adorable variation in the considered gomphrena genotypes. In case of growth habit 13 genotypes represented spreading type, 3 genotypes were upright and only one genotype displayed prostate type. Among the growth type three types of variations such as, tall, medium and dwarf forms are noticed. In case of inflorescence shape, two different shapes i.e., globular and tubular forms portrayed and three different sizes of stalk length of short, medium and long were observed. The flower colour, an important Floricultural trait, also represented 6 different shades recorded by the use of RHS colour chart. These results indicating that the prominent diversity among the various qualitative traits and are highly important, can be selected for future crop improvement programme in Gomphrena.

Genetic diversity of local fruits and its nutritional and commercial importance

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Local bio-diversity plays an important role in the socio-cultural, health-care needs and nutritional security of rural people of the developing countries. In geographically challenged areas like Assam, a large section of the population still relies on bari (home stead kitchen garden) system of garden to meet their nutritional and health-care needs. Wide range of diversity has been reported for local fruits of North east India. The under utilization of these traditional fruit species are in the verse of extinction due to lack of awareness of local people. The lack of appropriate technologies for planning and production and inadequate information of domestic resources and marketing opportunities are some of the bottlenecks in developing a systematic kitchen garden along with fruit. There is an urgent need to conserve these traditional fruits eg. Kordoi(use as medicines for liver tonic, jaundice), Noga tenga, Mirika tenga (rich source of Ascorbic acid) and develop strategies for commercialization of these highly nutritional underutilized local fruits. This is a demand of time to characterize and conserve these important fruits with scientific approach. Through proper morphological and nutritional characterization can maximise the utilization of these species for nutritional and health benefit of the local people along with economic benefit. Present pharmaceutical demand for these fruits signifies importance of cultivation not only to meet the nutritional requirements of the families and but also to earn additional income. Traditional fruits demand fewer resources and therefore fall within the management capabilities of marginal farmers with minimum production cost.

Technical Session - II
Genomics of Trait Specific Breeding

Insights into Ogura cytoplasmic male sterility system expediting breeding of cauliflower

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Ogura-type cytoplasmic male sterility (Ogu-CMS) has been widely used in the hybrid breeding industry for cruciferous vegetables. CMS is a category of male-sterility 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 cauliflower. Cauliflower (Brassicaoleracea var. botrytis L.) is an important member of vegetable Brassicas grown worldwide. It has been an important contributor in human diet. Mitochondrial markers can be used to differentiate diverse mitotypes as well as cytoplasm in angiosperms. In India, during the last three decades, a large number of CMS-based breeding lines/material have been generated in Indian cauliflowers by repeated backcrossing or somatic hybridization by exploiting various CMS sources.In this context, the present investigation highlighted the utility of organelle genome-based markers in distinguishing cytoplasm types in cauliflowers. Further, the CMS and doubled haploid (DH) based hybrid were developed and evaluated for different phenotypic and yield related traits. The three CMS lines Ogu118-6A, Ogu33A, Ogu34-1A were identified as good general combiner for developing early maturity hybrids. Less than unity value of σ2A/D coupled with σ2gca/σ2sca indicated the predominance of non-additive gene action in the expression of studied traits. The cytoplasmic effects on varying nuclear-genetic backgrounds rendered 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 caused dysplasia of flower structure affecting female fertility with inefficient nectar production. The finding provides an important reference to ameliorate understanding of mechanism of cytonuclear interactions in floral organ development in Brassicas. The results pave the way for expediting hybrid breeding of Indian cauliflowers and strengthening indigenous hybrid industry.

Neoteric approaches in Strawberry *(Fragaria×ananassa Duch.)* vis-à-vis breeding and genomics

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Strawberry (Fragaria×ananassa Duch.) is a low growing, herbaceous, perennial fruit crop having fibrous root system. The crop is a rich source of vitamin C, Mn and provides several other vitamins and minerals in low amount. Since strawberry shows wide range of ploidy level, it provides formidable wealth of gene that can be directed towards the betterment of human health. Use of recent technologies allows crop improvement with higher efficiency and lower risks of varietal failure in adverse climatic conditions. From the methods like selection, outcrossing and hybridization to genome mapping, genome sequencing and genome editing one can witness the increase in quality as well as higher productivity in strawberry. Strawberry which is an allo-octoploid species (2n = 8x = 56), has four discriminable subgenomes. Recent advances of NGS (Next Generation Sequencing) technologies have allowed the construction of chromosome-scale de novo whole genome assembly. Latterly, technologies have been developed to precisely engineer genes for traits of interest. One of this is known as "CRISPR" gene editing approach which is a form of gene editing that can be used to precisely modify a gene of interest without otherwise compromising the favorable traits of an elite variety. The University of Florida, strawberry breeding program has been able to identify several important gene regions that control disease resistance traits and are directly relevant to Florida growers. By using CRISPR technology, they were able to move genes into desirable genetic backgrounds which can be further moved via conventional crossing in later generations.

Genetic and phenotypic assessment of newly developed hybrids in gladiolus *(Gladiolus hybridus L.)* for floral and corm traits

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Gladiolus is an important crop cultivated by the farmers for its elegant cut flowers which have huge demand in the domestic and international market. There is need to develop gladiolus hybrids/varieties in a spectrum of colours with long spike and more florets per spike. The present experiment was carried out at the Research Farm of the Division of Floriculture and Landscaping, ICAR-Indian Agricultural Research Institute, New Delhi with twenty gladiolus hybrids including best check. The results indicated that early flowering i.e. 83.66, 84.33, 85.00 and 87.66 days after planting was recorded in Chandni x Snow Princess, P-16-1 x Eurovision, and Shweta x Regency and Berlew x Heady wine hybrids respectively. The maximum plant

height 144.33 cm, spike length 132.33 cm, was recorded in Green Pasture x Regency hybrid followed by Smokey Lady x Heady wine 133.66 cm and 120.66 cm respectively. Rachis length 71.66 cm, number of florets 20.00 was recorded in Vidushi (mutant) hybrid as compared to remaining hybrids and check. Nine hybrids such as Smokey Lady x Oscar, Green Pasture x Regency, Smokey Lady x Heady wine, Vidushi (mutant), (Green Willow x Cignet) x Little Fawn, P-16-1 x Eurovision, Mayur x Howard, Howard Open seedling and White Oak Open seedling have recorded 2.66-3.33 number of corms per plant. But, a greater number of cormels per plant i.e. 77.66 and 69.66 were found in two hybrids Smokey Lady x Heady wine and Howard Open seedling respectively. Maximum vase life 13.00 to 13.66 days in normal tap water was recorded in hybrids such as Smokey Lady x Heady wine, Chandni x Snow Princess, Vidushi (mutant) and George Mazure x Melody respectively as compared to remaining hybrids.

QTL mapping in bitter gourd for yield and yield related traits using SSR marker

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Bitter gourd (Momordica charantia L.) also known as balsam pear, bitter melon and bitter cucumber, is originated from Indo-Burma region. Bitter gourd can be considered as reservoir of nutrients being a rich source of vitamins, minerals and antioxidants. Its medicinal properties are due to presence of higher amount of momordicine, charantine, polypeptide P (hypoglycaemic activity) and saponin in the fruit. Yield is a complex polygenic trait. Various determinants of yield are affected by genotype and environmental interaction. QTL mapping provides a powerful tool to analyze the genetic basis of yield and yield determining factors. In present study two contrasting parents DBGS-2 and Pusa Purvi were taken and subsequent development of mapping population was done for development of linkage map. Generation mean analysis result revealed duplicate epitasis of various yield-attributing traits. Additive effect was found predominantly in fruit length, diameter and weight. Parental polymorphism was analyzed using 630 SSR markers, out of which 35 were observed as polymorphic. Using genotypic and phenotypic data, linkage map was developed through ICIMv4.2 software. A total of 23 QTLs for twelve traits were detected. The LOD score ranged from 3.01 to 64.47, the total phenotypic variance ranged from 1.52 to 34.57%. For yield per plant a major consistent QTL found on chromosome 1. MC_11_1580 marker was found linked with fruit length, weight and internodal length.

Understanding physio-biochemical and molecular basis of drought tolerance in Cucumber *(Cucumis sativus L.)*

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Cucumber (Cucumis sativus L.) 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; 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. Enzymatic activity was generally higher in tolerant genotypes and strong correlations existed between osmotic potential, malondialdehyde, hydrogen peroxide, and membrane stability etc. 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. Except SOD other enzyme related genes showed higher expression in tolerant genotype. These findings will potentially lay the groundwork for better understanding and targeted strategies to enhance stress tolerance in cucumber plants.

Advances in In-Situ root phenotyping of horticultural crops

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Roots are vital for the survival of nearly all plants. Roots are naturally plastic, and examining this plasticity in response to various stresses provides breeders the chance to investigate natural adaptation and to uncover beneficial root traits for increasing plant productivity in agricultural system. Improvements to the architecture of crop roots promises to boost water and nutrient use efficiency but profiling the root phenome (i.e. its structure and function) represents a significant bottleneck. To solve the challenges, innovative strategies are needed identify quantitative phenotypes and to explain the genetic basis of agriculturally important traits. These advances will facilitate the screening of high-performance germplasm in contexts

with limited resources. In recent years, many breakthroughs have been made for efficient analysis of root system which includes both 2D and 3D platform. High-throughput phenotyping platforms, imaging devices and software have been developed for non-destructive collection of phenotypic data from plant. Different developmental stages of pea seed germination have been examined using in situ magnetic resonance imaging (MRI) of plant roots. MRI is also used in sugar beet to study the below ground symptoms caused by cyst bean, cyst nematode and Rhizoctonia solani. Visible light imaging in bean 49 and legume, 3D imaging in pepper and laser imaging in sugar beet is used to study the root architecture. GPR (Ground-penetrating radar) has been widely used to measure the coarse root cassava, willow and citrus. Thus, it encouraged breeders and researchers to thoroughly analyse root properties and apply them to various breeding strategies.

Haploid breeding and its applications in vegetable crops

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Haploids are defined as organisms appearing like sporophyte possessing gametic chromosome compliment. In nature haploids are produced spontaneously in lower frequency through processes like polyembryony, chromosome elimination, semigamy, pseudogamy, etc. but now there are in- vitro technique to produce large number of haploids e.g. anther culture and ovule culture. Besides these methods there are several physical and chemical methods to produce haploids viz. irradiation, high and low temperature, use of abortive pollen and chemical like maleic hydrazide (MH) and belivtan. Guha and Maheshwari first time produced haploid embryos using anther culture in 1964. Haploids serves wide number of applications in genetic studies as well as in plant breeding. Haploids have diminishing features as compared to that of normal diploid plant. They are weak, thin, have less vigour, reduced cell size, tender in nature, have small flowers and are mostly sterile. In genetics it has utility in study of genes specially recessive one, mutation studies, etc. in plant breeding it has been used to develop doubled-haploid (DH), development of pure lines, somatic hybridization, development of somaclonal variants in tissue culture which are good source of biotic and abiotic resistance. Doubled-haploid help to shorten the generation cycles and production of complete homozygous inbred lines and accelerate various methods for crop improvement. It has been used in various crops like pepper, beetroot, onion and other cucurbits and asparagus. Hence, DH technology has important contribution in accelerating breeding program in vegetable crops and breaking chain for biotic and abiotic constraints and sustainable vegetable production. Several DH lines of various onion genotypes which were high yielding and resistant to various diseases were developed. The DH plants from melon showed recovery of stable lines with increased yield, improved quality traits and multiple disease resistance.

Combining ability analysis for yield and yield related traits in Papaya *(Carica papaya L.)*

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Papaya is a popular crop grown in the tropical and sub-tropical regions of the world, for its high yield potential and nutritionally rich fruits. The varieties that are grown in India for commercial cultivation is limited in number. This limitation has increased crop vulnerability to biotic and abiotic stresses, ultimately leading to crop failure. So, there is a need for development of more number of hybrids with diverse traits. Prior to the beginning of any improvement program, the parental lines should be evaluated by their combining ability. The knowledge of combining ability helps in identifying best parent combiners which may be hybridized to exploit heterosis, and superior hybrid combinations. Combining ability analysis is one of the efficient tools which helps in selecting parents and crosses for the improvement of particular characters. In the present investigation the papaya inbred and hybrids were evaluated for thirteen traits related to vigour, earliness and yield. In randomized block design with three replicates, 6 inbred, namely, Pusa Nanha (PN), Pune Selection 3 (PS 3), P-7-2, P-7-9, P-9-5 and P-9-12 and 30 hybrids of papaya were produced in 6 x 6 full diallel mating design (excluding the parental combinations). Parent PN, exhibited maximum negative GCA for plant height, petiole length and stem diameter. PS3 was identified as the best general combiners for yield related traits like fruit length, fruit diameter and fruiting zone. Best general combiner for fruit weight and fruit yield was P-7-9 and for number of fruits per plant and earliness was P-9-5. The hybrid, PS3 x PN showed SCA effect in desired direction for plant height, internodal length, number of nodes to first flower and days to fruit maturity. The hybrid combinations, P-9-12 x PS3, P-7-9 x PN, P-9-5 x PN, P-9-5 xP-7-9 and P-9-12 x P-7-9were superior with positive estimates of SCA effects for the number of fruits, fruit weight, pulp and fruit yield, that are the most important traits for the crop.

Genetics and marker trait association of gene(s) governing fertility restoration in Indian onion

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Cytoplasmic male sterility is widely used for the development of F1 hybrids in onion. Punjab Agricultural University, Ludhiana, Punjab, India has identified various male sterile and fertility restoration lines in the different genetic backgrounds of Indian onion. The genetics of fertility restoration has been studied in exotic lines, however genetics of Ms locus in Indian accessions has not been investigated yet. Therefore, to understand the genetic control of fertility restoration, segregating population between male sterile (D-121) and restorer (R-230) lines were developed. Bulb of segregating F2 population along with their parents was sown and each plant at full bloom stage were phenotypically assessed for presence and absence of the pollen and data were subjected to Chi-square (X^2) analysis. X^2 analysis showed best fit in 9:7 ratio, which indicates the involvement of two complimentary genes governing fertility restoration in Indian onion. The F2 population was further genotypically tested for fertility restoration using AcPMS marker, which accurately predicted the 84 per cent of phenotypes. Therefore, more tightly linked markers with Ms locus are needed to investigate the fertility restoration locus in Indian onion.

Application and intervention of biotechnology in horticultural crops

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Biotechnological innovations have significantly transformed the techniques of crop improvement revolutionizing agricultural production and providing sustainable solutions for global food security challenges. However, in recent times, biotechnology has come to a greater extent with a variety of techniques that allow the direct manipulation of genetic materials of organisms. Genes, otherwise difficult to transfer because of inherent barriers, can now be transferred into newer backgrounds to produce recombinant types. Genetic engineering, a cornerstone of biotechnology, allows the direct transfer of specific genes into crop plants, giving rise to genetically modified (GM) crops with desirable traits. Tissue culture, also known as micro propagation is a powerful innovation in agriculture that has revolutionized the propagation of plants. Furthermore, breakthroughs in genome editing, particularly the CRISPR-Cas9 technology, offer precise modifications of the plant genome, providing novel

opportunities for targeted crop improvement. Marker-assisted selection has accelerated traditional breeding approaches by utilizing genetic markers linked to specific traits. Biotechnological approaches have also facilitated the understanding of plant micro biomes leading to the development of microbial-based solutions for promoting crop health and nutrient uptake. Climate change presents new challenges to agriculture, and biotechnological innovations have responded by creating climate-resilient crops capable of withstanding adverse weather conditions. Among the agricultural crops, horticultural crops represent the marvels of nature and play crucial roles in providing vitamins, minerals, antioxidants and other supportive bio molecules for life including many medicinal compounds. These groups of plants also have various types of breeding disadvantages due to complex reproduction behaviour. In this regard, the application of biotechnological tools is of paramount importance in improving the horticultural sector more than another sector in agriculture.

Identification of a QTL associated with resistance to Phomopsis fruit rot in Eggplant through QTL- seq approach

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Eggplant is one of the most economically important and widely cultivated Solanaceous vegetable crops worldwide. The pathogen Diaporthe vexans(Sacc. and Syd.) Harter causesfruit rot, stem blight, canker, tipover, leaf blight or spot in eggplant leading to huge fresh yield, seed yield and quality loss to the growers. The goal of this study was to study genetics of disease and to identify quantitative trait loci (QTLs) associated with resistance. An F2 population (161 plants) was developed from a cross between Pusa Kranti (S) and BR-40-7 (R) and screened through artificial inoculation along with the parents. The goodness of fit for the observed F2 and backcross ratio with the expected Mendelian ratio was tested using chi-square ($\chi 2$). The segregation of F2 plants showed 92 susceptible: 69 resistant (9:7) depicting complimentary epistasis. Whole-genome resequencing of the parents along with the 10 resistant and 10 susceptible bulk revealed single nucleotide polymorphisms distributed across eggplant genome. QTL-seq bulk segregant analysis detected a genomic regionfrom 13.3 to 16.3 Mb on chromosome 1 which was significantly (surpassed 95% confidence interval) associated with resistance to Phomopsis fruit rot. The identified QTL had positive ΔSNP-index value of

0.3882indicating that the resistant parental line BR-40-7 harbors alleles for Phomopsis fruit rot resistance. A total of 229 candidate genes, including the typical NBS-LRR genes, resistant gene homologs, serine/threonine protein kinases and Jasmonoyl-L-amino acid synthetase protein were identified and proposed as the likely candidates. The detected QTLs/SNPs will further facilitate the molecular breeding of fruit rot resistance in eggplant. The present study reports the first QTLs associated with Phomopsis fruit rot resistance in eggplant.

Exploring SSRS based genetic distance for prediction of F1 hybrid performance for yield and fruit quality traits in muskmelon

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Determination of the extent of association of genetic distance and combining ability will be useful in designing a cost-effective breeding strategy for identifying potential melon (Cucumis melo L.) hybrids. Fifteen melon inbreeds, including four monoecious inbreeds and one male sterile line, MS-3 were crossed in a Line × tester to investigate the gene action for fruit yield and other traits and also to decipher the relationship between F1 hybrid performance, heterosis, combining ability for fruit yield and SSR based genetic distance. Genetic distance among the lines was assessed using 121 SSR markers. Fifty crosses and their fifteen parental lines were evaluated in two environments (E1, mulch and E2, No-mulch) during the year 2022. Among the fifteen lines Mono-916, Mono-965, GG-551, MC-2017-5, PAUS-31, PAUS-9 and CTNB-668 were the good combiners for developing early maturity hybrids, while the inbred Mono-1426 was the potential parent to breed for higher fruit weight, fruit number and fruit yield. Higher estimates of heterosis in E2 environment were contradictory to the lower hybrid performance and predominance of specific combining ability implying the presence of non-additive gene action coupled with dominance or over-dominance genetic effects. Highly polymorphic markers, such as CMMS35_3 and DM0220 reflected their ability to provide unique genetic profiles for their utilization in discriminating among genotypes with narrow genetic distance. Contrasting clustering patterns and insignificantly weak correlation between SSR and phenotypic based-genetic distances indicated that there was a poor agreement between SSR and phenotypic markers. Although dramatic performance differences were detected between parents and among F1 hybrid progenies, a strong relationship between genetic distance and heterotic effects was not consistently detected.

Unlocking the genetic secrets behind tomato *(Solanum lycopersicum l.)* yield and contributing traits: a holistic approach

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In recent years, the field of tomato breeding has witnessed remarkable progress driven by advances in genetics, genomics, and breeding methodologies. Therefore, an experiment was conducted entitled "Genetic Analysis of Yield and Yield-Contributing Traits in Tomato (Solanum lycopersicum L.)", at the Experimental Farm, Regional Horticulture Research and Training Station, Bajaura, Kullu (Himachal Pradesh), during the summer seasons of 2019, 2020, and 2021. The experiment was laid out in Randomized Complete Block Design with three replications comprising forty six genotypes to elucidate the information on the extent of mean performance, heterosis, combining ability, nature and magnitude of gene action for different horticultural traits. Inheritance of mature fruit colour in tomato was also studied by observing the segregation pattern of different generations (F2, B1 and B2) using chi- square analysis. The analysis of variance indicated highly significant differences among all the genotypes for all the traits studied. Based on GCA effects, the parents viz., Solan Lalima and BajT-4were the most promising for fruit yield per plant. Gene action studies indicated predominance for non-additive gene action for almost all the traits except for average fruit weight. The experimental results revealed that that on the basis of overall mean Solan Lalima × BajT-4, Solan Lalima × BajT-11, Arka Meghali × BajT-10, Arka Abha × H-7998, Arka Abha × BT-21, Solan Lalima × Arka Meghali and H-7998 × BajT-4performed well for majority of yield and yield contributing traits and these hybrids can be recommended for cultivation after multi-locational testing. Chi-square analysis revealed that Solan Lalima (red) × BN-7 (yellow) showed dominance of red colour over yellow colour.

Heterosis, Combining Ability and Potence Ratio for Yield and Quality Attributes of Parthenocarpic Cucumber *(Cucumis sativus L.)* Grown In Poly-Net House

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The present investigation was conducted to estimate the heterosis, combining ability and potence ratio for yield and quality attributes of parthenocarpic cucumber hybrids grown under poly-net house conditions. Eleven parthenocarpic parents were used to produce 28 F1 hybrids by line × tester mating design and 41 genotypes including two standard checks were evaluated for ten yield and quality traits in a Randomized Block Design (RBD) with three replications during February 2022 to June 2022. The analysis of combining ability revealed highly significant variance due to GCA and SCA effects for almost all the studied traits indicating the role of both additive and non-additive gene action in inheritance of these traits, respectively. The results revealed that the line 'PBRK-16' exhibited high and significantly positive GCA effects and per se performance for fruit yieldplant-1, fruit weight, fruit length, fruit diameter and water content whereas 'PBRK-15' and 'Punjab Kheera-1' for earliness traits and number of fruits plant-1, respectively. Among testers, 'PBRK-8' showed high and significant GCA effects and per se performance for fruit yield plant-1and number of fruits plant-1.The F1 hybrids 'PBRK-16 × PBRK-18', 'PBRK-16 × PBRK-8' and 'PBRK-16 × PBRK-1' exhibited high and significantly positive SCA effects, per se performance and economic heterosis for fruit yield plant-1and number of fruits plant-1whereas F1 hybrids 'Punjab Kheera-1 × PBRK-1' and 'PBRK-9 × PBRK-17' for earliness traits. Potence ratio study illustrated that partial to over-dominance effect was involved in the inheritance of all the studied traits. Therefore, it was concluded that these high yielding hybrids can be used as commercial cultivation under poly-net house.

Unraveling the coloring mechanism of mango; insights into pigment composition and its variation among the mango progenies

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Mango (Mangifera indica) exhibits a diverse range of peel colors, reflecting their distinct nature of cultivar. Broadly they are grouped into red, green and yellow. The coloration of mango peel is predominantly attributed to the presence of carotenoid and anthocyanin pigments. An experiment was conducted to study the peel coloration among the progenies of Amrapali and Vanraj combination. To understand the nature and dimensions of peel color, we used Minolta

colorimeter to analyze the colors through hunter scales ‘L’, ‘a’, ‘b’, ‘c’ and ‘h’. The ‘L’ value ranged from 33.97 to 69.32. with Amrapali and Vanraj recording 51.95 and 38.84 respectively. The ‘a’, ‘b’, ‘c’ and ‘h’ value ranged from -12.35 to 26.33, 11.86 to 62.81, 11.85 to 63.67 and 37.34 to 132.2 respectively. The total anthocyanin content in peel of the progenies varies from 3.16 to 29.74 mg/100g FW with the highest levels observed in Vanraj (29.74mg/100g FW) while Amrapali exhibited a content of 4.42mg/100g FW. Conversely total carotenoid content varies from 2.92 to 47.34 mg/100g FW with Vanraj and Amrapali recording 15.56 and 24.69 mg/100g FW respectively. The progeny R6P21 exhibited the highest carotenoid content of 47.34 mg/100g FW, while R2P65 displayed the lowest of 2.92 mg/100g FW. The progenies also recorded the Lycopene content which varies from 1.57 to 14.35 mg/100g FW. Crucially, we identified a significant positive correlation between the 'a' parameter and total anthocyanin content, while total carotenoid content exhibited a negative correlation with 'a.' Furthermore, we conducted a comprehensive analysis of the anthocyanin and carotenoid profiles in the peel of mango progenies, focusing on their content and composition. Liquid chromatography and mass spectrometry were employed to identify and quantify these pigments. Major anthocyanin pigments contributing to the red coloration were Delphinidin, Cyanidin, Pelargonidin, and Malvidin. On the other hand, the yellow coloration was primarily imparted by carotenoids such as β carotene, violaxanthin, α carotene, neoxanthin, and lutein. Notably, yellow-colored progenies exhibited significantly higher carotenoid levels, while red-colored progenies contained elevated anthocyanin compounds. In conclusion, our study sheds light on the complex interplay between pigments and peel color parameters in progenies. These findings will deepen our understanding of the factors contributing to mango peel color variation and provide valuable insights for future research aiming to enhance fruit color and nutritional quality.

Genetic control of bush growth habit in Cucurbita moschata Duchesne

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Bush growth promotes early maturity, high yield, favours mechanical weed control and accommodates more number of plants per unit area in C. moschata. To understand the genetic control of bush growth, segregating population between PVR-1343 (Vine) and MVSR-6711 (Bush type) was developed and their vine length was recorded at two stages viz., 40DAT (days after transplanting) and 80DAT and data was subjected to Chi-square (X^2) analysis. The first-generation hybrid resembled the bush parent at 40DAT. X^2 analysis of F2 segregation showed best fit in 3(Bush type):1(Vine type) ratio. Backcross with PVR-1343 resulted in 1:1 ratio for vine and bush growth habits, while all plants showed bush growth with MVSR-6711. This inferred single dominant gene control for bush growth habit at 40 DAT. At 80DAT, F2 plants segregated into bush, medium vine and vine growth habits, which fitted best into F2 phenotypic ratio of 1:2:1 for incomplete dominance. Backcross with MVSR-6711 showed best fit in 1:1 (medium vine:bush) ratio, while backcross with PVR-1343 gave plants with medium vine and vine growth habit. Thus, the transitional shift of bushy growth habit to vine at later stage could be attributed to incomplete dominance or developmental reversal of dominance of bush growth habit.

Whole-genome resequencing-based QTL-seq identifies major quantitative trait loci linked to fertility-restoration in eggplant

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Development of restorer line is a pre-requisite for cytoplasmic male sterility based heterosis breeding programme. A single dominant gene located in nucleus nullifies the effect of chimeric mitochondrial open reading frames; however, there is no information available regarding the location of genomic region and nature of underlying genes conditioning fertility restoration in eggplant. In the present investigation, an alloplasmic male sterile line 'MS-291' was crossed with restorer line 'R-2-1' to develop an F2 mapping population.The whole genome resequencing of parents and two contrasting bulks (fertile and sterile) followed by QTL analysis led to the identification of a major QTL 'qRfEg6.1' on terminus of chromosome 6. 8 SNP based KASP markers were scoredon177 F2individuals and a partial genetic map was generated. The marker Eg0337 (3.4 cM) exhibited a high prediction accuracy (>90%) and can be used for marker assisted breeding. Functional annotation of the region led to the identification of 39 genes involved in RNA processing and development of male gametophyte. Out of these, 17 genes coded for pentatricopeptide repeatproteins. The novel QTL and candidate genes identified in the present study provides basis for further study on fertility restoration of CGMS hybrids in brinjal.

Technical Session - III
Artificial Intelligence in Horticulture

Effect of sensor based fertigation scheduling on water productivity and nutritional density of Nagpur Mandarin (Citrus reticulata)

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Nagpur mandarin(Citrus reticulata) is globally considered as a premium fruit crop and future growth of citrus industry will be marked not only by a simple increase in yield. In light of many newly emerging challenges, changing the production pattern paired with input use efficiency must be seen as a huge challenging undertaking. Nagpur mandarin cultivation is popular among citrus growers due to its constant demand in the domestic market and easy adaptability to varied agro-climatic conditions in Vidharbharegion of Maharashtra. In these parts of Maharashtra water is scarce commodity and hence there is need to apply water judiciously as per the water requirement of the crop and the actual water requirement of Nagpur mandarin crop depends on age, season, and location and management strategies. In view of this, an experiment was conducted at the ICAR-CCRI, Nagpur (latitude 210 08'', longitude 790 01''and 349 m msl) is to be developed sensor based fertigation scheduling across phenological/critical stages for enhancing water productivity and nutritional density of Nagpur mandarin in Ambia Bahar. Based on the atmospheric demand, the average Nagpur mandarin evapotranspiration are 16,284 Litrestree-1 and water were applied to Nagpur mandarin tree at various stages ranged from 736 to 3438 Literstree-1month-1. For which, 4 main irrigation and 3 sub-fertilizer treatments were designed under split plot. In sensor based fertigation scheduling, at 25 % *AMC & N,P,K,B for new leaf initiation, 40 % *AMC&N, P, K, Fe, Mn, Zn for crop development, 55%*AMC&K, Fe, Mn, Zn for maturity and 40 %*AMC&P, K, Zn for harvesting is the best for improving water productivity and nutritional density of Nagpur Mandarin.In conclusion, In sensor based fertigation scheduling, Single Lateral with ring type micro-irrigation was the best for 11th year old Nagpur mandarin treeis recommended, applicable water saving strategy and good alternative with respect to other techniques of water managements when water resources are limited in order to increase water productivity and nutritional density while other physiological growth, roots, soil moisture and water use parameters are maintained at an acceptable level.

Forecasting tea production in India: an artificial neural network approach

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Tea is one of the most important beverage crops in India. India is the largest consumer and second-largest producer of tea in the world. Tea production is mostly concentrated in the states of Assam, West Bengal, Tamil Nadu, Kerala, and Karnataka, where it is a significant source of income and employment. During the year 2021–2022, the total tea production in India was about 1344.40 M.kg from an area of 619773.70 ha. The forecasting of tea production in India is crucial since the tea sector contributes significantly to the country's national economy in terms of employment creation, income generation, and foreign exchange earnings. In this study, Artificial Neural Network (ANN)is used to forecast the production of tea. ANN is a type of artificial intelligence technique that is data-driven and self-adaptive. Neural networks have been widely recognized as a powerful tool for time series forecasting. The data on tea production in India from 1960 to 2021 was collected and used to train the neural network. The accuracy of the model was evaluated by using Mean Absolute Percentage Error (MAPE). The forecasting of tea production for the next five years is done using the developed model. An ANN model with one lagged input and one neuron in hidden layer (NNAR (1,1)) is found to be effective in predicting the future value of tea production in India.

Development and ergonomic study of mini-mechanical harvesting implement of Bhut jolokia *(Capsicum chinese Jaqc.)*

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Bhut Jolokia (Capsicum chinese Jaqc.) or Bhutjolokia is regarded as the world hottest chilli beating Red Savina Habanero in terms of Scoville heat units. The ghost pepper plant is grown extensively in Northeastern regions specially Assam, Nagaland, Manipur and Mizoram. The pungency and toxicity of the bhut jolokia due to the presence of 3 to 5% more capsaicin, makes the bhut jolokia growers suffers extensively causing burning sensation of hands and face during harvesting and storage. Thus, there was a need of development of mini-mechanical harvesting implement which would overall prohibit capsaicin presence in its fluid to come in contact with human body. The mechanical bhut jolokia harvesting implement developed is small in size, portable, does not need any mechanical or electrical source to operate and can easily be operated by a single push key. The research was conducted using nine numbers of subjects including both genders and ergonomic and physiological study was also done using RULA assessment testing. The research was conducted in Horticulture Farm, AAU, Jorhat.

Application of artificial intelligence on grading and sorting of fruits and vegetables

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Grading and sorting of fruits and vegetables is an important operation for achieving better quality, productivity and economic growth but it is a labour intensive operation with high level of inconsistency, low precision and is prone to human fatigue. Artificial intelligence (AI) is an emerging tool in this field to overcome these challenges. AI systems is proposed to be an astute system which can substitute the human workforce to overcome visual variability, inaccuracy, and fatigue in quality grading and sorting and thus reducing the post-harvest loses. The quality evaluation of fruits and vegetables by grading and sorting which include maturity evaluation, quality identification, injury detection, and decay and disease detection for various fruits can be addressed by AI models. With the advancement of computer vision, image processing and machine learning techniques different AI models are widely used to achieve automated fruit and vegetable grading and sorting. Artificial neural network (ANN) models had shown a great potential over other models in grading by providing solutions for making quality decisions and improving postharvest efficiency such as by classifying the ripeness and firmness levels of fruits and vegetables and also by detecting the size, mass, colour, and external defects and bruises etc.

Artificial intelligence in horticulture

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Artificial intelligence (AI) has become an innovative tool across a range of industries, and itsapplications have now reached horticulture, revolutionizing the field of modern agriculture.Crop monitoring, yield forecasting, disease detection, targeted irrigation, and automated harvesting are just a few of the many applications of artificial intelligence in horticulture. Real-time data collection is made possible by cutting edge sensors and drones withAI algorithms.This enables farmers to monitor their plant's health, development patterns, and the environment. Predictive models driven by AI can predict accurate yields using historical data and machine learning techniques, allowing farmers to utilize resources more effectivelyandpredict market demand. The identification of diseases and pest control in horticultural settings has been significantlyenhanced by the incorporation of AI-driven image recognition and deep learning technology.It enables farmers to quickly discover and diagnose plant illnesses, lowering dependency onchemical pesticides and supporting sustainable

practices. By supplying individual irrigationschedules based on crop needs and environmental parameters, AI-driven precision irrigation systems maximize water use. This saves water, improves crop output, and harmful effect on the environment. The use of AI in horticulture has the potential to have a significant positive impact like effective crop yield with minimal damage but there are still issues to be resolved, including data security, implementation costs, and the lack of specialized labor.The horticultural business may, however, become more sustainable, fruitful, and effective in the future thanks to ongoing developments in AI technology and greater accessibility.

Technical Session - IV
Strategies for Development of Minor Commercial CropsProduction

Capegooseberry *(Physalis peruviana L.)* A promising fruit crops growing in South-East Rajasthan

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Capegooseberry *(Physalis peruviana L.)* is indigenous to South America but was cultivated in South Africa in the region of the Cape of Good Hope during the 19th century, imparting the common name “Capegooseberry”. Its somatic chromosome number; 2n=24. It is the only important annual herbaceous, minor tropical fruit crop of India. The crop has potential for use as nutraceutical.Capegooseberry is a member of solanaceae family. This family has many tribes and contributes many plants which are important to mankind as food or medicine. Capegooseberry is a self pollinated, herbaceous in nature and reaches 2 to 3 feet in height under favourable growing conditions. After the flower falls off, the persistent calyx expands, forming a straw- coloured husk much larger than the fruit enclosed, which take 70 to 80 days to mature. Fruits of capegooseberry are small with 1-3.5cm in diameter; they are very juicy, aromatic yellow orange in colour and round in shape at maturity. Capegooseberry is usually propagated by seed.Seeds may be sown in poly bags (22x15cm with 150 gauges) 6 weeks prior to transplanting; about 250 g seeds are required for one hectare area, its seeds are small and seedlings are planted when they are 15-20cm tall during September-October. Fertilizer ingredient require 15 tones FYM, 120kg N2, 80kg P2O5 and 60kg K2O for per ha. apply after planting. Intercultural practices such as weeding should be done after in which 30 days of planting. It’s should be irrigated once in 12-15 days in winter and 6-8 days in summer. Capegooseberry fruits 80-90 days taken to first harvesting from transplanting. When persistent calyx, fruit stalk dried completely and fruit colour changes into yellow colour its optimum stage for harvesting. The average yield is 30-40 q/ha. Pest and disease can not harmful effect on the crop during growing condition also yield. Though, Capegooseberry is important in view of its horticultural crops its fruit fetch in the market at high prices. It needs to be accentuated in order to cultivation adoption of this crop to also help in improve socio-economy of the farmer. Cultivation adoption is worth adoption under S-E Rajasthan conditions.

In- depth study of floral bio-active constituents and antioxidant potential of Arundina graminifolia *(D. Don)* Hocr. – An endangered medicinal orchid species

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Arundina graminifolia, is a medicinal orchid species know as one of the largest groups in the Orchidaceae family recorded over 1100 species in the world. In India, Arun dina is mostly distributed in the North Eastern Himalayan region also known as bamboo orchid. Owing to their well-known nutritional value and medicinal properties, the genu Arun dina has attracted interest in many health products and pharmaceutical fields. Arun dina herb is a well-known traditional Chinese herbal medicine that has immuno modulatory, anti-tumor, anti-diabetic and anti-oxidant properties. In the present study, Arun dinagra mini folia or bambooor chid flowers have beenai medto explore for their neutraceutical potential such as bioactive phenolics, anthocyanins, vitamin Eandam inoacids through LC-MS/MS, micro-minerals through ICP-MS, and non-targeted bioactive compounds through LC-HRMS. The in-vitro antioxidant activity such as total antioxidant activity, CUPRAC, DPPH, ABTS, Metal Chelation etc., of selected A. gramini folia orchid flowers has studied to explore their neutraceutical potential. The investigation showed that A. gramini folia flowers recorded highest amount of phenolics such as gallic acid (516.28 mg/kg), Quercetin 3-O-Galactoside (89.92 mg/kg), anthocyanins like petunidin (164.86 mg/kg) and Vitamin E such asgamma tocopherol (257.18 mg/kg). The quantification of amino acids showed the presence oflysin, leucine and other few essential amino acids in the flowers of Arun dina. The analysis of minerals and antioxidant potential also revealed that these flowers has possesses tremen dousneut raceuticaling redients. The study non-target compound through LC-HRMS has been reported total more than 60 major bio-active compounds of phenolics, flavonoids derivatives. In A.graminifolia species, the elevated relative abundance of the potentially bioactive metabolites,namely gamma tocopherol, quercetin, gallic acid and petunidin suggests its suitability as apotential functional food ingredient. Hence, the present study indicated that selected medicin all yor chid species are superiorre servoir of bioactive in gredients. The untargeted metabolomics approach will further unfold A. gramini folia flowers nutraceutical potential. The findings of the study are expected to be valuable for floriculturists, food and drug scientists, and pharmaceutical industrial operators alike and the flowers based by-products may be utilize in the food and drug based pharmaceutical industries.

The effect of pollination treatment on capsule formationin Diplomerishirsuta *(Lindl.):* Anendangeredorchidspecies

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Diplomeris hirsuta (Lindl.) is a lithophytic orchid popularly known as Snow Orchid. It is a rareand threatened terrestrial orchid in India. The vulnerability of this species has created greatinterest among the researchers to conserve the orchid plants. Breeding system determines how aspecies reproduces, seeds will be generated, and dependency on the pollinators for seed set.Failure in reproduction of plants can be either due to the absence of pollinator or less pollinatorspresent in the area. No studies have been conducted with respect to the breeding system of thisorchid. To evaluate the effectiveness of breeding systems, capsule formation along with capsule length, width, and abortion was recorded in Diplomeris hirsute by following seven pollination treatments in different locations. The incidences of Agamospermy in Diplomeris were rare at the study site resulting in zero% of observed flowers forming capsules. In addition, hand pollination resulted in significantly greater capsule formation whenflowers were subjected to Induced xenogamy (73.33%) followed by Inducedau togamy (66.66%)and Spontaneous autogamy(26.67%) in East Sikkim and 66.67%, 53.33% and 26.67% in North Sikkim, respectively. The capsule formation was 175 % more in Induced xenogamy at Assam Linzey, East Sikkim and100% more in Phamtam, North Sikkim as compared to the control breeding system. The length and breadth of the capsule was also observed to be more in Induced xenogamy (167cm, 0.43cmand 160cm, 0.43cm) in both the locations, respectively. Since the breeding system of Diplomerishirsute is still unclear, it is crucial for conservation and reintroduction of this endangered species into its natural habitat. Additionally, it will assist breeder to develop novel plant varieties and also helps in a symbiotic germination of species for large scale production.

Orchid conservation in the face of challenges: Addressing illegal trade and threats

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Orchids are famous for their captivating beauty and ecological significance, stand as a diverse and esteemed group of flowering plants, and encompass over 28,000 species across the globe. However, these remarkable flowering plants confront a multitude of conservation complexities and are besieged by an array of threats within their native habitats. Preserving orchids is of paramount importance due to their ecological indispensability, aesthetic allure, and potential medicinal benefits. Orchids function as ecological linchpins, fostering equilibrium within ecosystems by providing shelter and sustenance for a wide spectrum of life forms. Moreover, they bolster local economies through their pivotal roles in horticulture and ecotourism endeavors. Despite their exalted status, orchids confront a litany of jeopardies. The loss and degradation of habitats due to deforestation, urban expansion, and agricultural encroachment loom as pervasive threats to their survival. Alongside this, the illicit collection of orchids for commercial trade, coupled with excessive exploitation for ornamental purposes, exacerbates the dwindling of wild populations. The specter of climate change casts yet another formidable shadow over orchids. The orchestration of temperature shifts, altered rainfall patterns, and heightened frequency of extreme weather events disrupts the intricate symphony upon which orchids rely for pollination, germination, and ultimate viability. This adverse effect also influences the symbiotic partnerships between orchids and their mycorrhizal fungi, pivotal for nutrient absorption and seed propagation. This study delves into the persistent specter of illicit trade, laying bare the grim challenges it poses. Intrinsic to this exploration are the primary threats that entwine themselves around this extraordinary flora. Through comprehensive analysis, the article unravels the layered efforts taken to ensure the continuity of orchids' existence, while simultaneously underscoring the critical need to curtail illegal trade practices. By amplifying awareness of these multifaceted issues, this article illuminates a path toward an enlightened and sustainable coexistence with the mesmerizing world of orchids. This article explores into the realm of orchid conservation, highlighting the intricate tapestry of challenges that this revered plant group faces. From the subtleties of ecological balance to the darkness of illicit trade, this abstract navigates through the nuances of orchid preservation. It underscores the imperative of understanding and addressing these challenges for the enduring splendor of orchids and the ecosystems they grace.

Effect of different growth factors on orchid cultivation

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Orchids, renowned for their exquisite beauty and versatility, are prized in the floriculture industry for their diverse size, colors, shapes, and extended vase life. They fetch a premium price in both national and international markets and have a hugedemand as cut flowers, potted plants, hanging baskets, and indoor decorations. In the pursuit of optimal growth and development of orchids, light emerges as a pivotal growth factor. Adequate light plays a important role in fostering proper growth, nutrient storage, and ultimately in the flowering cycle of orchids. Balancing light exposure with cooling techniques proves essential, particularly in sun-drenched climates. Employing shading strategies in such environments can effectively maintain greenhouse air temperatures at levels 5–10 °C below the ambient temperature. This not only increases relative humidity by approximately 15–20% but also diminishes solar radiation transmission by 30–50% compared to unshaded greenhouses. Moreover, shading materials double as insulators in colder climates, significantly reduces nocturnal heat loss from greenhouses. This innovative approach allows for maintaining the greenhouse's internal air temperature approximately 5°C above outdoor levels while curtailing energy consumption for heating by 15-20%. While some orchid species thrive in intense light conditions, the consensus leans towards diffused light for fostering orchid growth. Orchids exhibit tolerance for direct sunlight exposure during early morning or late afternoon/early evening, yet their light requirements remain substantial. Recent studies underscore the benefits of employing shading nets, which not only enhance greenhouse conditions but also augment the efficiency of cooling mechanisms. The insights presented in this article carry implications of great value for both orchid cultivators and researchers alike. By optimizing light exposure through well-calibrated shading techniques, stakeholders in the orchid industry can elevate their cultivation practices, improve yields, and contribute to the vitality and longevity of these exquisite floral treasures.

Pickling cucumbers: A review

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While virtually any cucumber can be pickled, certain cucumber varieties are more suited for preservation due to factors such as skin thickness, seed quantity, and overall texture. These preferred cucumbers, commonly known as gherkins (Cucumis sativus L.), are cultivated for their ideal size, shape, and crispness when used in pickling. The cultivation, processing, and export of gherkins began in India in the early 1990s, starting in Karnataka and later expanding to Tamil Nadu, Andhra Pradesh, and Telangana. India now accounts for approximately 15% of the world's gherkin production. Gherkins are primarily utilized in the creation of pickles through fermentation or vinegar-based preservation methods. Various strategies for enhancing gherkin crop development, encompassing breeding techniques, agricultural practices, and post-harvest handling methods to improve yield, quality, and disease resistance. Accessible gherkin varieties prove highly advantageous to farmers, necessitating comprehensive knowledge from seed treatment to post-harvest management. The unique characteristics of gherkins make them a preferred choice for preserving the desirable crunchy texture and tangy flavour associated with pickles. India has established itself as a prominent source for superior gherkin cultivation, processing, and export to meet the growing global demand, with significant contributions from government initiatives in supporting this crop's growth.

Production technology of dragon fruit

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Dragon fruit, a recently introduced super fruit in India and considered to be a promising remunerative fruit crop. Dragon Fruit is a climbing fast growing cactus species which has received worldwide recognition not only as an ornamental plant but also as a fruit crop and industrial source of compounds. It has high demand in national and international markets. Originate from Mexico and Central South America. Fruit is named as pitaya because of the bracts or scales on the fruit skin and hence the name of pitaya meaning ‘‘the scaly fruit’’. It is a long day plant with beautiful night blooming flower that is nicknamed as “Noble Woman” or “Queen of the Night”. The fruit is non climacteric, large oblong with red peel and large green scale. It has widely brought about high content of nutrients medicinal and cancer preventing

effects. The biggest advantage of this crop is once it planted, it will grow for about 20 years. One hectare could accommodate 1000 to 2000 plants. The agronomic practices are easy and less expensive. The neglected mine areas where other commercial crops are not suitable to cultivate, it has the potential to survive in a dry area and adaptive to various marginal soil conditions. Now it is knocking door in various agro-climatic zone of India. The most successful tidings are coming from Gujarat where it is cultivated as monocrop. It bears fruit in the second year after planting. Attains full production within five years. It is fast return future crop. The requirement of water and tillage practices of dragon fruit is low. Due to fewer pest and disease attacks it requires minimal after care.

Beyond the harvest: Extending kiwi fruit storage viability

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Kiwifruit, renowned for its vibrant flavor and exceptional nutritional profile, holds a prominent position in global fruit markets. However, its intrinsic characteristics, coupled with the challenges of seasonal availability, have prompted a growing interest in extending its post-harvest storage viability. The economic significance of prolonging storage life is emphasized, as it facilitates marketing well beyond the harvest season. This study delves into multifaceted approaches spanning pre-harvest, harvest, and post-harvest phases to enhance storage longevity. The pre-harvest factors are dissected, encompassing the pivotal role of maturity stage, climatic and soil conditions, water relations, and the positioning of fruiting shoots. And during harvesting are highlighted to mitigate damage like cuts and bruising, crucial for maintaining prolonged storage potential. Post-harvest aspects are explored with a focus on factors like potential Botrytis cinerea infection, pre-cooling techniques, and specific storage conditions including temperature, relative humidity, and ethylene exposure. Moreover, this study addresses the application of innovative cooling methods such as Control Atmosphere storage, Ultra Low Oxygen storage, and hypobaric storage, revealing their growing adoption in recent years. The cumulative insights emphasize the need for a holistic approach to prolonging storage. Such efforts not only empower horticultural practices but also facilitate market stability and enhance economic growth by minimizing wastage and catering to consumer needs. As global food demand increases and seasonal fluctuations persist, the significance of optimizing fruit storage longevity becomes increasingly evident. This study contributes to the overarching goal of sustainable agriculture and resilient supply chains, underscoring the importance of looking beyond the harvest to secure a prosperous and nourished future.

Orchids in peril: climate change challenges and conservation

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Orchids, known for their exquisite blooms and grace our planet's landscapes with beauty, yet, these delicate wonders face some serious threats, such as habitat loss, illegal trade and climate change etc. questions about their existence. Research reveals that over half of evaluated orchid species are at risk, underscoring the escalating danger they confront. Alongside climate change emerges as a potential threat, capable of reorienting ecosystems based niches, so thereby resilience is gradually becoming low for the orchids to survive in nature. Analytical understanding on the impact of climate change on niche based orchid distribution pattern is of paramount importance for developing a road map towards an effective conservation protocol. Earth's climatic shifts which are being manifested in the form of sea-level fluctuations, foster isolation and connection among islands and mainland regions, enables orchids to maintain their biodiversity. The same climate change as reflected in global temperature rise also influencing orchids' adaptive capacities thereby their survival at its core. Having a deeper perspective towards global richness and nature of proliferation of orchid species across the continent and varied ecosystem, there lies an urgent necessity for research and more so on public awareness to minimize the climate change impacts on orchids. Tourism sectors growth and diversification fused with floral macrocosm also brings orchids in the fore front seeking an attention. This paper is an effort to call for diversified research efforts and in developing strategies to mitigate the challenges.

Role of rooting media and planting time on stem cuttings of kiwifruit *(Actinidia deliciosa chev.)*

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The present study entitled, “Role of rooting media and planting time on stem cuttings of kiwifruit (Actinidia deliciosa Chev.)” was carried out at Horticultural Research & Training Station and Krishi Vigyan Kendra, Kandaghat, Solan (H P) during 2020-21. The experiment was laid out in (RBD) Factorial with three replications having ten treatments of rooting media viz; T1: Sand – 2", T2: Sand – 3", T3: FYM – 2" + Sand – 2", T4: FYM – 3" + Sand – 3", T5: Coco peat – 2" + Sand – 2", T6: Coco peat – 3" + Sand – 3", T7: Sand – 2" + Poultry manure – 2", T8: Sand – 3"+ Goat manure – 2", T9: Mixture 2" [Sand + FYM+ Coco peat (1:1:1)] and T10: Control (Soil) and three different time planting time viz; D1: 22nd January 2020, D2: 29th January 2020, D3: 8th February 2020. The observations were recorded on sprouting percentage, shoot length, number of leaves, leaf area, rooting percentage, length of longest root, total root length, shoot and root biomass, leaf chlorophyll. From the present study, it was concluded that among different media T6: Coco peat – 3" + Sand – 3" had maximum shoot length (174.30 cm), number of leaves (28.30 cm), rooting percentage (66.00 %) and total root length (8.72 m) and rooting media, g). Among different dates of planting D3: 8th February recorded maximum shoot length (153.67 cm), number of leaves (25.33), rooting percentage (49.95 %) and total root length (7.37 m). The treatment combination T6D3: Coco peat – 3" + Sand – 3" + 8th February produced best nursery plants of kiwifruit in terms of growth parameters i.e. maximum spouting percentage (88.2 %), shoot length (202.50 cm), leaf area (195.64 cm2), rooting percentage (73.77 %), length of longest root (34.86 cm), total root length (10.23 m) and shoot root biomass (93.37 g).

Underutilised and unexploited vegetables of North East India in combating malnutrition

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Underutilized or unexploited vegetable crops represent a treasure trove of agricultural potential that remains largely untapped. These vegetables are neither cultivated on a commercial scale nor widely traded, resulting in limited attention from both researchers and farmers. This underutilization extends to areas such as planting materials, production techniques, and nutritional benefits. In India's northeastern region, where malnutrition is prevalent, certain underutilized vegetables native to the area hold promise as a viable solution. Many of these vegetables boast higher levels of essential vitamins and minerals compared to

their commonly cultivated counterparts. Consequently, they offer a valuable means of combating malnutrition and maintaining dietary diversity. Examples of these underutilized gems include winged bean, tree tomato, sweet gourd, barbadine, chayote, velvet bean, tree bean, jack bean, aerial yam, bird-eye-chilli, as well as a variety of leafy vegetables like Kola Kosu, Jhilmil Saak, Bon Jaluk, Suka Saak, Dhekia, Mosondari, Bor Manimuni, Mati Kanduri, Bhedailota, Bor Tengesi, Xoru Tengesi, Brahmi, Tita bhekuri, Hati Bhekuri, Keheraj, Khutora, Kon Bilahi, Kotahi Bengena, Modhu xuleng, Pirali Paleng, Tita Bhekuri, and more. Neglecting these vegetables puts them at risk of extinction. Therefore, comprehensive research is imperative. This research should focus on developing proper production technology, disease management techniques, processing methods, and thorough nutritional analysis. By doing so, we can unlock the full potential of these underutilized vegetables, ensuring their continued existence while simultaneously addressing nutritional challenges in the region. Embracing these lesser-known crops is a step towards a more diverse and nutritious diet, promoting food security and sustainability in the process.

Underutilized minor fruits of Barak valley region of Assam and their nutraceutical values

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Barak Valley Region is located in the southernmost part of the Indian state Assam and geographically lies approximately between 23°N to 24° N latitudes and 92°E to 93°E longitudes. The region is bestowed with rich genetic diversity of different underutilized minor fruits found in wild, semi wild and semi domesticated condition. Minor fruits, also known as lesser known fruits are less palatable, grown in adverse agro-climatic conditions with limited resources without proper scientific management. The lack of awareness about their potential uses, unorganized market and poor market value, these fruit plants are grown on a very small scale and get less importance than the conventional fruits. Some of the popular underutilized fruits of this region are Dillenia indica L. (Ou-tenga), Elaeocarpus floribundus Bl. (Jalphai), Garcinia spp. (Thekera), Syzygium cumini (L.) Skeels., Syzygium jambos (Bogi Jamun), Tamarindus indica L. (Teteli), Terminalia bellirica (Gartn.) Roxb., Terminalia chebula Retz. (Silikha), Phyllanthus acidus (Poramlakhi), Averrhoea carambola (Kordoi), Spondias mangifera (Amora), Baccaurea sapida (Lateku), Artocarpus heterophyllus etc. These fruits are rich source of vitamins, minerals and several essential nutrient elements and play a pivotal role in food and nutritional security of human beings.The bioactive compounds present in the fruits directly attributed to antioxidant properties and help to fight against various free radicals. Apart from nutritive value, minor fruits are being used in the ethno-medicines from time immemorial and provides significant source of livelihood support for many rural communities. The regular consumption of these fruits prevent several diseases and disorders including obesity, diabetes and chronic diseases and have a greater potential to cure several deficiency disorders and also increase the immunity against diseases.

Effect of intercropping in Dragon fruit orchard in Assam condition

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Intercropping means growing of two or more crops of different species simultaneously on the same piece of land for complete utilization of the resources available at the farm. Selection of intercrops is the main aspect to consider while practicing intercropping. It adds diversity to the farm plant population and results in increased cropping intensity and productivity of the fruit orchards. Dragon fruit (Hylocereus spp.), an important tropical fruit crop, is planted with a spacing of 2.5x2.5 m2. Its adaptability to Assam condition is very good with abiotic stress tolerant like drought and temperature extremes. It acts as a high value low volume crop in Assam. In dragon fruit orchard, it was found that among different intercrops king chilli and brinjal are the best companion. The main crop, i.e., dragon fruit gave a yield of 16 tone/ha whereas both the intercrops i.e.,brinjal and king chilli gave a yield of 15 tone/ha and 8 tone/ha respectively. It was found that, the yield of main crop is not hampered by the intercrops. While comparing the income of dragon fruit cultivated as sole crop was Rs. 43,54,500/ha and dragon fruit intercropped with king chilli and brinjal was Rs. 64,04,500.00/ha. It was found that intercropping can give maximum return per hectare area. Research shows that vegetables, being short duration, shallow rooted with very low plant height makes them ideal companion of dragon fruit. It can be concluded that intercropping of short duration vegetables in dragon fruit orchard not only maximize the resource utilization in terms of land, labour and other inputs but also play a pivotal role in minimizing the risk of crop failure by ensuring and enhancing the net income per unit of area.

Mechanical deseeding of Roselle and its effects on quality of brewed Roselle tea

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The manual deseeding of Roselle can be a time-consuming and labor-intensive process. Dealing with bulk quantities manual deseeding can result in loss of edible parts of calyx due to human error and drudgery. Therefore, considering the need and expectations of the small-scale manufactures an efficient, low-cost, fast deseeding design was developed and compared with hand/manual deseeding. The rate of deseeding for the machine was 2.5kg/hour with minimum broken percentage and with good quality of deseeded calyces. Brewed Roselle tea was taken for quality tests and to see the effect of mechanical deseeding compared with

manual deseeding. Mechanically and manually deseeded whole calyx and powder (dried at 80 °C) were selected as treatments. The quality parameters like Anthocyanin (monomeric), Total phenol content, Total flavonoid, Antioxidant activity, Total soluble solids, colour, Sensory Analysis, Bulk density, True density, Porosity were determined for both mechanical and manual deseeded calyces and powders. Sensory assessment of the Roselle tea revealed that the sample mechanically deseeded whole calyx dried at 80 °C was highly accepted and judged best among other Roselle tea samples. Also, the porosity of mechanical deseeded calyces dried at 80 °C have higher porosity (51.41%) and lower bulk density (0.69 gm/cm3), which plays important role for production of tea or herbal infusion of dried Roselle because a lower bulk density allows for better infusion and extraction of flavours and compounds. The result obtained from the quality parameters opened up a possibility having a good impact on the small-scale manufactures, marginal farmers and Self-help groups (SHGs) for having a good quality Roselle's product and smooth deseeding operation with the deseeder.

Genetic variability in wood apple fruits in Awadh region of Uttar Pradesh

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Wood apple also known as Feronia limonia L. is a dry land fruit in the shape of pyriform, oval, oblong, 15-17 m in diameter, belongs to Rutaceae family. It requires a monsoon climate with a distinct dry season. It can be planted in all kinds of soil. Preponderance of wood apple seedlings are seen growing naturally at scattered/isolated areas of various agro climatic zones of Awadh region of Uttar Pradesh, India, and chance for the selection of superior genotypes are very high due to huge genetic diversity in the exiting populations. In order to reveal the genetic variability in wood apple fruits, as fruit sample with shoot from diverse areas of province were collected and analysed for various physico-chemical attributes. Results of study revealed wide range of variability found with respect to fruit length, width, diameter, weight, fruit shape, leaf length, spine size, pulp weight, shell thickness, No. of seeds per fruit , pulp wt., seed wt. and fruit quality traits among the studied genotypes. This variability can be exploited for the selection of superior genotype for conservation, evaluation, utilization and a source for future breeding programme in crop improvement.

Morpho physico-chemical study of some indigenous leafy vegetables

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In present study, 14 types of Indigenous leafy vegetables were selected and analyzed in the laboratory, Biswanath college of Agriculture, AAU with the aim to study the morphological characters, nutritional and biochemical constituents and occurrence of diseases and pests. The results revealed that maximum (11.50 cm) leaf length in Mandhania (Eryngium foetidum), Xukloti (Pogostemon heyneanus) recorded highest leaf width (8.30 cm) and leaf area (41.08 cm2). In case of leaf shape, leaf margin, leaf apex and plant type also vary among the plant species. Highest moisture content (92.80 %) was found in Ponounuwa (Peperomia pellucida). Whereas, the highest level of Ascorbic acid (719.82 mg/100g) and Vitamin A content (8685.00 IU) were found in Khutura (Amaranthus viridis). The highest protein was found (4.80 g/100g) in Pirali paleng (Talinum triangularae). Out of fourteen leafy vegetables, Noltenga (Tetrastigma leucostaphylum), Bhedailota (Paederia foetida) and Leheti saak (Celosia argentea) had highest amount of total phenol, flavonoids and alkaloids (259.10, 288.90 mg/100g and 3.18 % respectively). Similarly, maximum calcium (2109.00 mg/100 g) and magnesium (4037.00 mg/100 g) was found in Bhedailota (Paederia foetida). Whereas, highest potassium content (8958.36 mg/100g) was observed in Pirali paleng (Talinum triangularae) and iron (396.17 mg/100g) in khutura (Amaranthus viridis). Masundari plant (Houttuynia cordata) had the highest total leaf chlorophyll (2.49 mg/g fw) and maximum total antioxidant activity (24.06 ug/ml) in Matikanduri (Alternanthera sessilis). Thus from the present study, it was found that almost all the selected indigenous leafy vegetables contained good sources of vitamins, minerals, phyto-chemicals and antioxidant properties.

Effect of shoot pruning on flowering and fruit set pattern in litchi *(Litchi chinensis Sonn.)*

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The trial was conducted in experimental plot of Bihar Agricultural College, Sabour, Bhagalpur to study the flowering and fruit set pattern in litchi cv. Purbi as influenced with different pruning levels and time of pruning during the year 2019-2020.The experiment was comprised of seven treatments with four replications. The shoot pruning levels were 15cm pruning, 30cm pruning, 45cm pruning in the month of July and August including un-pruned control. Pruning treatments

significantly influenced the time of emergence vegetative shoots and panicle, time of anthesis, duration of flowering and fruit set. After pruning number of days taken to initiate vegetative flush varied from 21 days (15 cm pruning in July) to 41 days in 45 cm shoot pruning in August. Un-pruned shoots were earliest to flower, although the maximum flowers and fruit set of 25.05 fruit /panicle was observed with 15 cm shoot pruning in July. Effect of treatments was not found significant on sex ration and flowering duration which varied from 11.67 days in T7 (45 cm pruning in August) to 15.67 days in T4 (45cm pruning in July). The maximum panicle length of 26.66 cm and spread of 17.53 cm was noted in T2 (15 cm pruning in July) followed by T3 (30 cm pruning in July). Significantly maximum number of fruit set (25.05 fruits per panicle) was recorded in T2 (15 cm pruning in July) followed by T5 (15 cm pruning in August). Thus, post-harvest shoot pruning was the most effective treatment in increasing flowering and fruit set in litchi.

Technical Session - IX
Horticulture Based Farming System

Horticulture based farming system

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Farming is a process of harnessing solar energy in the form of economic plant and animal products. 'System' implies a set of interrelated practices and processes organized into functional entity i.e. an arrangement of components or parts that interact according to some process and transforms inputs into outputs. Farming system is an integrated resource management strategy for obtaining economic and sustained crop and livestock production and preserving the resource base with high environmental quality. Horticulture based farming system includes suitable combination of agricultural crops, horticultural crops, multipurpose trees and shrubs. This system is also known as Agri-horticulture system, Agri-horti-silvi-pastoral system, Horti-silvi-pastoral system. In Agri-horticulture system, 2/3 area is covered under horticultural crops and 1/3 area is used for the cultivation of cereals, oil crop etc. In Agri-horti-silvi-pastoral system, the middle 1/3 area is taken for the cultivation of horticultural crops and upper 1/3 area and lower 1/3 area are being cultivated for establishment of economic forest plant plantation with fodder and cereals, millets etc. respectively. The Horti-silvi-pastoral system has great potential to provide a sustainable land use system, which would maintain an acceptable level of production of fruits, vegetables, fuel wood, timber, fodder etc. and at the same time conserve the basic resources a which production depends.

Black pepper based mixed cropping system for sustainable productivity and Food security

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The Konkan region of Maharashtra falls under the west-coast plains and ghat region which highly suitable for cultivation of spices. Black pepper is most important cash crops. It is called as low volume high value crop. Due to its perennial nature and slow growth, black pepper should lend itself to intercropping with seasonal crops. It's helps to improve soil properties and get additional income to the farmers. In present day orchards possess many problems to farmers such as erosion and weed growth is heavy and takes much labour to control. High temperatures are also leads to

high mortality of young pepper vines. So, tackling this problem in relation to increase production and quality we proposed experiment entitled "Black pepper based mixed cropping system for sustainable productivity and food security". The experiment was carried out in six different treatments (intercrops) namely T1 – Black Pepper + Colocasia + Pineapple, T2 – Black pepper + Arrowroot + Pineapple, T3 – Black pepper + Elephant foot yam + Pineapple, T4 – Black pepper + Tapioca + Pineapple, T5 – Black pepper + Greater yam and T6 – Black pepper alone with four replications. The yield of intercrops in different inter crops per/ha varied as colocasia 3.04 t/ha, arrow route 4.69 t/ha, elephant foot yam 11.43 t/ha, tapioca 10.22 t/ha and greater yam 7.21 t/ha respectively. The maximum yield of pine apple was found in Elephant foot yam + Pineapple mixed cropping system (10.18 t/ha). The maximum yield of black pepper was reported in treatment T3 i.e. 533.50 g/plot. As regard to the growth of black pepper the T1 has shown maximum plant height (3.04 m). Among the different cropping systems T3- black pepper + Elephant foot yam + Pineapple showed maximum net returns (2432983 Rs.) with highest B:C ratio (3.68).

Organic greenery unveiled: A holistic review of soil enrichment and plant thriving

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Organic farming practices have gained immense popularity in recent years due to their eco-friendly and sustainable nature. Among various organic fertilizers, organic liquid manures significantly improve soil fertility and promote overall plant health. This abstract delves into widely recognized organic liquid manures - highlighting their properties and benefits- Panchagavya, Jeevamrut, Vermiwash, Amritpaani, Amritsanjveeni, and Cow Urine. Panchagavya, traditional organic liquid manure, is prepared by blending five key elements derived from cows - cow dung, cow urine, cow milk, curd, and ghee. Each component contributes essential nutrients and beneficial microorganisms to enhance plant growth and immunity. The unique combination of Panchagavya components provides a balanced nutrient profile, comprising nitrogen, phosphorus, potassium, calcium, and various micronutrients, making it an excellent alternative to chemical fertilizers. Moreover, beneficial microorganisms like lactobacillus and yeast foster nutrient availability and soil microbial diversity, promoting a healthy ecosystem. Their organic nature ensures minimal harm to the environment, reduces soil degradation, and prevents the accumulation of toxic residues in crops. Moreover, the sustained use of these organic liquid manures leads to improved soil structure, water retention capacity, and enhanced nutrient absorption by plants, ultimately boosting crop yield and quality. In conclusion, Panchagavya, Jeevamrut, Vermiwash, Amritpaani, Amritsanjveeni, and Cow Urine represent effective and sustainable alternatives to chemical fertilizers, presenting a promising approach to modern agriculture. Embracing these organic liquid manures fosters a symbiotic relationship between agriculture and nature, promoting long-term environmental and agricultural sustainability.

Effect of cultivation practice on growth and yield attributes of King chilli in Darrang district of Assam

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The present field investigation was conducted under Krishi Vigyan Kendra (KVK), Darrang, Assam during Rabi season 2022-23 to study the “Effect of cultivation practice on Growth and Yield attributes of King Chilli in Darrang district of Assam”. The investigation was designed in a Randomized Block Design with five replications under three different cultivation practices. The results revealed that cultivation of King chilliin Poly house condition with 100% RDF (Recommended Dose of Fertilizer) registered significant values on growth characters like plant height (98.54 cm), leaf length (9.32 cm), number of leaves (117.50), and yield characters like fruit length(5.90cm), fruit diameter (3.11cm), fruit weight (5.92 g), less days to 1st flowering (81.50 DAT) and 50% flowering (97.20 DAT), number offruits(47.52) and fruit yield (3.10qt) followed by Open condition with 100% RDF and without RDF cultivation practices. The treatment without RDF cultivation practices recorded least plantheight (62.72 cm), leaf length (7.51 cm), smaller number of leaves (98.81), low number offruits (37.40) and fruit yield (1.77qt). Polyhouse condition with 100%RDF was found superior in respect of growth and yield attributes of King chilli over all other two cultivation practice sand moreover open condition with 100% RDF recorded maximal net income (29.04 000Rs.)and highest B: C ratio (2.14) followed by in without RDF cultivation practices and Polyhouse condition with 100% RDF and that showed net income 14.63 000Rs. & 28.32000Rs. And B: Cratio1.74 and 1.88 respectively.

Adoption status of crop production practices for potato in sub montane zone of Punjab, India

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Potato (Solanum tuberosum) is a widely cultivated root vegetable in the Solanaceae family which is grown in almost all the states in India and under diversified agro- climatic conditions. This crop produces large amount of food in a small area, being highly nutritious and in ever-increasing global demand, potatoes play an important role in improving food security. The present study investigated the adoption status of different crop production practices in potatoin Sub montane zone of Punjab, India, in district Shaheed Bhagat Singh Nagar. The study included data gathered from 50 respondents in semi-structured interview schedule. The results revealed

that~60 per cent of respondents used recommended seed rate (30-45 q/ha), while a ~40%per cent of respondents used higher seed rate. About ~54 per cent of respondents applied less than recommended fertilizer- N (<150 kg N/ha) while 36 per cent respondent apply fertilizer- N between 151 and 200 kg N/ha. The fertilizer-P application rate varied between 125 and 250 kg P2O5/ha. A large proportion of farmers (~66%) did not applied fertilizer-K, while ~34 per cent farmers applied 50-75 kg K2O/ha. Majority (~58%) of farmers applied insecticide one time, while the proportion of farmers who applied two foliar applications of insecticide was ~32 per cent. It was observed that ~10% of respondents did not apply insecticides. Thus, study suggests that there is a need to raise awareness about the different component technologies that should be used to improve crop productivity.

Integrated fish cum duck cum horticulture farming: an approach for sustainable livelihood security of farmers of Sonitpur district Assam

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An integrated approach of farming fish duck and horticultural crops was undertaken at farmers' field in total 0.26 ha and individual plot size of 0.13 ha area in the year 2022-23. The study was conducted at two villages namely Napam and Bhalujharoni of Sonitpur district of Assam. In the study it was observed that the gross profit of Rs. 6.32 lakhs and net profit of 4.20 lakhs with a benefit cost ration of 3.1 was obtained in Integrated duck cum fish cum horticulture farming whereas in traditional practice of fish farming a gross profit of Rs. 3.62 lakhs and net profit of 1.57 lakhs with a benefit cost ration of 1.90 was obtained by the farmers. The study revealed that adoption of the technology gave additional income of 2.63 lakhs compared to traditional fish farming. Apart from that it was also found that duck culture along with fish considerably increase the pond productivity and helps in increasing dissolve oxygen content in fish pond. From the study it can be concluded that integrated fish cum duck and horticulture farming is a sustainable approach for income generation and waste to wealth creation.

Identification of feasible and profitable IFS modules for different agro-ecological situations at Barpeta district

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Integrated farming system (IFS) is a sustainable eco-friendly agriculture system. It combines various enterprises such as crops, livestock, aquaculture, poultry, sericulture, agro forestry, and mushroom and bee culture in a way to achieve economic and sustained agricultural production through efficient utilization of resources. It fulfils the multiple objectives and overall upliftment of rural community. A study was carried out in Barpeta district, Assam with five different IFS models at ten different locations viz Parabharal, Kalbari, Saderi, Keotkuchi, Sarupeta, Kuchiajhar, Bhella, Bhogpur, Rupdiga and Doloigaon during 2019-22. The components of IFS model included are model I: Integrated Pig (fatterning) cum fish farming, model II:Integrated Fish + Duck + Horti farming, model III: Integrated Poultry + Fish + Crop (maize) system, model IV: Paddy – Toria cultivation with Apiculture and model V: Paddy – Vegetables + Mushroom cultivation + vermicompost production. Each model was established with two selected farmers. The result revealed that the highest gross return (Rs.318000), net return (Rs.186000) and BCR (2:4) were found in Integrated Pig (fatterning) cum fish farming (model I) followed by Integrated Poultry + Fish + Crop (maize) system (model III), Integrated Fish + Duck + Horti farming (model II), Paddy – Vegetables + Mushroom cultivation + vermicompost production (model V) and Paddy – Toria cultivation with Apiculture (model IV).

Integrated duck-fish-horticulture farming: An ambitious entrepreneurial endeavour

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Integrated duck-fish-horticulture model was set up under supervision of KVK, Nalbari, Assam for higher income generation per unit area. Over a span of 3 successive years, 2016-2019 data was compiled based on annual income, showcasing the efficacy of this approach. A duck shed was constructed over a 0.13 hectare pond water surface area for recycling of animal wastes. Khaki Campbell ducks (30) for egg production and Viola broiler ducks (15) for meat purposes were housed in the shed. Four batches of broiler ducks were reared each year. Ducks were allowed to graze and scavenge, supplemented with residual food and restricted concentrate feeding. The duck excreta fell directly into the water for manuring the pond. The pond's periphery was planted with bananas and Assam lemons and seasonal cucurbitaceous vegetables

viz. bottle gourd, pumpkin, bitter gourd etc. to augment the income. The pond was stocked with fingerlings of both Indian and exotic major carps, (Catla, Rohu, Mrigal, Silver and Common carps in 2:3:3:1:1) @ 6000 per ha as polyculture practice. No supplementary concentrate feed was provided to the fish. Instead, cow dung was deposited along the bank, slowly leaching into the water to stimulate plankton growth. The integration of ducks elevated water quality parameters in the pond, as evidenced by pH, dissolved oxygen, and alkalinity that enhanced growth rates of fishes compared to control ponds lacking ducks. The duck integrated pond yielded an annual fish harvest of 3.2 t/ha/year compared to 2.2 t/ha/year in control pond. Annual fish production was found 423 kgs. The egg production of Khaki Campbell ducks averaged 236.00±0.52 per annum, while the Vigova broiler ducks reached a body weight of 2.30±0.24 kg within three months. Eggs were marketed at Rs. 10.00 per egg, and broiler ducks fetched Rs. 600.00 each. Health management included vaccinations against duck plague and fowl pox virus. Mortality rate was 3.7% and had negligible disease incidences. The B:C ratios of fish, ducks and horticultural crops were 2.7, 3.1 and 2.5 generating an income of Rs. 1.56, 1.05, 0.42 lakh, respectively. These collective outcomes signify the viability of integrated fish-duck-horticulture farming as a highly profitable entrepreneurial venture with limited inputs suitable for generating employment opportunities and women empowerment in rural settings.

Horticulture-based farming systems: An integrated approach to sustainableagriculture

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Horticulture-based farming systems have emerged as a promising paradigm in modern agriculture, aiming to meet the challenges of food security, environmental sustainability, and economic viability. Traditional farming has proven to be ecologically detrimental and economically unsustainable, leading to soil degradation, loss of biodiversity, and increased reliance on chemical inputs whereas, horticulture-based farming systems prioritize diversity, emphasizing the cultivation of fruits, vegetables, nuts, herbs, and ornamental crops. The principles of horticulture-based farming systems in agro forestry, where fruit and nut-bearing trees are inter-planted with other crops. This approach provides a source of income and also contributes to carbon sequestration and soil improvement. The integration oflivestock'scomplements horticulture by recycling nutrients andoffer revenue streams. The application of modern technologies in horticulture-based farming enhances productivity and reduces environmental impacts. Precision agriculture techniques, like drip irrigation and remote sensing, ensures efficient water usage and nutrient application. The adoption of horticulture-based farming systems has positive socio-economic implications. l-scale

farmers benefit from diversified income sources and reduced market risks, leading to improved livelihoods,food security and the preservation of indigenous varieties. Therefore, a horticulture-based farming system offers a holistic and sustainable approach to modern agriculture. By prioritizing diversity, ecological balance, and technological innovation, these systems hold the potential to meet the world's growing food demands and sustainability. The policy makers, researchers, and farmers must collaborate to promote and implement the systems on a wider scale, thus moving towards a more resilient and prosperous agriculture future.

System productivity and carbon sequestration potential of coconut based cropping systemunder integrated nutrient management practices

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A field experiment was carried out at Horticultural Research Station, Kahikuchi of Assam Agricultural University for six consecutive years (2014-15 to 2019-20) to study the productivity and potential of carbon sequestration as influenced by integrated nutrient management practices under coconut based cropping system. Integrated nutrient management (INM) practices viz. T1: 75 % recommended NPK + 25% N through organic recycling with vermicompost, T2: 50 % RDF + 50% N through organic recycling with vermicompost + vermiwash application + biofertilizer + In situ green manuring, T3: Fully organic- 100% N through organic recycling with vermicompost + vermiwash application + biofertilizer + In situ green manuring and green leaf manuring + coconut husk incorporation and mulching with coconut leaves were imposed in coconut based cropping system involving banana, pineapple, Assam lemon, turmeric and black pepper. For comparison, T4 control: monocrop of coconut with recommended NPK and organic manure was maintained. Four treatments were laid out in a block of 0.45 ha area each. Among the different INM practices, treatment T2 sequestered the highest amount of above ground carbon stock (38.1 t/ha) followed by T1 (31.7 t/ha) and T3 (28.7 t/ha), whereas the treatment T4 (coconut monocrop) had sequestered 26.6 t/ha. The below ground soil carbon stock in the rhizosphere of different crops was highest in the nutrient management under T3 followed by T2 and T1, whereas it was lowest in coconut monocrop. The productivity of the system was higher in intercropping garden and the coconut nut yield (6 year average) was the highest under T2 (13857 nuts/ha) followed by T1 and T3, whereas coconut alone (T4) registered significantly the lowest nut yield (11647 nuts/ha).

Sustainable model of horticulture- based IFS for marginal farmer – A case study

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Dhemaji is the easternmost district of Assam with 47.5 percent tribal population comprising 78.5% marginal and small farmers. Though the agriculture is the prime sector for subsistence of more than 85 farm families, extensive farming is not possible for marginal and small farmers due to limited resources. If properly managed, integrated farming systems (IFS) have the potential to increase livelihood and employment by marginal farm families. IFS can afford profit from business synergies, yield diversification, and environmental soundness and are frequently less hazardous. IFS models have been proposed by a number of scholars to support small and marginal farms families. The present study is carried out to document a successful IFS developed by intervention and technological backstopping by KVK Dhemaji in a backyard of progressive marginal farmer of Dhemaji district of Assam during 2020-22. The system is fabricated with horticultural, poultry and fishery with resource-based modification proved viable and profitable. The average gross annual income has raised up to Rs.1.4 lakh with 2.93 BC ratio which was Rs.0.18 lakh before intervention from the area of 0.20 ha. The major share of income (64%) from horticulture sector followed by poultry (19%) and fishery (17%). The study unwraps the viability of the horticulture-based IFS in agroclimatic situation of Dhemaji district.

Integrated fish-duck-horticulture farming system: A strategy for enhancing farmer's income

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Integrated farming is widely regarded as a feasible and effective approach to bolstering the rural economy due to its capacity to deliver significant cost savings over time, requiring only a modest initial investment, and ultimately resulting in higher profitability. The objective of this study was to investigate the income generation potential of integrated fish-duck-horticulture farming in farmers' fields over a three-year period spanning from 2017-18 to 2019-20. The trials were carried out in four villages located in the Udalguri district of Assam, specifically Hirabari, Kacharitol, Jhargaon, and Deurigaon. An economic analysis has been undertaken to evaluate the integrated farming system, together with the practises adopted by farmers. The findings suggest that the implementation of integrated fish-duck-horticulture farming led to a gross profit of Rs. 5.93 lakh per hectare, whereas the conventional fish farming approach resulted in a gross profit of Rs. 2.37 lakh per hectare. The net profits for each hectare were Rs.

3.37 lakh and Rs. 1.48 lakh, respectively. The study has provided evidence that the use of an integrated farming system, which combines fish, ducks, and horticulture, results in supplementary net revenue of Rs. 1.89 lakhs per hectare of water area compared to the traditional fish farming system. In addition, the incorporation of fish, duck meat, duck eggs, and horticultural items such as malbhog banana, Assam lemon, black pepper, and others, plays a significant role in augmenting the standard of food and enhancing the security of livelihoods for households with limited resources. The research findings demonstrate that the adoption of a holistic farming approach, encompassing the integration of fish, ducks, and horticulture, holds promise in effectively tackling issues pertaining to sustainability, livelihood security, and revenue generation.

Effect of paddy straw as organic mulch in turmeric cultivation

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Turmeric cultivation is a common practice of rural farm families at least on a small scale in the backyard. The crop is 300-315 days in duration with 120 days of vegetative and rhizome initiation stage; weed, moisture stress, and mechanical damage of tender sprouts in the initial stage are some problems during organic cultivation. In the present study, paddy straw was tried as organic mulch during 2021-22to address the problem. The study revealed that up to 75 days after planting (DAP) the growth of weeds was suppressed whereas in plots without mulch required three manual weeding. The crop with mulch resulted uniform germination, less mechanical damage of tender sprouts as compared to the crop without mulch which showed less germination and damage of sprouts occurred due to heavy rain. The use of paddy straw mulch resulted in increased plant height (113 cm), highest number of suckers (7 no.), number of rhizomes per plant (14 no.), length (8.50 cm) and width of rhizome (3.00 cm) was significantly increased in mulching (14, 8.5 and 3.0 respectively) over the crop without mulch. Organic mulching showed significantly higher yield in Turmeric (318 q/ha) when compared with the crop without mulch (248.2 q/ha).

Economic implication of vegetable-based farming system: A micro-level approach

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Horticulture based farming could be one of the potential sources to increase the income of farmers and employment generation in agrarian agriculture, as well as meeting the demand for healthy foods with changing consumption habit of the growing population. Therefore, during 2020-21, present study was conducted in Nagaon district of Assam with a sample size of 100 farmers using multistage random sampling where pretested schedule was used by PRA and interview method to examine the status, income, employment, and problems associated with horticulture-based farming system. Arecanut and coconut are found to be the common crops grown by all the selected farmers and the highest net return of Rs.298480 per ha from Vegetables+ Livestock component+ Spices +Coconut/Arecanut farming system out of the 6 selected farming systems. The labor employment was highest in Rice +Vegetables +Toria +Fishery+ Coconut/Arecanut farming system. In order to prioritize the problem, Pareto analysis is done and it has been found that animal menace and pest and disease are the major production problems causing (› 80 %) out of total 10 production problems. Marketing problems like processing, assembling and storage facility are major problems causing (› 80 % problems) among the sample farmers. To deal with the problems these farmers should be given proper training on management of animal and pest menace, proper storage facilities and post-harvest management. This may be the best strategy to address the yield loss occurs due to spoilage.

Technical Session - V
Production of Seeds and Planting Materials

Biochemical changes during in vitro organogenesis of *Anthurium andreanum linn*

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High frequency plant regeneration of Anthurium andreanum Linn.was achieved from leaf explant implanted on MS basal medium supplemented with different concentrations and combinations of 2,4-D and TDZ through intervening callus phase. Well-developed shoots were successfully rooted on MS basal medium fortified with different concentrations and combinations of IBA and NAA. Culture of calli in MS medium supplemented with 2,4-D (3.0 mg/l) + TDZ (0.1 mg/l) synthesized higher amount (4.129 OD min-1 g-1) of protein; MS medium containing 2,4-D (2.0 mg/l) + TDZ (0.2 mg/l) generated greater peroxidase (7.816 OD min-1 g-1) while, polyphenol oxidase content (1.128 OD min-1 g-1) was found higher in the MS medium containing 2,4-D (1.0 mg/l) + TDZ (0.2 mg/l). Protein content was found higher (6.122 OD min-1 g-1) in the in vitro regenerated plantlet when transferred in MS medium containing IBA (2.0 mg/l) + NAA (1.0 mg/l) while, MS medium containing IBA (1.5 mg/l) + NAA (1.0 mg/l) had the highest peroxidase content (4.751 OD min-1 g-1). Similarly, polyphenol oxidase content was found highest (5.600 OD min-1 g-1) with MS medium containing only IBA (3.5 mg/l). Culture in hormone free MS basal medium recorded the minimum results might be due to the lack of phytohormones that restrict the growth and developmental processes towards a definite direction.

Fruit cracking management through agrochemicals in pomegranate cv. Bhagwa under western Rajasthan condition

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Pomegranate (Punica granatum L.), which belongs to the Punicaceae family, is one of the most economical functional crops in the world. Because of its wide adaptability to different ecological conditions, this crop has been becoming a highly profitable and farmer's choicest crop. Pomegranate is consumed in the forms of whole fresh fruit, extracted arils, fresh and fermented juice, and jams and also is used as flavouring and colouring agents in the food and beverage industry and as dyes in the beauty sector. Pomegranate cultivation in India spreads over an area of 2.83 lakh hectares with a record production of 31.46 lakh MT of fruits (NHB,2019-20). Maharashtra state known for it's cultivation in India. While, in Rajasthan 11.67 thousand hectares area and 81.11 thousand MT produced annually from Badmer, Jalore, Bhilwara, Chittorgarh, Jaisalmer, Bikaner, Sikar Sriganaganagar, Hanumangarh districts. In Rajasthan region main production constraint of this crop is cracking due to edapho-climatic conditions, soil moisture status as well as deficiency of micronutrient etc. In keeping view of this is a On farm trial were formulated on four year old orchard of pomegranate cv. Bhagwa at farmer field under jurisdiction of KVK, Jalore (Rajasthan). This selected orchard were planted in the year 2018 at spacing 3 M X 4 M and maintained under drip system and constantly applied FYM and fertilizers (40 kg FYM, 1.40 kg Urea, 1.00 SSP and 0.15 MOP per plant as per package of practices Jalore). Tow treatments (T1 - Farmer Practice (No spray or limited Spray of Borax @ 0.2-0.3 %), T2 Soil application of Gypsum @ 2 kg/plant at the time of stress released and fruit setting and Two sprays of Boron @ 0.25% + Gibberellic acid @ 50ppm at the time of Fruit enlargement stage) were applied on uniformly selected plants as per standard methodology with ten replications. Among the treatments combined application of gypsum (2 kg), gibberellic acid (50 ppm) and boron (0.25 %) was reduced significantly fruit cracking (20%) over the control and additionally also reduced fruit hardening.

Reproductive potential and seed germinability of microspore derived heteroploids in brinjal

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The present study aimed to investigate the reproductive behaviour and seed germinability behaviour of microspore derived heteroploids in brinjal. The reproductive potential was investigated from pollen viability, self and cross compatibilities, while set seed of responding genotypes and their crosses with diploid testers were subjected to seed germination behaviour. With respect to the reproductive potential, doubled –haploids performed equally well to the diploid donor(PSB-72×P-219) and its parents except two genotypes with lower fruit set ability due to closed anther pores and poor pollen densities. All the other Doubled haploids (DH) lines have good pollen viabilities and densities. Among aneuploids, which were mostly deletion lines responded variably for self and cross compatibilities. Among all, MC-2, MC-29A, MC-121 and MC-146 carried self as well as cross compatibilities with diploid inbreds and set seed, while six genotypes did not show fruit set on self as well as cross pollination. Six aneuploids did not cross with diploid inbreds. All the haploid plants were found sterile with non viable pollen grains. Triploid was self sterile, but produced fruit as well as seed on cross pollination with one inbred. The germination percentage of DH lines varied between 75.33-99.33%, while it remained between 66.67 and 97.33% in aneuploids. DH × diploid crosses varied from 18.67 to 94.89% seed germination. However, compatible aneuploid × diploid crosses carried 11.33- 70.67% seed germination. This investigation highlighted that DH and few aneuploids as well as DH based hybrids carried potential for utilization in brinjal crop improvement.

Rootstock improvement in mango *(Mangifera indica L.)* for widening genetic base and enhanced climate resilience

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Rootstock breeding is an indispensable part of fruit breeding since it provides basic ground support, nutrient translocation and tolerance to various soil borne biotic and abiotic stresses. Polyembryony, soil related stress tolerance and favorable effect on scion are important features of a suitable rootstock. With this view and to diversify rootstock, screening of germplasm for polyembryony, salinity stress and assessing the effect of newly identified rootstock i.e., ML-2 and ML-6 on early growth was carried out. The stones collected from ML-2, ML-6, Vellaicolamban, Pahutan, CJ-1, CJ-2, EC-95862, Kurukkan, Nekkare, Kitchner, Phillipino

varieties of mango were sown during 2023 and were assessed for the percentage of polyembryony and it was found that all of these have shown polyembryony which ranged from 20-50%. On challenging with salinity stress i.e., 5 dsm-1 the activity of proline, glycine betain, SOD, catalase and scavenging of ROS was found better in case of Kurukkan followed by Nekkare. Root transcriptome study revealed YABBY transcription factor and T6PP genes were significantly upregulated in salinity tolerant variety 13-1 under salinity stress condition. Further the effect of rootstocks viz., ML-2 and ML-6 (salinity tolerant) on Dashaheri scion (graft year: 2022) was also assessed and it was found that ML-6 was at par with the performance of ML-2 for growth related traits viz., length of scion, no. of leaves, leaf length but in case of leave width ML-6 was found superior. The effect of these root stock on inducing dwarfness assessed from mean internode length was also assessed during early growth period (first year of growth) and it was found that the mean internode length significantly lower (6.12 cm) in case of ML-2 grafted plants as compared to ML-6 grafted plants (8.77 cm). Although the difference for number of internode between these two were non-significant. With this additional feature of inducing dwarfness along with salinity tolerance, ML-2 can be a potential rootstock stock.

Effect of different root stocks on growth, yieldand quality in brinjal

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The aim of this investigation was to study the effect of different rootstocks on growth, yield and quality in brinjal. In experiment there was two factors rootstocks (R) -Solanumtorvum, Konkan Prabha, Swarn Pratibha, Arka Nidhi and scion seedlings and scion (S)-KaliRavai, Bandhtiware local and Manjiri laid out in split plot design with two replication at Agriculture research station, Palghar during 2022-23. The data regarding effect of interaction of rootstocks and scion on plant height at 15, 30 DAT, girth of rootstock and scion at 15, 30,90 DAT, no. of branches at 30, 60 DAT, no. of days for flowering, no. of days for 50 % flowering, no. of fruits, fruit diameter, bacterial wilt and fruit & shoot borer showed non-significant effect. While plant height at 45, 60, 75DAT, girth of rootstock and scion at 45, 60, 75DAT, no. of branches at 90 DAT, yield per plant and yield per ha. recorded significant effect. The treatment T3 (R1-S. torvum X S3-Manjiri) was found to be most promising as compare to rest of the treatments in respects of plant height, girth of rootstock and girth ofscionat45DAT (44.52,10.73,10.63), 60DAT (73.65,13.54,13.32), 75DAT(92.73,17.46,17.23) & 90 DAT (117.69, 21.39, 20.84), number of branches at 90 DAT (30.57), yield per plant (1.83 kg) and fruit yield /ha (50.91 t/ha) with minimum incidence of bacterial wilt (2.18%)and shoot and fruit borer (3.69 %).

Performance of different houseplants in response to different rooting media

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The present study was carried out to study the effect of different rooting media on the rooting of different houseplants. The present experiment was conducted under low-cost polyhouse, Horticulture Farm, School of Agricultural Sciences, Nagaland University, Medziphema, Nagaland and laid out in 2 factorial Completely Randomized Design with three replications. Four houseplant viz. Codiaeum variegatum 'Petra', Codiaeum variegatum 'Gold Dust', Codiaeum variegatum 'Zanzibar' and Codiaeum variegatum 'Mammy' was taken and planted in five rooting media namely top soil, riverbed coarse sand, riverbed fine sand, coco peat and perlite. According to the results, it was observed that houseplant Codiaeum variegatum 'Petra' showed the maximum rooting percentage, root length, number of roots per rooted cutting and number of rooted cutting in the rooting media riverbed fine sand.

Effect of Pruning Height on Growth Characteristics of Ber *(Ziziphus mauritiana Lamk.)*

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An experiment on effect of pruning on growth characteristic of ber was under taken during 2020-21 and 2021-22 at a farmer's field at Manikpur, Bongaigaon, Assam. The experiment was laid out in factorial RBD with variety as factor with two varieties 'Apple ber' and 'Thailand ber' and pruning height as the other factor with two height of pruning i.e. 50 cm and 75 cm from the ground level. Results depicted that height of pruning had no significant effect on plant height, diameter of primary branches, leaf area and LAI. Whereas, significant variation in number of primary branches was recorded due to the influence of pruning height. The maximum primary branches (8.28 no./plant) were recorded in the pruning height of 75 cm from the ground level. This parameter might have significant influence of number of fruits per plant and ultimately the yield. Hence, pruning height of 75 cm from the ground level can be termed as the best in terms of growth characteristics of ber.

ptimization of planting time of watermelon cultivation in Udalguri district

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Watermelon cultivation has widely been popularized in the district of Udalguri during the recent years. The farmers have taken up watermelon as the second crop in the rice fallow areas of the district. Most of the cultivators sow the watermelon seeds during the end of rabi season mostly during the months of January to March which results in May-June harvest. The farmers of the district suffers from heavy loss in watermelon cultivation, since all the harvested produce is become available in the markets at the same time. The selling price of watermelon during this period goes as low as to Rs. 5 per kg which discourages the farmers of the district. Keeping in mind the selling prices, a study has been taken up to optimizes the watermelon sowing time to obtain maximum profit from the crop in the district. The study has been conducted during 2021-22 and 2022-23 in Sarbaherua and Jhargaon villages of the district, respectively. Three optimum watermelon sowing time viz. 15th October - 15th November; 15th December - 15th January, and 15th January - 15th February, as farmers' practice has been selected. The results of the study shows that the 15th December - 15th January sowing period fetches highest selling prices of Rs. 32 per kg during 2021-22 and Rs. 30 per kg during 2022-23 season. The highest benefit cost ratio of 4.31 and 4.16 is also observed in the same sowing time. In conclusion, the findings of the study suggests that the watermelon sown during the period of 15th December - 15th January have been profitable to the farmers of Udalguri district.

Seedpriming: A seed technological tool to increase chilling tolerance in Chilies

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Chili pepper (Capsicum frutescens L.) is an important horticultural crop that has high economicvalues but the extensive cultivation in lower temperature can reduce yields due to chilling stress conditions. Pepper plants are originally from tropic regions and require high temperature conditions for their development. Consequently, the optimum growth temperature is between 25and 30°C.The temperature changes affect a variety of physiological functions and morphologicaldevelopment. Plant tolerance must be increased to be able to adapt in chilling stress conditions. One method that can be used is seed priming, which is pre-soaking the seeds to increase germination under unfavorable conditions. When temperature decreases below 15°C, peppergrowth is reduced in which flowering and fruit production stops. The effect

of seed priming on germination varies with the species, chemicals, rates and duration.Various chemicals with different characteristics have been used as priming agents. These chemicals include hormones,organic solutes, polyethylene glycol, inorganic salts and natural source extracts. During seed priming, the seeds are soaked in a solution containing bio-stimulants or other micronutrients for a definite time after which the moisture content is brought to a level just below that which isrequired for radical emergence.In modern seed production management, seed priming is apromising technique forbiotic and abiotic management, which has been known for many yearsto improve seed germination and the efficacy of abiotic stress responses. Seed priming withsalicylic acid at either rate increases the seedling emergence, seedling growth, root and leafnumber, water relations, membrane stability, and activities of enzymatic antioxidants. Therefore,in order to increase chilling tolerance and other abiotic stress tolerance in terms of physiological seed quality characters, particularly germination rate, earlyseedling vigour and growth of seedlings in chillis, techniques of seed priming would be the potent method.

Vernalization and its sensitivity in onions: Influence on flowering, seed yield and quality under field conditions

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Flowering in favourable climatic conditions is a prerequisite for higher seed yield, which occurs in response to vernalization in onion. In this study, we investigated the effect of different vernalization treatments on flowering, seed yield and quality of PRO-7 and Punjab Naroya cultivars provided by staggered planting at monthly intervals. This study demonstrated the significant ($p \leq 0.00001$) impact of vernalization on all the studied traits except for days to sprouting. Warmer vernalization (19.4°C) delayed flowering (63 days)in October-planted crop, consequently floral and seed development occurred at lower temperatures (13.5/23.3°C), producing 4.132g seeds/plant and 91.2% germination. November-planted crop experienced 14°C vernalization temperature and yielded maximum seeds/plant (4.49g) with good germination (91.06%).11.7°C vernalization ledto early flowering (47days) in December-planted crops enabling floral development at low (16.8°C)and seed development at higher (26°C) temperatures, resulted in reduced seed yield and germination. January-planted crop however, had the lowest seed yield (0.44g) with poor germination (17.79%) as it experienced high vernalization (16.4°C) and post-vernalization temperatures (26.9°C). Correlation studies also revealed the positive and significant correlation of vernalization temperature with the days to scape initiation. The period of vernalization sensitivity differed substantially between genotypes. The relative expression of AcFT2, a candidate flowering gene, revealed significant

upregulation in vernalized bulbs under field conditions. The study demonstrated that both vernalization and post-vernalization temperature play critical roles in determining the timing of flowering, seed yield and quality however, the specific vernalization requirements vary between genotypes.

Effect of different growing media and sowing dates on seedling growth of Bhut Jolokia *(Capsicum chinense Jacq)*

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"Effect of different growing media and sowing dates on seedling growth of Bhut Jolokia (Capsicum chinense Jacq)". A total of six different growing media [M1: Sand+ Cocopeat+ decomposed cow dung, M2: Sand+ Cocopeat+ Vermicompost, M3: Sand+ Cocopeat+ Forest-Soil, M4: Sand+ Cocopeat+ Vermicompost+ Perlite, M5: Sand+ Cocopeat+ Vermicompost inoculated with Microbial Consortium @ 1g/100g, M6:Sand+ Garden- soil+ decomposed cow dung(Control)] and 5 sowing dates (Middle of August, September, October, November and December'22). The study revealed that the germination per cent was significantly higher in S3 (75.87 %) and M4 (84.25 %). The Morphological parameters like seedling height at 20 and 30 days after emergence, DAE (3.64 and 4.51cm), number of green leaves per seedling at 40 days after sowing, DAS (4.33), shoot length at transplanting (4.98cm) was observed to perform better under S1 whereas seedling height at 10 DAE (2.59cm) perform better under S2 and root length at transplanting (8.62cm) under S3 and among the different growing media, all the morphological parameters were recorded highest in M6. Similarly, the phenological parameters like days to seedling emergence (8 days) and days to emergence of 1st leaf (14.42 days) was lowest under S1 whereas days to transplanting (43.56 days) was found to be lowest in S2. The physiological parameters like SVI perform better under S3 and M6, fresh weight and leaf area was higher in S2 and M6, dry weight in S1 and M6 whereas RLWC and total leaf chlorophyll content perform better under S3 and M4. The B: C ratio was maximum in S3M6. And the incidence of damping off was recorded highest in S3M2. Therefore, M6 media and S2 sowing can be recommended for seedling production in Assam condition.

Day length extension as a tool to improve spike quality and corm production of Gladiolus *(Gladiolus hybridus Hort.)*

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Day length extension (DLE) is used extensively in floriculture industry to regulate vegetative as well as reproductive growth of different crops. Gladiolus has elegant and magnificent spikes as primary economic part and corms as production material. Shorter daylight hours in winters cause winter blindness in crop which is overcome by exposure to long days. Response of Gladiolus to DLE through light emitting diodes (200 W) was studied for spike quality and corm production. The plants were exposed to six DLE treatments; DLE for 2 hours at 30 days after sprouting (DAS) (E1P1), 2 hours at 40DAS (E1P2), 2 hours at 50DAS (E1P3), 4 hours at 30DAS (E2P1), 4 hours at 40DAS (E2P2), 4 hours at 50DAS (E2P3) in the evening and plants under natural day length served as control. Under 2 hours DLE at 50DAS, spike length (82.83 cm), spike weight (53.83 g) and floret size (10.02 cm) improved significantly as compared to control. Also, spikes reached color break stage in 106 days under E1P3 in comparison to 135 days in control which was at par to E2P2 (134.33 days). Under E1P1 and E1P3, number of corms produced (2.33 and 2.17), corm weight (100.44 and 90.99g) and diameter (52.77 and 52.32mm, respectively) was significantly higher than control but at par with one another, indicating similar effects of DLE after 30 and 50 DAS in enhancing corm production. Therefore, keeping in view economic benefits, E1P3 could be employed for better spike quality and corm production.

Effect of sterilization and potting media on growth of seedlings for graftingin Chilli *(Capsicum annuumL.)*

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The experiment was conducted at Hi-tech unit, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri during kharif season 2021-22. In experiment there was two factors (Non-sterilized potting media (S0) and sterilized potting media (S1)) and six combination of potting media (M1: 100% Cocopeat, M2: 75% Cocopeat +25% Vermicompost, M3: 50% Cocopeat + 50% Vermicompost M4: 25% Cocopeat + 75%Vermicompost,M5:75%Cocopeat+25%sawdust,andM6:75%Cocopeat +25%Ricehusk). For rootstock seedlings treatment combination S1M4 registered minimum days for seed germination (6.67 days) and number of days (48.73 days) for graftable stage, with maximum seedling height (14.68cm), diameter at collar region (1.51mm), number of functional

leaves (7.40), length of taproot (6.23cm), number of adventitious roots (17.70), fresh weight (197.13mg), dry weight (26.97 mg). For scion seedlings the treatment combination S1M4 gives best results with minimum days for germination (6.67 days) with maximum seedling height (16.31cm), diameter at collar region (1.48mm), number of functional leaves (6.27), length of taproot (8.92cm), number of adventitious roots (27.00), fresh weight (278.30mg), dry weight (26.47mg), minimum number of days (41.90days) for graftable stage.

Advances in planting material generation: a boon for fruit production

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Availability of quality planting material is an integral part towards the high productivity of fruit crops through rejuvenating old unproductive seedling orchards, replacing inferior genetic stocks and reducing incidence of heavy pest and disease incidence. There is enough scope for the farmers with sound technical knowledge to generate a good income through production and supply of quality planting materials. This increasing demand for quality planting materials could only be possible through tissue culture, where mass multiplication of disease free planting materials may be produced within shortest possible time and as an alternative to conventional method. In banana in-vitro propagation and macro-propagation have been commercially adopted. In apple, cherry and walnut for identification of rootstocks resistant to biotic and abiotic stress where 21 species of Malus were evaluated based on stomatal distribution as vigorous, semi-vigorous semi-dwarfing and near dwarfing. On the other hand micro propagation of clonal rootstocks of apple and cherry (‘Mazard’ and ‘Mahaleb’) has been standardized for large-scale production of clonal rootstocks like, MM-111 and MM-106. Micrografting is another technique which consists of grafting of shoot tip of 0.1-0.5 mm with apical meristem, on in-vitro raised rootstock has been standardized for large-scale production of disease-free planting material. Soft wood grafting has come up as one of the most commercial used fast multiplication for different tropical and subtropical fruit crops. The primary foundation for the commercial scale production of planting material is maintenance of healthy mother block for both rootstock and scion.

Cluster-fruiting cultivar of brinjal intended for cultivation in middle Gujarat

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Brinjal (*Solanum melongena* L.) is one of the most common tropical vegetables grown in India. A large number of cultivars differing in size, shape and colour of fruits are grown in India. There are three main botanical varieties under the species melongena. In Middle Gujarat, brinjal crop occupied about 39.44% area of Gujarat contributing 40.43% share in production during the year 2020-21. Brinjal cultivar i.e. Anand Doli developed from the cross Doli 5 x GOB 1 through pedigree method of selection during 2006-07 to 2012-13.This genotype (AB13-03) was tested in PET (Preliminary Evaluation Trial) during 2013-14 and onwards in different trials (LSVT:Large Scale Varietal Trial) over locations in the state from the year 2014-15 to 2018-19. This genotype depicted 561.40q/ha average fruit yield under middle Gujarat condition. This genotype exhibited 44.70, 38.82, 17.72, 26.28, 40.74 and 40.20 per cent higher fruit yield at Anand over the checks GOB 1, GBL 1, GJB 2, GJLB 4, Doli 5 and Punjab Sadabahar, respectively. The genotype was contributed in AICRP (VC) during 2014-15 in IET-Long (Initial Evaluation Trial-Long) and advanced in AVT-I and AVT-II (Advance Varietal Trial I&II)during 2015-16and2016-17, respectively. It endows with the special attributes of dark pink fruit skin colour with strong glossiness, club shaped fruit with medium size and cluster fruiting pattern with 3-5 fruits in single cluster. It has erect plant growth habit and dentate leaf margin. The variety had small diameter of blossom end scar. The genotype showed resistant to little leaf disease reaction and lower or comparable number of jassid and whitefly as well as fruit borer damage as compared to the local and national checks. The fruits of this variety contain higher dry matter (14.32%), total phenol (0.087%) and protein (0.82%) as compared to the checks varieties GJB 2, GJLB4, Doli 5 and Punjab Sadabahar. This variety was found to have good quality attributes as compared to local variety Doli 5. Hence the traders and consumers have appreciated fruits of this genotype owing to its attractive dark pink fruit skin colour with strong glossiness and medium in size. Based on the aforementioned merits of the brinjal genotype AB 13-03, it has been released as a new variety called Gujarat Anand Brinjal 6 (GAB 6, also known as "Anand Doli") for middle Gujarat regime.

onion flowers during experiment. Maximum honey bees' activity were found around 2-3 PM. Effect of bee attractants were more on A. indica than Stingless bees. Jaggery @ 10% showed maximum honeybee population in 1st and 2nd spray regardless of different hour and days after spray. Maximum A. indica activity were recorded as 22.6 bee/5m2/5min after 1 day of spray at 2 pm. Highest seed yield ha-1 was registered in plots treated with jaggery @ 10% followed by yellow glossy paper and sugar solution (10%) treated plants. Seed quality parameters followed the same trend as seed yield. Application of jaggery (10%) solution twice (10 and 50% flowering stage) can be suggested to the onion seed growers of Red and Laterite Zone of West Bengal for seed yield and quality enhancement.

In vitro approach with Carbon Nanotubes in Horticulture

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Carbon nanotubes are vital in plant biotechnology because they affect the growth and differentiation of cells, tissues, organs, and entire plants. Carbon nanotubes can also be used to strengthen the structure of scaffolds and give them new properties, such as electrical conductivity, which may help direct cell growth. CNTs have become prominent due to their unparalleled mechanical, electrical, thermal, and chemical capabilities. Carbon nanotubes may be a key biomaterial for making and keeping track of engineered tissue. Compared to free molecules, biomolecules are more biostable when coupled to CNTs because they are protected from cellular metabolism and destruction. CNTs are capable of penetrating seed coats and promoting germination and plant growth. It can be functionalized with proteins, nucleic acids and medicines to transport cargo to cells and organs. These reduce cell adhesion and hindered cell proliferation. CNTs also produced hyperpolarization of the plasma membrane, oxidative stress, cell aggregation, and death. Elicitors are chemicals that excite plant defence mechanisms and stimulate the production of target molecules in cultured cells by cellular proliferation, differentiation phenomena and productions of valuable pharmaceutical secondary metabolites. MS medium supplemented with various concentrations of MWCNTs Like FCNTs in Banana (Musa Paradisiaca) "Malbhog" is reported to have accelerated shoot proliferation. Similarly, blackberry (Rubus adenotrichos) supplemented with SWCNTs-COOH was reported beneficial for plant growth and rooting. The SWCNTs- COOH assay reported the shortest average time for root emergence and the plants also had the highest stem growth. Hence, CNTs may be a promising contender for use as highly potent elicitors in plant tissue culture, consequently changing plant growth and primary and secondary metabolism and protecting plants from stress.

Standardization of rooting media and growth regulators for faster multiplication of grape rootstock progenies through thin semi-hardwood cuttings

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Grape cultivation relies on both rootstock and scion, and Dogridge has been a traditional rootstock in the Indian grape industry. However, due to climate change, developing rootstocks with Dogridge qualities and improved resilience to salinity and drought is essential. To address this, grape rootstocks have been developed through mutation and hybridization. Efficiently screening these progenies for salinity tolerance is crucial to expedite selection. Grape rootstocks are typically propagated from hardwood cuttings, so optimizing the propagation of thin semi-hardwood cuttings is important. Hence, the experiment trial carried out at Indian Institute of Horticultural Research, Bangalore consisted of standardizing rooting media and growth regulator concentration to get maximum rooting success in thin semi-hardwood cuttings. Two media, coco peat and a coco peat-sand mix (1:1) were tested, along with six concentrations of IAA and IBA, either alone or combined, using a Factorial Complete Randomized Design with three replications. Results showed that cuttings treated with 3000 ppm IBA had the highest survival rate (90% success at 60 days after planting), followed by the 2500 ppm IBA treatment. Maximum root length (3.93 cm) was observed in cuttings treated with 0.4g IBA/100 g talc, followed by those treated with 3000 ppm IBA at 60 days after planting. The coco peat-sand mix (1:1) proved superior to coco peat alone, resulting in higher success rates and longer root length. In summary, the use of 3000 ppm IBA treatment in was successful for propagating thin semi-hardwood cuttings for grape rootstock development.

Effect of indigenous bee attractants on seed production of onion

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Seed setting in onion plants are higher in the presence of pollinators, mostly honey bees. Substance which has phago stimulatory effect, chemicals which affect the olfactory senses and materials which affect the visual senses positively affects the bee visitation on crops. The effectiveness of indigenous bee attractants, viz. jaggery @ 10%, sugar solution @ 10%, dill seed oil @ 0.5%, cumin seed oil @ 0.5%, rose water and yellow glossy paper were evaluated to judge its ability to bring various pollinator species to the crop, and its effect on onion seed yield and quality. Thirteen insects belonging to 11 genera, 10 families and 5 orders were found visited the

Nursery performance of Khasi Mandarin on different citrus rootstocks under mid-hills of Nagaland

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A comprehensive two-year study (2021 and 2022) was conducted at Department of Horticulture, School of Agricultural Sciences, Nagaland University, Nagaland, under shade net conditions. The primary objective of the experiment was to evaluate the nursery performance of Khasi mandarin scion grafted on various citrus rootstocks including eight citrus genotypes; Indian wild orange (Citrus indica), Tasi orange (Citrus sinensis), Rangpur lime (Citrus limonia), Khasi papeda (Citrus latipes), Citrange (Poncirus sp.), Karna khatta (Citrus karna), Kachai lemon (Citrus jambhiri) and Rough lemon (Citrus jambhiri). The experiment was carried out in a Completely Randomized Design with eight treatment and three replications. The maximum graft success (91.30%), highest increase in scion height (13.63 cm), scion diameter (4.86 mm) and scion leaves (24.55) were recorded in Rough Lemon; however, took the longest duration for bud sprout (19.02 days) as compared to other rootstocks. The highest total chlorophyll, chlorophyll 'a' & 'b' content of scion were recorded highest when grafted in Citrange. Rangpur lime rootstock exhibited the maximum leaf area (22.14 cm2) and excised leaf water loss (19.55%) and leaf perimeter on scion Khasi mandarin. From the findings, based on grafting performances of different rootstock genotypes at nursery stage, Rough lemon showed a vigorous effect on Khasi mandarin, followed by Karna khatta and Rangpur lime, while C.indica proved to be an inferior rootstock with most of the characters studied.

Technical Session - VI
Innovation for Sustainable Horticultural Productions

The effect of plant growth regulators and growing environment on growth and development of guava cuttings

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The present study would be carried out at nursery production area of Department of Horticulture, Lovely Professional University, Phagwara (Punjab). The study consisted of different treatments of plant growth hormones viz. IAA (1000,2000,3000 and 4000ppm), IBA (1000,2000,3000 and 4000ppm) and NAA (500,1000 and 1500ppm) along with different types of guava cuttings i.e. softwood, hardwood and semi-hardwood cutting raised under two different growing namely, open and controlled environment. The study would be laid in a factorial completely randomized block design with 3 replications. Different physical and biochemical seedling parameters such as shoot length, root length, chlorophyll content, transpiration rate, photosynthetic rate, disease incidence etc. would be evaluated to determine the suitable type of guava cutting under the desired growing environment with help of a plant growth regulator. The findings of the present study would be helpful for the determination of suitable conditions for the propagation and multiplication of disease-free guava seedlings along with better economic returns. Thereby, it would be helpful the improving the socio-economic status of the guava growers and would be helpful for doubling their income besides providing them with the quality planting material for higher returns and productivity.

Response of mulching materials and training-pruning on growth of jamun *(Syzygium cumini L.)* cv. Goma Priyanka

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Jamun (Syzygiumcumini L.) is a most potential underutilised fruit crop of India and it is nutritious fruit with a variety of uses; virtually every part of the tree has been utilized by men. It is native to India and belongs to family Myrtaceae. Fruit is good source of iron, sugars, minerals, protein, carbohydrate, etc. Fully ripe fruits are eaten fresh and can be processed into beverages like squash, wine, vinegar, etc. Fruits are used as an effective medicine against diabetes, heart and liver trouble. Goma Priyanka variety of jamun was released from CIAH regional Station, CHES, Godhra, Gujarat. It is semi-dwarf, spreading, dense foliage and drooping branches, precocious bearer and suitable for HDP. Mulch reduces the loss of moisture from the soil, enhances the rate of penetration of rainwater or irrigation in the soil and controls the growth of weed. Mulching can be done with black polythene or any organic materials. Canopy management (training & pruning) of jamun helps in development and maintenance of their structure in relation to the size and shape for the maximum productivity and quality. The crux of the canopy management lies in the fact, as to how best we manipulate the tree vigour and use the available sunlight and temperature to increase the productivity and quality and minimize the adverse effects of weather parameters. Basically, the training is a potential tool to manage the canopy architecture of the plant. Pruning is a tool to regulate tree size and shape.

The effect of different growth promoting substances on yield and incidence of papaya ring spot virus under different growing conditions

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An experiment entitled “The effect of different growth promoting substances on yield and incidence of papaya ring spot virus under different growing conditions” was carried out during 2020-22 at Yelwala, Mysuru. The experiment was laid out by adopting Factorial Randomized Block Design (FRBD) comprising of two factors with three replications. The experiment was carried out to study the comparative performance of papaya cv. Arka Prabhath under two different growing conditions viz., insect proof net and (G1) and open condition (G2) with an application of different growth promoting substances (T1). Among the different growing

conditions and treatments, the application of 100 per cent of RDF through Fertigation + Trichokavach (50g/plant) + Chitosan (20 g/plant)and spray (0.2 %) + Seaweed extract (20 g/plant) and spray (0.2 %) + Penicillium pinophilum (20 g/plant) + Pseudomonas putidda (4 ml/L) + Phosphoric acid (20 ml/ plant) + Salicylic acid (300 ppm) + Neem cake (250 g) + VAM (5 g/plant) + Power plus (5 ml/L) + Vermicompost (3 kg) + Micronutrient spray (4 g/L) recorded the maximum number of fruits per plant (65.36), fruit set percentage (81.16 %), average fruit weight (1845.25 g) and yield per plant (134.01 kg) as compared to open condition. It was also noticed that, the maximum days taken for first disease appearance (150.83 days) in plants applied with T10 and grown under open condition. Whereas, the significantly nil PRSV incidence was noticed in plants grown under insect proof net as compared to open condition.

Effect of round the year pruning and fertilizer doses on soil, leaf and fruit nutrient content of Phalsa cv. local

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An experiment was carried out to find out the effects of round the year pruning and fertilizer doses on soil, leaf and fruit nutrient content of phalsa cv. Local during the years 2020-21 and 2021-22. The experiment consists of two factors one is pruning time (P1= 1st week of January (Control), P2= 1st week of March, P3= 1st week of May, P4= 1st week of July, P5= 1st week of September and P6= 1st week of November) and second is fertilizer doses (F1= 100:50:50 g NPK/plant (Control), F2= 200:75:75 g NPK/plant, F3= 300:100:100 g NPK/plant). The experiment was laid out in completely randomized design (Factorial) with three repetitions. The factor pruning time had a non-significant effect on soil and fruit nutrient content of phalsa in both the years. The soil available N (253.09 and 254.76 kg/ha), available P2O5(54.17 and 56.60 kg/ha) and available K2O (276.49 and 278.22 kg/ha) was found maximum with fertilizer dose F3= 300:100:100 g NPK/plant. The maximum fruit nitrogen content (0.724 and 0.748 %), phosphorous content (0.045 and 0.046 %) and potassium content (0.558 and 0.543 %) was recorded with fertilizer treatment of F3= 300:100:100 g NPK/plant. The pruning time and fertilizer doses had a significant effect on leaf nutrient content of phalsa in both the years. The maximum leaf nitrogen content (1.96 and 2.02 %), phosphorous content (0.163 and 0.175 %) and potassium content (1.53 and 1.58 %) found in treatment P2pruning in 1stweek of March. The fertilizer dose F3= 300:100:100 g NPK/plant recorded maximum leaf nitrogen content (1.95 and 2.03 %), phosphorous content (0.175 and 0.184 %) and potassium content (1.53 and 1.56 %).

Impact of organic manure and irrigation scheduling using hydrogel application on growth and yield of Brown mustard *(Brassica juncea L.)*

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Brown mustard (Brassica juncea L.) is a member of the Brassicaceae family. It is rich in vitamin A, vitamin C, phenolic compounds, glucosinolates, and other compounds that possess antioxidant properties. In Sikkim Himalaya, brown mustard faces huge scarcity of water which limits it growth and yield. An investigation was carried out to study the impact of organic manure and irrigation scheduling with hydrogel application on growth and yield of brown mustard. The experiment was laid out in CRD with 13 treatments and 3 replications. Among different growth and yield parameter observed, treatment T5 (Vermicompost 100% @ 18 t/ha +Irrigation water @100% pot capacity + Hydrogel @ 2.5 kg/ha) performed significantly better in all the attributes (plant height as 107.33 cm, number of leaves as 27.33, plant girth as 12.17 cm, number of primary and secondary roots as 16 and 48.33 respectively, root length as 23.80 cm, leaf width and leaf length as 28.67 cm and 18.33 cm respectively, maximum leaf yield per plant as 738.33 g, maximum leaf yield q/ha as 491.73 and maximum average leaf weight as 27 g) which was closely followed by T6 (Vermicompost100% @ 9 t/ha+ Irrigation water @ 75% pot capacity + Hydrogel @ 2.5 kg/ha). Highest B:C ratio (3.02) was recorded in T5 (Vermicompost 100% @ 9 t/ha + Irrigation water @ 100% pot capacity + Hydrogel @ 2.5 kg/ha) and the lowest (0.83) was recorded in T13 (FYM 100% @ 18 t/ha + Irrigation water @100% pot capacity(check)). The result concluded that vermicompost 100% at 9 t/ha, irrigation water at 100% and hydrogel application at 2.5kg per hectare significantly enhanced growth, yield and B:C ratio of the brown mustard. Therefore, it may be recommended to the farmers for commercial cultivation of brown mustard under organic growing conditions of Sikkim Himalayas.

Interaction of time and size of cuttings and IBA concentration on the root and shoot growth of Dragon fruit *(Hylocereus costaricensis britton & rose)* saplings

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Dragon fruit is an emerging fruit of the 21st century and the North Eastern region of India with humid tropical and subtropical climate is very suitable for its cultivation. Dragon fruit can be propagated sexually through seeds and asexually through grafting, micropropagation and stem

cuttings. But, stem cutting is preferred for its propagation due to its ability to provide true to type plants with early yielding capacity (within 2 years after planting). Moreover, stem cutting technique is cheaper and can be performed by a layman. Dragon fruit saplings prepared from the cuttings of 10, 15 and 20 cm sizes collected in January and April and treated with 100, 250, 500 and 0 ppm IBA were evaluated for root and shoot parameters with an objective to choose the best combination of time and size of cuttings and IBA concentration for the stem cutting technique of dragon fruit. The results revealed that 20 cm cuttings taken in April and treated with 250 ppm IBA led to best root and shoot parameters with early (22.33 DAP) shoot initiation, highest root (20.83) and shoot (4.4) numbers, highest chlorophyll (0.51 mg/g) and nitrogen (2.75 %) content, highest vascular cambium thickness (0.15 mm) and highest survival (100 %). The root formation was early (14 DAP) in 20 cm cuttings taken in April and treated with 500 ppm IBA. So, the results suggest that (20cm cuttings+April+ 250 ppm IBA) is the best combination for the root growth and subsequent vegetative growth of dragon fruit stem cuttings.

Cover crops for enhancing vegetable crop production, profitability and sustaining soil health

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Cover crops are an indispensable component of vegetable cropping system and gaining importance in recent years. In addition to enhancing vegetable crop production and increasing farm income they offer multitude of benefits by lessening the negative effects of conventional agriculture like nutrient leaching, soil erosion, weed problem, reduced soil health and fertility etc. Tillage radish (Raphanus sativus L.) has been utilized as a popular cover crop that can be included in an intensive vegetable cropping system for harnessing multiple benefits. It is an excellent nitrogen scavenger and can provide excellent soil cover, conserve soil moisture, helps in sequestering carbon, reduces bulk density, improves porosity, increases organic matter of soil and prevents weed growth. The present investigation was conducted during Rabi, Spring-Summer and summer season of 2017-2018 and 2018-2019 at the Farm of Krishi Vigyan Kendra, Kokrajhar district, under Assam Agricultural University, Jorhat and situated at Lower Brahmaputra Valley Zone (LBVZ) of Assam State. The objective was to study the effect of inclusion of forage radish cover crop on the yield and cost of production of subsequent vegetable crops in a cropping system and the influence of residue return of cover crops and vegetable

crops on soil health. The treatment combinations include three levels of forage radish cover crops including control (CC1:100% cover, CC2:75% cover, CC3:50% cover and CC0:0% cover) and three level of vegetable cropping system (CS1: okra followed by bitter gourd, CS2: chilli followed by dolichos bean, CS3: cowpea followed amaranth). Cost economic analysis of different treatments revealed that treatment combinations CC1CS2 (cent percent radish cover crop followed by chilli crop and again followed by next vegetable crop i.e., dolichos bean) recorded the highest B:C ratio of 6.39. The lowest B:C ratio of 2.20 was recorded by the treatment combinations CC0CS3(control plots without surface cover and cowpea followed by amaranth). The residue returns of cover crops and vegetable crops were found to be beneficial in improving physical and chemical properties of soil. For sustainable production of vegetable crops in a cropping system, as well for improving soil health, forage radish cover crop (Raphanus sativus L. var. longipinnatus), syn. Daikon or Japanese radish can be used as cover crop before sowing of spring summer and summer season vegetable crops.

Effect of organic biostimulants for improvement of rooting and growth in kiwifruit *(Actinidia deliciosa)* cuttings

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Seaweed extracts have shown profoundly positive effects on crop growth, quality and reproduction in diverse agricultural and horticultural crops. Seaweed extracts can be used to promote the rooting and growth of cuttings in perennial fruit species like kiwifruit (Actinidia deliciosa). In this study, the cuttings were treated with 1, 5, 10 and 50 % solutions of G Sap (Gracilaria edulis), K Sap (Kappaphycus alvarezii), AN (Ascophyllum nodosum), EM (Ecklonia maxima), HA (Humic acid) and control (water) for 6 hours as base dipping. Subsequently, the treatments of G Sap, K Sap, AN, EM, HA and control were repeated every 15 days for a period of six months as application of 50 ml solutions in the potted cuttings. All the treatments exhibited significant effects on the rooting percent in all the kiwifruit cultivars, namely 'Monty', 'Abbott', 'Hayward', 'Allison' and 'Bruno' ($P \leq 0.01$) as compared to the control. Shoot and root growth parameters including leaf number per cutting, number of roots per cutting, number of branches, plant height, shoot diameter, root length, root diameter and root weight were all positively increased with the application of seaweed extracts ($P \leq 0.05$). Cuttings treated with seaweed extract exhibited significantly higher levels of pigments (chlorophyll a, chlorophyll b and total carotenoids), metabolites (total carbohydrates and soluble phenols) and less electrolyte leakage as compared to the control cuttings. Significant positive and negative correlations were observed between biochemical parameters combined with plant nutrient concentration. Principal component analysis (PCA) revealed that PC1 and PC2 (first two

principal components) accounted for 75% of the entire variation. While, PC1 accounted for 63% of the total variation, PC2 accounted for 11% of the total variation. The leaves and the roots of kiwifruit cultivar 'Hayward' treated with G Sap at 10%, K Sap at 10%, AN at 10%, EM at 10%, HA at 10% exhibited higher expression of all four root promoting candidate genes (GH3-3, LBD16, LBD29 and LRP1) compared to the control. Therefore, it can be concluded that, seaweed extract and humic acid can be used as a suitable alternative to synthetic hormones for promoting the rooting and growth of kiwifruit cuttings.

Bundelkhand: Status, scope, constraints, strategies of vegetables and spices

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The world's vegetable productions have reached to a total of 956 million tones and have been growing up by 56 % in the last decade. Vegetable production in country increased from 16.5 million tons in 1950-51 to 200.45 million tons in 2020-21. However, Indian Horticulture achieved a significant increase in vegetable production with a total of more than 113.5 MT. During the year 2020-21, a total of 200.45 million tons vegetable were produced from an area of 10.86 million hectares accounting for productivity of 18.46 t/ha. In UP, vegetable crops are grown on an extensive area and it is second largest producer of vegetables in the country next only to West Bengal. During 2019-20, the area under vegetables was 1.24 million hectares with production of 26.19 million tones. Bundelkhand, a region home to 18 million people spread over 7 districts of Uttar Pradesh (Chitrakoot, Banda, Jhansi, Jalaun, Hamirpur, Mahoba and Lalitpur) and six districts of Madhya Pradesh (Chhatarpur, Tikamgarh, Damoh, Sagar, Datia and Panna). The districts of Bundelkhand region is suffering severely, as their economy relies heavily on agriculture. This region of Uttar Pradesh is predominantly vegetarian and therefore, bulk of the population depends upon vegetables. In Bundelkhand region, rainfall is often in high bursts. Of the total 850 mm annual rainfall in 54 rainy days, 400 mm may fall in just 20 hours, with intensity going up to 30 to 50 mm per hour. Over 95% of the annual rainfall occurs between June and September in 40-45 rainy days, with peak in July-August. However, in some places 24 to 32 rainy days have also been recorded. The precipitation is so erratic that a deluge is followed by long spell of no rain. Such type of long intervals between two rainy days during Monsoon, many times as long as 15 days leads to drastic yield reduction or total crop failure. In such circumstances, resilient crops like tomato, brinjal, chillies, peas & beans, annual and perennial cucurbits, bulbs, corms and tubers and production systems involving mulching, intercropping, micro-irrigation etc. are more relevant. Bundelkhand region of UP is far behind in vegetable

cultivation because of many agro-climatic and socio-economic reasons. Almost three decades back, a limited agricultural area in Bundelkhand region was irrigated even though some districts were known for their certain vegetable commodities like brinjal of Banda, ginger and turmeric of Jhansi & Lalitpur, red chillies of Chitrakoot, seed spices and peas of Jalaun & Hamirpur etc. However, present day scenario has been changed. In all seven districts of Bundelkhand region, the area under vegetable crops is 1, 53,662 hectare and production is 23, 14,344 metric tons (productivity 150.61 q/ha). From area and production point of view, district Jalaun stands on first position in vegetable cultivation followed by Jhansi, Lalitpur and Mahoba. The districts Hamirpur, Banda and Chitrakoot are relatively poor in area and production of vegetable crops. However, higher level of productivity of vegetables has been realized in Chitrakoot exceeding the average productivity in Bundelkhand region, U.P. and that at national level. The vegetable dominating districts like Jalaun, Jhansi Lalitpur, and Mahoba have comparatively lower productivity. This is because of the fact that almost 80% or higher area in these districts is covered under a single green pea crop which has relatively lower productivity as compared to other crops like solanaceous, cucurbits, Cole or root crops. Contrarily, Chitrakoot and Banda districts with higher productivity have diversified vegetable crops under cultivation.

Studies on *Kharif* onion under organic and inorganic fertilizer nutrient level

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Onion is one of the most important vegetable crops grown in India, having both the food and medicinal values. Due to its ability to flavour a variety of vegetable preparations, it is a necessary component of every kitchen and is referred to as the "Queen of the Kitchen". The experiment was conducted in a randomized block design with three replications at Vegetable Research Farm of BUAT, Banda, during the Kharif season of 2022. The holistic aim of this experiment was to search out the most suitable variety of Kharif onion that could easily produce the optimum yield with better profitability and also to standardize appropriate organic and inorganic nutrient management techniques that suit well to the crops and variety in the region. The experiment consisted of one-factor treatments. Therefore, a total of 09 treatments combination arrived to test, and every treatments were replicated thrice in an experimental unit i. e., T1- Farmer practice (NPKS): 70-40-40-0 kg/ha, T2- NPKS:100- 50-50-30 kg/ha, T3- NPKS: 120-50-50-40 kg/ha, T4- NPKS: 140-50-60-50 kg/ha, T5- NPKS: 150-50-60-70 kg/ha, T6- 20 ton enriched FYM, T7- 75% RDN + 5 ton enriched FYM, T8- 50 % RDN + 10 ton enriched FYM, T9- 25 % RDN + 15 ton enriched

FYM and they were applied with an objective to study the effect of organic and inorganic nutrients on growth, yield, quality and economics of kharif onion. In general, the weather condition was quite conducive resulting in harnessing good crop yields during the year of field experimentation. The soil of the experimental field was silt clay loam in texture having moderate basicity (pH-8.2, EC-0.31) and poor fertility. Overall, the soil holds organic carbon of 0.38 %, available nitrogen of 254 kgha-1, available phosphorus of 17.3 kgha-1, potassium of 259.3 kg ha-1 and Sulphur of 13.96, respectively. On the basis of result obtained and summarized from the present study, it can be concluded that all the observations taken for kharif onion were found to be superior with the application of organic and inorganic nutrients. In the study, it was observed that the application of T9-25 % RDN + 15 ton enriched FYM increased all growth and yield parameters such as plant height (cm), number leaves (cm), neck thickness (cm), bolting percentage, days to maturity (60-70%) neck fall followed by T7 and T8.While the maximum B: C was recorded under T5-NPKS: 150-50-60-70 kg/ha followed by T5, T4 and T8. There for among all the combinations of organic and inorganic nutrients applied 25 % RDN + 15 ton enriched FYM was found significantly most effective in increasing the yield and yield attributing traits. Hence, application of T9-25 % RDN + 15 ton enriched FYM recorded higher yield (232 q/ha) and excellent quality bulbs may be suggested for cultivation in kharif onion as well as the maximum net return per hectare but maximum B: C ratio observed in Treatment T5 due to low cost of cultivation. However, we can see the soil status in treatment T9-25 % RDN + 15 ton enriched FYM, that is significantly improve the soil health and fertility under Bundelkhand region.

Understanding the impact of or genes on endogenous levels of PGRS in Indian cauliflower

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Endogenous plant growth hormones (PGRs) regulate growth and developmental transitions in plants. Cauliflower has typical developmental transitions. The novel spontaneous mutant Or gene causes β-carotene accumulation in cauliflower. It also impacts curd and plant morphologies which indicate for possible interactions with PGRs. The present study was undertaken using 3 plant types i.e., CFOr-HM (homozygous for Or gene), CFOr-HT (heterozygous for Or gene), and CFWT (white type) in Randomized Block Design (RBD) with three replications during Rabi 2021-22 at ICAR-IARI, New Delhi. Leaf samples from four critical developmental stages i.e. vegetative, curd initiation, Full curd and bolting were collected in

liquid nitrogen and analysed for PGRs using HPLC. The study revealed significant differences in tested genotypes and stages for endogenous GA3 and IAA contents. The GA3, ABA and IAA content was observed to be 1.74, 0.607 and 0.228 ppm in CFOr-HM which was 35.01% and 5.6 % lower GA and ABA than CFWT, respectively and 57.01% higher IAA than CFWT. Among the developmental stage, the mean content value of GA3, ABA and IAA were highest at bolting (5.088 ppm), curd initiation (0.774 ppm) and bolting stage (0.302 ppm), respectively. These findings show prominence of GA3 in Or gene introgression lines of cauliflower and the levels of PGRs will be useful for understanding the crosstalk between the PGRs and developmental transitions.

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 theball 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 N2 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.

Integrated use of nutrients on yield, fruit quality and foliar nutrient content in pomegranate cv. Bhagwa

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An experiment on "Integrated use of nutrients on yield, fruit quality and foliar nutrient content in Pomegranate cv. Bhagwa" was carried out at College of Horticulture, Chiplima, Odisha University of Agriculture and Technology, Sambalpur during 2021-2022 in Randomized Block Design with nine treatments replicated thrice. The treatments were T1 : RDF (500 g N: 125g P2O5: 125 g K2O)/ Plant; T2 : Half of the RDF; T3 : 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through FYM; T4 : 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through FYM + Azotobactor + PSB; T5 : 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through Vermicompost ; T6: 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through Vermicompost + Azotobactor + PSB; T7: 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through Poultry manure; T8 : 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through Poultry manure + Azotobactor + PSB; T9 : Control (No manures and fertilizers or biofertilizers). Data were recorded yield, fruit quality and foliar nutrient content (macro and micronutrients) . From the above recorded parameters the treatment T8 i.e. 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through Poultry manure + Azotobactor + PSB was found best followed by T7: 75% of 'N' of RDF + Full 'P' + Full 'K' + 25% N through Poultry manure with respect to growth, yield, nutritional and other parameters studied.

Influence of different organic inputs and growing conditions on physical, chemical and microbial soil status of organically grown Strawberry *(Fragaria x ananassa duch.)*

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Studies were conducted to evaluate the "Influence of organic inputs and growing conditions on physical, chemical and microbial soil status of organically grown strawberry (Fragaria x ananassa Duch.)" in the Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during the period 2020-2022. The field experiment was laid out in Factorial Randomized Block Design (RBD) with five treatments replicated three times under four different growing conditions with spacing of 30cm x 60cm. The four different growing conditions were rain shelter with insect proof net (S1) (top covered with 200 micron UV film and side wall of 40 mesh net), rain shelter without insect proof net (S2), net house (50% shade) i.e. S3 and open condition (S4). Treatments were FYM @ 180 g/plant (T1), rock phosphate @ 4.50 g/plant +microbial consortium @ 0.063g/plant (T2), T2 + vermicompost @ 45 g/plant (T3), T2 + enrich compost @ 45 g/plant (T4) and T2 + poultry manure @ 45 g/plant (T5). The results revealed that most of the soil physical and biochemical characters were significantly influenced by combination of treatment and growing conditions. Among treatment combinations, T3S1 was the best in respect to soil physical parameters such as lower bulk density (0.92 gcm-3), higher water holding capacity (22.92 %), porosity (22.66%) and Soil PH (5.25) than control (only FYM) in strawberry experimental plots. The study on nutrient status of the soil revealed that available N (293.70 kg/ha), P (65.27 kg/ha), K (146.03 kg/ha), organic carbon (0.89%) and soil microbial biomass carbon (313.02 g/g soil) were found to be significantly higher in pooled study under treatment combination T3S1 (vermicompost @ 45 g/plant+ rock phosphate @ 4.5 g/plant + microbial consortium @ 0.063 g/plant in growing condition S1). Moreover, soil electrical conductivity recorded the maximum value (1.42dsm-1) at treatment combination T5S1 i.e. poultry manure @ 45 g/plant + rock phosphate @ 4.5 g/plant + microbial consortium @ 0.063 g/plant in growing condition S1 followed by treatment combination T3S1 (1.41dsm-1).

Standardization of NPK for lupine *(Lupinus perennis l.)* cut flower and seed production under hill zone of Karnataka

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The investigation entitled “Standardization of NPK for Lupine (Lupinus perennis L.) cut flower and seed production under hill zone of Karnataka" was carried out in the open field at the experimental farm at College of Horticulture, Mudigere, Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga during 2020-21.The experiment was laid out in Randomized Block Design (RBD) having ten treatments viz., T1 - 85:21:43 (Check), T2 - 50:20:40, T3 - 50:25:40, T4 - 75:20:40, T5 - 75:25:40, T6 - 50:20:45, T7 - 50:25:45, T8 - 75:20:45, T9 - 75:25:45, T10 - Control and three replications. The results revealed that growth, flowering, quality and yield parameters of lupine were significantly influenced by the application of different doses of NPK. In growth parameters, the treatment comprising of 85:21:43 kg NPK/ha recorded the maximum plant height (96.59 cm), leaf area (296.07 cm2), number of branches per plant (25.67), dry weight of plant (67.25 g/plant) and it was statistically on par with the treatment comprising of 75:25:45 kg NPK/ha. Whereas flowering, quality and yield parameters of lupine viz., minimum days taken for flower stalk emergence (48.20),days taken for 50 per cent flowering (25.40), the maximum duration of flowering (58.03 days),stalk length (71.56 cm), vase life (4.85 days), cut flower yield per ha (4.07 lakh), seed yield per ha (13.75 q/ha) with maximum B:C ratio i.e., 5.95 and 6.22 for cut flower and seed yield per ha, respectively and lower available N, P and K i.e.,271.55, 19.86and 192.47 kg per ha, respectively were recorded in treatment comprising of 75:25:45 kg NPK/ha which was found superior over check and other treatments studied. Hence, treatment combination 75:25:45 kg/ha may be recommended for commercial cultivation of lupine under hill zone of Karnataka.

Studies on floral biology of different cultivars of Pomegranate *(Punica granatum L.)* in semi-arid region of Bundelkhand

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The study analyzed the floral biology of eight pomegranate cultivars in the semi-arid region of Bundelkhand during the Ambe bahar season of 2021. Cultivars studied were Super Bhagwa, Mridula, Jalore Seedless, Ruby, Bhagwa, G-137, Ganesh, and Arakta. Parameters related to flower biology, floral biometry, and pollen were examined. Majority of cultivars exhibited

axillary solitary bearing habit, with Mridula taking 22.92 days for bud growth completion. First flower opening occurred earliest in Bhagwa on 8th February and latest in Arakta on 16th February. Bhagwa (18th Feb) and Arakta (26th Feb) reached 50 percent flowering earliest and latest, respectively. Full bloom and flowering varied from 6 days (Ganesh) to 15 days (Bhagwa), from 2nd week of February to 2nd week of March. Total flowering duration ranged from 26 days in G-137 to 39 days in Bhagwa. Hermaphrodite flowers constituted around half of male flowers across all cultivars. Super Bhagwa, Arakta, and Super Bhagwa had highest percentages of bisexual flowers, male flowers, and sex ratio, respectively. Thrum flowers (58.59%) were more prevalent than pin flowers (34.38%) and homostylous flowers (10%). Flower buds developed quicker in length than width, average size 2.64 x 1.22 cm. Stamen length varied from 9.04 mm in Mridula to 7.21 mm in Jalore Seedless. Combined stigma + style length ranged from 5.8 mm to 11.7 mm, ovary width from 6.35 mm (Jalore Seedless) to 4.2 mm (Arakta), and overall pistil length from 10.7 mm to 20.7 mm across all cultivars. Anthesis and anther dehiscence times occurred between 6 am to 6 pm, with anthesis peaking (33.84 percent) between 10 am to 12 noon and maximum anther dehiscence (32.23 percent) happening between 8 to 10 am. Pollen viability ranged from 95.35 percent (highest in Ganesh) to 84.31 percent (lowest in Jalore Seedless). Number of viable pollen grains varied from 165.8 in G-137 to 116.0 in Arakta, while non-viable pollen grains ranged from 22.5 in Jalore Seedless to 8.0 in Ganesh. The findings offer valuable information for future crop improvement programs in pomegranate cultivation.

Influence of plant density and de-blossoming on Zombie pea *(Vigna vexillata)*: an underutilized nutritious vegetable

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Vigna vexillata belonging to the family Fabaceae is a potential and under-exploited legume known by several names viz. tuber cowpea, zombi pea, wild cowpea, etc. This legume is distributed in major continents like Africa, Asia, Australia and America.Southern Africa and South-East Asia are reported as primary and secondary centres of diversity, respectively. In India, it is found in the hilly-subhilly tracts of peninsular India and in the Himalayan region. Protein content in tubers of Vigna vexillata was recorded up to eightfold higher than that in sweet potato and tapioca. It is a climate-resilient legume and reported as a source of biotic and abiotic stresses tolerance. In this context, astudy was conductedat the ICAR-Central Tuber Crop Research Institute (CTCRI), Regional Centre, Bhubaneswar, during the winter season of 2021-22 in order to analyse the effects of plant density and de blossoming on performance of tuber cowpea. The trial was laid out in the Split plot design with 8treatments and 3 replications. There

were 4 levels of spacings (S1-45 cm ×15 cm, S2-45 cm × 30 cm, S3- 60 cm ×15 cm and S4- 60 cm ×30 cm) in the main plot and 2 levels of de blossoming (F1-flower removal and F2-flower retention) treatments in the sub plot. Results revealed that maximum final plant height (69.03 cm), leaves /plant (11.13) and branches/plant (13.10) were observed in S4. Highest leaf area/plant (545.95 sq. cm.) was observed in S3. Maximum tuber length(16.17 cm), tuber girth (16.08 cm), fresh tuber weight(322.39 g), dry tuber weight (107.08 g), tubers/plant (2.6) and tuber yield/plant(121.85 g) were found in case of S4. Highest tuber yield (150.85 q/ha) was obtained at the closest spacing S1(45 cm x 15 cm). De blossoming resulted in maximum final plant height (72.45 cm), plant girth (3.31 cm), branches/plant (13.72), leaves/plant(11.81), leaf area/plant(592.62 sq.cm.),tuber length(16.07 cm), tuber girth (16.39 cm), tubers / plant (2.47), fresh weight of tuber (363.02 g), dry weight of tuber (124.55 g), tuber yield/plant (129.94 g) and tuber yield (120 q/ha). Among the interactions, maximum tuber yield/hectare was produced in S1F1(158.14 q/ha).

Effect of tillage and nutrient management on growth, yield and quality of strawberry under rice fallow

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The present research was carried out at the ICAR Farm, Assam Agricultural University, Jorhat, during 2021 and 2022, to investigate the affect of tillage, stubble mulch, and fertilizer management on growth, yield, and quality of strawberry (Var. Winter dawn). The experiment was carried out using a split plot design, with three main plots each having Bed planting with rice stubble mulch (M1), Minimum tillage with rice stubble mulch (M2) and Conventional tillage practise (M3) and four sub plots each having different fertilizer and manure combination viz. N1=10-7-7 g/m2 N-P-K with 5kg/m2 FYM, N2=7.5-5-5 g/m2 N-P-K + vermicompost 200g/m2 (instant mixture), N3= 5-3.5-3.5 g/m2 N-P-K + vermicompost 200g/m2 (instant mixture), N4= 200-20-2 g (FYM-lime-wood ash) per plant. Vermicompost was incubated with Azospirillum and Azotobacter before application. The findings showed that the strawberry plants were strongly impacted by all of the treatments in terms of growth, yield, and quality. Under tillage and mulching practices in main plots maximum plant height of (18.26 cm), leaf number (14.98) and crown diameter (54.73 mm) at 120 DAP, maximum number of flowers (17.03), maximum fruits per plant (13.86), fruit set percentage (80.94%), maximum fruit weight (26.08 g), maximum yield of (368.78 g) per plant and the best quality parameters like maximum TSS (7.88 0B), reducing sugars (5.63 %), total sugars (6.38 %),minimum acidity content of (0.54%) and maximum ascorbic acid of (50.45 mg/100g) was observed in M1.Under

nutrient management (sub plots) maximum plant height (18.81 cm), leaf number (18.73) and crown diameter of (52.53 mm) at 120 DAP, minimum (62.26) days to first flowering, maximum flowers/plant (17.59),maximum fruits/plant (14.35), maximum yield of (374.53 g/plant) and (18.30 t/ha) under N4[200-20-2 (FYM-lime-wood ash) g/plant]. Best quality parameters like highest TSS, sugars and low acidity were observed under N3 (5-3.5-3.5 g/m2 N-P-K + vermicompost 200g/m2).This field study clearly shows that the treatment combination of (M1N4) Bed planting with rice stubble mulch along with 200-20-2 (FYM-lime-wood ash) g/plant in equal split at 10 and 30 DAP (as instant mixture) gave maximum growth attributes, yield and highest monetary returns. And (M1N3) Bed planting with rice stubble mulch along with 5-3.5-3.5 g/m2 N-P-K + vermicompost 200g/m2 in equal split at 10 and 30 DAP (as instant mixture) found to be suitable for best quality fruits.

Effect of salicylic acid and CaCl2 on growth and yield of tomato variety "Indam-14301" in arid environment of western Rajasthan

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A field experiment was conducted during the winter (rabi) seasons of 2019 Bikaner, Rajasthan, to study the effect of salicylic acid and CaCl2 on growth and yield of tomato. The experiment was laid out in randomized block design (factorial), comprising combinations of 5salicylic acid spray and 5 calcium chloride (CaCl2). The results indicated that spray of 150 ppm salicylic acid had significant effect on growth characters at different stage (plant height, number of leaves per plant and DMA/plant, yields attributes (number of fruits per plant, diameter of fruit, average fruit weight, fruit yield per plant and yield) which was at par with spray of 200 ppm salicylic acid. However, both these treatments significantly increased growth characters at different stage (plant height, number of leaves per plant and DMA/plant, yields attributes (number of fruits per plant, diameter of fruit, average fruit weight, fruit yield per plant and yield). The tomato crop under the influence of 1.5 % calcium chloride spray recorded significantly higher plant height, number of leaves per plant and DMA/plant, yields attributes (number of fruits per plant, diameter of fruit, average fruit weight, fruit yield per plant and yield and was found at par 2.0 % calcium chloride spray, and both these treatments significantly influenced the growth characters at different stage (plant height, number of leaves per plant and DMA/plant, yields attributes (number of fruits per plant, diameter of fruit, average fruit weight, fruit yield per plant and yield).

Impact of inorganic fertilizer, FYM, vermicompost and biofertilizers on growth and quality of lettuce *(Lactuca Sativa L.)*

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ABSTRACT

Field experiment was conducted during Rabi season at the experimental farm, department of Horticulture, Assam Agricultural University, Jorhat in 2019-20 and 2020-21 to study the effect of integrated nutrients on growth and quality of lettuce. The experiment was laid out in a randomized block design (RBD) with eight treatments and three replications. The treatments were T1: Control, T2: 40:20:40 Kg NPK ha-1, T3: 40:20:40 Kg NPK ha-1+ FYM 2t ha-1, T4: 40:20:40 Kg NPK ha-1 +FYM 2t ha-1+ PSB, T5: FYM 3t ha-1+ PSB, T6: 40:20:40 Kg NPK ha-1 +VC 1t ha-1, T7: 40:20:40 Kg NPK ha-1+ VC 1t ha-1 +PSB and T8: VC 2t ha-1 +PSB.Observations on the growth parameters were taken at 30 DAP, 45 DAP and at harvest. The results of the experiment revealed that the treatment T7 recorded maximum plant height (26.92cm), number of leaves per plant (29.17), leaf length (27.64cm), leaf breadth (27.67cm), leaf canopy spread (29.75cm), leaf area (543.33cm2), fresh weight of leaf (206.33g),dry weight of leaf (13.85g) and yield (27.5t/ha) across the years. Among the quality parameters the highest ascorbic acid (3.76 mg /100g) and calcium (20.67 mg /100g) was recorded in T7. Maximum crude protein (1.44%) content was exhibited by the treatments T6 and T7.

Inoculation of microbial nitrogen fixers improves productivity and profitability for sweet potato *(Ipomoea batatas)* growers

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Sweet potato (Ipomoea batatas) of the family Convolvulaceae is one of the primary sources of phytonutrients that can feed this projected ever-growing population. Its tuberous roots are large, starchy and sweet-tasting and are used as a root vegetable. Sweet potatoes contain carotenoids and anthocyanin, which may lower the risk of cancer. It lowers the risk of blood sugar, LDL cholesterol and obesity. During this post-pandemic era, the therapeutic value of sweet potatoes must be considered to replace common medicines. Furthermore, to achieve global food and nutrition security, as well as to address the critical threats of climate change, biodiversity degradation and the health hazards particles in daily diets, our crop production systems must undergo significant transformations. At present, we must increase the

productivity of zero-residue vegetables, which can only be achieved by selecting High-Yielding Varieties (HYV), implementing Good Agricultural Practices (GAP), and Integrated Nutrient Management (INM) practices. In this context, the use of biofertilizers such as Azospirillum, Azotobacter, Phosphate Solubilizing Bacteria, and others is extremely beneficial to plant growth, soil health, and production costs. Azospirillum is a nitrogen-fixing bacteria that promotes plant growth by changing the forms of plant nutrients like nitrogen and phosphorus to make them more available, as well as competing with pathogens at the root zone and reducing plant disease. With this in mind, we investigated the effect of microbial inoculation on sweet potato yield and economics. In this particular experiment, we evaluated the integration of Azospirillum @ 5kg ha-1 as a source of nitrogen-fixing bacteria along with the soil test-based fertilizer dose (75:50:75 kg ha-1 of N, P2O5, and K2O). The results of this experiment revealed that microbial inoculation combined with the application of soil test-based synthetic fertilizer produced much more sweet potato (176 q ha-1) with an optimum corm weight of 196g as compared to other nutrient sources. Sweet potatoes produced by this nutrient combination produced 40% more yield than the sweet potato produced by the farmers' practice and earned a net income of Rs.1,67,500/-ha with a maximum benefit-cost ratio of 2.73. Thus, sweet potato growers may benefit from combining this microbial inoculation with the use of synthetic fertilizers in order to maximize yield and economic benefits.

Impact of inorganic fertilizers, vermicompost, FYM and biofertilizers on growth and yield of Amaranth

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A field experiment was conducted at the experimental farm, Department of Horticulture, Assam Agricultural University, Jorhat in the year 2023 to study the effect of integrated nutrient management on growth, yield and quality of amaranth. The experiment was laid out in a randomized block design (RBD) with three replications. The treatment combinations were T0: Control, T1: 100% RDF (60:30:20 kg NPK/ha) + FYM 5t/ha, (T2): 100% RDF + Vermicompost 4t/ha, T3:100% RDF+ Vermicompost 2t/ha + PSB + Azotobacter, T4: 75 % RDF +FYM 5t/ha, T5:75 % RDF + Vermicompost 4t/ha,T6:75 % RDF + Vermicompost 2t /ha +PSB + Azotobacter,T7: 75 % RDF instant mixture with incubated vermicompost 1t/ha and T8:100% RDF instant mixture with incubated vermicompost 1t/ha. Among the treatments, the treatment T8 recorded maximum plant height (47.08cm, 66.62cm and 85.85cm), plant width (23.73cm, 33.80cm and 44.75cm) at 30DAS, 45DAS and at harvest, respectively. Maximum number of leaves (78.00) was exhibited by T8 andwas at par with treatment T3 (77.77). The highest fresh weight (0.92g) anddry weight (0.23g) of individual leaf were recorded by the treatment T6

andT8, respectively.Maximum fresh weight of leaves (68.42 g/plant), fresh weight of stem (90.17g/plant), plant weight (158.59 g/plant) and leaf to stem ratio (0.76) was exhibited by T3. Among different treatments, the treatment T8 showed maximum stem girth (2.4 cm), number of branches (6.79) and days to harvest (54 days). The highest leaf yield (14.25t/ha), stem yield (18.78t/ha) and total crop yield (33.86t/ha) was observed in the treatment T3.

Influence of micronutrients on growth and yield traits of Cashew *(Anacardium occidentale L.)* Variety VRI 3

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Cashew (*Anacardium occidentale* L.) is native to Brazil and belongs to the family Anacardiaceae. India is the largest area holder of this crop. Cultivation of cashew in India confines mainly to the peninsular areas. It is grown in Kerala, Karnataka, Goa and Maharashtra along the west coast and Tamil Nadu, Andhra Pradesh, Orissa and West Bengal along the east coast. In India, Andhra Pradesh has the largest area and Maharashtra ranks first in production and productivity in cashew. Manuring in cashew is not a regular practice in the existing orchards of India, even though adequate application of fertilizers might be the required for cashew for growth and yield. Micronutrient disorders were observed during the early stage as well as the full grown stage of cashew. The present investigation was carried out to study the effect of foliar and soil application of micronutrients on growth and yield of cashew var. VRI-3 with the objective to improve nut yield. This experiment was carried out in a farmer's field at Kandamanur, Theni District of Tamil Nadu. This trial was laid out in a Randomized Block Design with seven treatments and replicated thrice. The present study results revealed that the foliar application of micronutrient mixtures recorded the highest values in T4 (NPK + micronutrient combination II (RDF + 0.75 % $ZnSO_4$, 0.75 % $FeSO_4$, 0.75 % $CuSO_4$, 0.5% Borax, 0.2% $MnSO_4$) for the traits such as average apple weight (59.66 g), number of fruits per tree (2015.0), average nut weight (7.40 g), 100 nut weight (671.66 g) and yield per tree (15.66 kg/tree), followed by T3 treatment (NPK + micronutrient combination II (RDF+ 0.5 % $ZnSO_4$, 0.5 % $FeSO_4$, 0.5 % $CuSO_4$, 0.3 % Borax, 0.1 % $MnSO_4$), the characters such as average apple weight (57.86 g), number of fruits per tree (1971), average nut weight (7.28 g), 100 nut weight (661.66 g), and yield per tree (15.58 kg/tree). The control (T1-Absolute control) recorded the lowest values in all the traits. T4 treatment (foliar application of micronutrients) recorded the highest B:C ratio (2.74) followed by soil application of micronutrients (2.39) whereas the lowest B:C ratio was noticed in control (1.52). T4 treatment recorded 30 per cent increased yield over the control. In the present

study it was concluded that foliar application of micronutrients such as 0.75% $ZnSO_4$, 0.75 % $FeSO_4$, 0.75 % $CuSO_4$, 0.5% Borax, 0.2% $MnSO_4$ along with recommended dose of fertilizers applied during panicle development stage increases the nut weight, nut yield and number of fruits per tree.

Physiological response of jamun *(Syzigium cumini (l.) Skeels)* cv. Goma priyanka to foliar application of potassium silicate and humic acid

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A field experiment was conducted over two consecutive years (2021-22 and 2022-23) to investigate the impact of potassium silicate (KS) and humic acid (HA) on the physiological parameters of Jamun (Syzygium cumini (L.) Skeels) cv. Goma Priyanka. The study involved four different levels of potassium silicate (0 ppm, 1000 ppm, 2000 ppm, and 3000 ppm), four levels of humic acid (0 ppm, 1000 ppm, 2000 ppm, and 3000 ppm), and various combinations of the two treatments. In total, 16 treatment combinations were arranged in a factorial randomized block design.The results revealed that the application of potassium silicate, humic acid, and their interaction had significant effects on the physiological parameters of the Jamun plants. Among the various treatments, the KS3 treatment (3000 ppm of potassium silicate) demonstrated the most significant improvements in several physiological parameters. The application of KS3 (potassium silicate at 3000 ppm) resulted in significant improvements in several physiological parameters of Jamun (Syzygium cumini (L.) Skeels) cv. Goma Priyanka. KS3-treated plants exhibited the highest relative water content (79.71%), indicating improved water retention. Additionally, the total chlorophyll content was maximized (1.80 mg g-1), enhancing the plants' photosynthetic capacity. The treatment also led to a higher membrane stability index (26.50), signifying enhanced membrane integrity under stress. The PAR value recorded at 1753.04 mmolm-2s-1 indicated the plants' increased ability to capture light for photosynthesis. Furthermore, the photosynthetic rate significantly rose to 5.64 mol m-2 s-1, and stomatal conductance increased to 6.34 mmol m-2 s-1, suggesting improved gas exchange and water vapour loss regulation. The relative humidity around KS3-treated plants reached 2.66%, indicating better moisture retention. Notably, the proline content was lowest (41.55 moles g-1) in the KS3-treated plants, indicating reduced stress levels. These findings highlight the potential benefits of using potassium silicate at 3000 ppm in promoting the growth and stress tolerance of Jamun plants. In conclusion, the application of 3000 ppm of potassium silicate (KS3) showed the most favourable effects on the physiological parameters of Jamun

(Syzygium cumini (L.) Skeels) cv. Goma Priyanka. These findings provide valuable insights into the potential benefits of using potassium silicate and humic acid to improve the growth and stress tolerance of Jamun plants, contributing to agricultural practices and crop management strategies. Further research and field trials may be warranted to optimize the application rates and determine the long-term effects of these treatments.

Pre harvest spray of calcium chloride and chitosan on yield and physico-chemical parameters of mango cv. Mallika

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This experiment was conducted under the experimental area of BAU Sabour, Bhagalpur, Bihar in the year 2021-22 to show the effect of calcium chloride (1.5 % and 3.0 %) and chitosan (0.5 % and 1.0 %) alone and their combinations on yield and physico-chemical parameters of mango (*Mangifera indica* L.) cv. Mallika. These chemicals were sprayed at 15th days and 30th days before harvesting in 2020-21. The experiment was conducted in randomized block design with three replications and nine treatments. The results of our study clearly showed that physical parameters such as fruit length, breadth, volume and weight (155 mm, 95 mm, 532 ml, 561.53g) were recorded maximum withT8- CaCl2 3% + chitosan 1%. It was also found that this treatment had highest yield (18.58 kg/plant). Minimum peel per cent (14.30) was observed in T6-CaCl2 1.5% + chitosan 1% whereas minimum stone per cent (8.99) and maximum pulp per cent (76.86) was in T8-CaCl23%+ Chitosan 1%. Highest TSS, TSS: acid ratio, total sugar, reducing sugar, ascorbic acid (13.46 O Brix, 21.36, 3.79 %, 1.78 %, 60.86 mg/100g pulp) was also in T8 while phenol, anthocyanin and antioxidant content (49.36 mg GAE/gm pulp,0.82 mg/100g peel, 62 mol Trolox equivalent/g pulp) was in T7- CaCl2 3%+ chitosan 0.5%.

Impact of foliar application of nutrients and organic substances on growth, fruit physico-chemical attributes and leaf nutrient status of apple cv. Anna under semiarid region of Haryana

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An experiment was conducted during two succeeding years, 2020–21 and 2021–22, to study the influence of different plant nutrients and organic substances on growth, flowering, quality, yield attributes, and leaf nutrition status of the Anna apple cultivar. The experiment consists of a total of nineteen treatments laid out in a randomized block design (RBD). Among the various treatments used, T12 (2.0% nitrogen plus 15% cow urine) was found superior for the growth characteristics of plants, viz., plant height and plant spread. However, the number of days taken for flowering, fruit set, fruit weight, fruit diameter, yield attributes, TSS, acidity, total sugar, total phenol, total anthocyanin content, and total carbohydrate content were significantly influenced by treatment T6 (400 ppm Boron + 4% Humic acid) in both years. The nitrogen content of the leaf was significantly increased with treatment with 2% nitrogen and 15% cow urine (T12). Phosphorus and potassium content were not significantly affected by various treatments in both years.

Effect of different level of phosphorus and potassium on growth, yield and quality of cowpea *(Vigna unguiculata l.)* Cv. Kashi nidhi

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For sustainable food production to meet the increasing population in developing countries, need for phosphorus fertilizer application is expected to increase yield and potassium fertilizer to improve quality of seeds. The study was carried out to evaluate the effect of phosphorus and potassium on growth, yield and yield components of cowpea cv. Kashi Nidhi during summer season 2020-21 and to determine suitable recommendation in the study area. Experiment was laid out in RBD with three replications. On the basis of one year research trial it was concluded that the application of 20:80:60 NPK kg/ha (T10) showed maximum growth attributes i.e. plant height (96.57 cm), number of leaves/plant (67.71), number of nodules/plant (13.60), number of branches/plant (11.60), fresh weight of green pod (7.23 g), dry weight of green pod (1.45 g), early flower initiation (37.28 DAS), 50% flowering (45.67 DAS), days to first pod set (3.70 days), and highest yield attributes i.e. number of pods per plant (25.44), length of pod (30.34 cm), girth of pod (0.93 cm), green pod yield per plant (0.171 kg) and green pod yield per ha (181.87 q/ha) with pale blue or purple colour flower showed in all the treatments, tenderness found in all treatments (except 20:40:20 NPK kg/ha) as well as of good keeping quality of cowpea. Application of 20:80:60 kg/ha (T10) had secured highest net profit (Rs. 314658.30) as well as B:C ratio (1:5.82). This indicated the application of 20:80:60 NPK kg/ha had significantly showed better performance from other level of phosphorus and potassium.

Natural farming: A game changer in horticulture

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Natural farming is regarded as an agro ecology-based, varied farming system that incorporates plants, animals, and trees as well as functional biodiversity. A Japanese scientist named Fukuoka created the so-called "do-nothing" strategy, rejecting both modern a chemical-free alternative to traditional farming, natural farming draws on decades of agricultural knowledge. Fukuoka wrote a book titled "The One Straw Revolution: An Introduction to Natural Farming" in which he advocates for everyone to utilize sensible and sustainable practices; to stop using pesticides, fertilizer, tillage, and maybe most importantly, unnecessary effort. Zero Budget Natural Farming (ZBNF) was originally promoted by an agriculturist Sh. Subhash Palekar in mid-1990s, who have been awarded with one of the highest civilian awards of India, Padma Shri in 2016 for promoting this alternative farming practices. In India, Natural farming is promoted as Bharatiya Prakritik Krishi Paddhati Programme (BPKP) under centrally sponsored scheme-Paramparagat Krishi Vikas Yojana (PKVY). BPKP is aimed at promoting traditional indigenous practices which reduces externally purchased inputs. It is largely based on on-farm biomass recycling with major stress on biomass mulching, use of on-farm cow dung-urine formulations, periodic soil aeration and exclusion of all synthetic chemical inputs. There are four pillars of natural farming - Jeevamritha, Beejamritha, Acchadana (mulching) and Whapsa (soil moisture) revitalize the soil microbial population and moisture, thus indirectly increasing the nutrient content in the soil. In natural farming homemade inputs are used like Agniastra, Neemastra, and Brahmastra, Kashyam ark for pest and disease control. There are different practices followed in natural farming for climate resilient ZBNF namely, Ghanjeevamrit, Polycropping, sowing of seeds before monsoon, navadhanya, cover crop, intercropping, mixed cropping. There are different types of horticultural crops which can be grown under natural farming are Banana, leafy vegetables, cucurbits, Solanaceous varieties, Okra, cool season vegetables, spices and condiments, tubers, coconut based intercrops, cocoa, nutmeg, coffee, cashew, pepper, coconut, arecanut. Natural Farming helps in alters the soil physical, chemical and biological properties in cabbage field. Panchgavya, Brijamrit helps in bitter gourd seed germination process as well as seedling growth and development under saline conditions. Ghanjeevamrit + Jeevamrit + Mulching helps in yield performances, soil health and nutrient uptake in wheat + gram inter cropping system.

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 buildup of carbohydrate above the girdled portion and the plant roots become deficient 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 (Pyrus pashia) 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.

Application of artificial intelligence on grading and sorting of fruits and vegetables

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Grading and sorting of fruits and vegetables is an important operation for achieving better quality , productivity and economic growth but it is a labour intensive operation with high level of inconsistency, low precision and is prone to human fatigue. Artificial intelligence (AI) is an emerging tool in this field to overcome these challenges. AI systems is proposed to be an astute system which can substitute the human workforce to overcome visual variability, inaccuracy, and fatigue in quality grading and sorting and thus reducing the post harvest loses. The quality evaluation of fruits and vegetables by grading and sorting which include maturity evaluation, quality identification, injury detection, and decay and disease detection for various

fruits can be addressed by AI models. With the advancement of computer vision, image processing and machine learning techniques different AI models are widely used to achieve automated fruit and vegetable grading and sorting. Artificial neural network (ANN) models had shown a great potential over other models in grading by providing solutions for making quality decisions and improving postharvest efficiency such as by classifying the ripeness and firmness levels of fruits and vegetables and also by detecting the size, mass, colour, and external defects and bruises etc.

Effectof plant growth regulators on growth, fruit maturity and yield of Pomegranate *(Punicagranatum)* cv.Bhagwa in north western plateau zone of Odisha

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An experiment on the topic entitled “Effect of plant growth regulators on growth, fruitmaturity and yield of Pomegranate (Punica granatum) cv. Bhagwa was carried out in North Western Plateau Zone of Odisha” at demonstration plot of Regional Research and Technology Transfer Sub Station, Kirei, Sundargarh, under Odisha University of Agriculture and Technology, during 2019-20 & 2020-21 in Randomized Block Design with eleven treatments replicated thrice. The treatments were imposed in the ambe bahar crop of pomegranate during both the years. They were T1: (Ethrel @ 500 ppm at 45 days prior to flowering), T2: (NAA @ 10ppm before flowering), T3: (NAA @10 ppm thrice at the time of flowering, 1 MAF & 2 MAF),T4: (NAA @ 40 ppm thrice at the time of flowering, 1 MAF & 2 MAF), T5: (GA3 @ 50 ppm thrice at the time of flowering, 1 MAF & 2 MAF), T6: (GA3 @ 75 ppm thrice at the time of flowering, 1 MAF & 2 MAF), T7: (NAA @ 10 ppm+ GA3@ 50 ppm thrice at the time offlowering, 1 MAF & 2 MAF), T8: (NAA @40 ppm+ GA3 @ 50 ppm thrice at the time offlowering, 1 MAF & 2 MAF), T9: (NAA @10 ppm+ GA3@ 75 ppm thrice at the time off lowering, 1 MAF & 2 MAF), T10: (NAA 40 ppm+ GA3 @ 75 ppm thrice at the time off lowering, 1 MAF & 2 MAF) and T11: (Control i.e. only water spray thrice at the time off lowering, 1 MAF & 2 MAF).Data’s were recorded on different vegetative growth, duration required for fruit maturity and yield of Pomegranate cv. Bhagwa during the years 2019-20 ad2020-21. From the pooled data, it was inferred that the treatment T6 i.e. (GA3 @ 75 ppm thrice atthe time of flowering, 1 MAF & 2 MAF) was found best that had recorded highest values for above parameters like plant height (133.80 cm), plant spread (123.93 cm), number of shoots(68.83), number of fruits per plant (55.33), fruit weight (210.00 g) and yield (11.68kg/plant) followed byT5(with plant height (128.17 cm), plant spread (123.27 cm), number of fruits per plant (51.83), fruit weight (204.67 g) and yield (10.64 kg/plant). The control plants (T11) had recorded the lowest values for the above parameters studied viz. plant height (112.43cm), number of fruits per plant (40.33), fruit weight (173.33 g) and fruit yield(6.83 kg/plant).

Effect of growth regulators and propagation media on germination, growth and vigour of papaya seedlings cv. Sapna

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An experiment was conducted at Horticultural Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat to find out suitable hormone and propagation medium for seedling growth of papaya. The experiment was laid out in Factorial Completely Randomized Design with 11 different treatments comprising of two growth hormones of GA3 (200 ppm and 500 ppm) and NAA (200 ppm and 500 ppm) and two combinations of growing media [Garden soil + sand + FYM + Cocopeat (1:1:1:1) and Garden soil + sand + vermicompost + cocopeat (1:1:1:1)] and was compared with the recommended media mix of Garden soil + sand + FYM (1:1:1). The results indicated that combination of 500 ppm NAA with Garden soil + sand + vermicompost + cocopeat in the ratio of 1:1:1:1 was most effective for better seedling height, length of tap root, total dry matter of seedling, higher number of leaves, and greater vigour index in papaya cv. Sapna. However, increased germination percentage and minimum days for germination was recorded with the combination of 500 ppm GA3 + Garden soil + vermicompost + cocopeat (1:1:1). It was concluded that the combination of 500 ppm NAA media mix of Garden soil + sand + vermicompost + cocopeat in the ratio of 1:1:1:1 was found most suitable for enhanced seedling growth and higher vigour in papaya.

Effect of integrated nutrient management practices on growth, yield and quality of Papaya *(Carica papaya l.)*

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In order to determine the impacts of integrated nutrient management on the growth and yield of papaya, a field experiment was conducted at a farmers' field in Kalchini, Alipurduar, West Bengal, during the years of 2018–19 and 2019–20. The experiment consisted of 5 Factors (control, biofertilizer + FYM, vermicompost+biofertilizer, boron+ FYM, zinc + FYM), 4 Treatments (Control, Recommended Dose of Fertilizer (RDF) of NPK, 50% RDF, and 75 percent RDF), and it was replicated three times. The data was statistically analysed using a completely randomised block design. With RDF of NPK+vermicompost+biofertilizer, the maximum growth-related parameters, including leaf area (1353.57 cm2), leaf chlorophyll content (44.40 mg 100 g-1), and nitrogen content in leaf (1.41%), phosphorus content in leaf (0.829%), potassium content in leaf (2.92%)were observed. In terms of yield related attributes viz., total

number of fruits (38.72), fruit setting percentage (73.29%), total yield (59.47 kg ha-1) and average fruit weight (1.67 kg) was found highest with RDF of NPK + vermicompost+biofertilizer treatment. In terms of quality attributes, RDF of NPK+ vermicompost+biofertilizer was shown to be superior to other treatments viz., total Sugar (10.93%), reducing sugar (9.67%), beta-carotene content (4.22 mg 100g-1 of pulp), ascorbic acid content (62.06 mg 100g-1 of pulp). Whereas highest TSS (14.650B) was observed in treatment 75% RDF of NPK+ vermicompost + biofertilizer.

Impact of inorganic fertilizers, vermicompost, FYM and biofertilizers on growth and yield of Amaranth

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A field experiment was conducted at the experimental farm, Department of Horticulture, Assam Agricultural University, Jorhat in the year 2023 to study the effect of integrated nutrient management on growth, yield and quality of amaranth. The experiment was laid out in a randomized block design (RBD) with three replications. The treatment combinations were T0: Control, T1: 100% RDF (60:30:20 kg NPK/ha) + FYM 5t/ha, (T2): 100% RDF + Vermicompost 4t/ha, T3:100% RDF+ Vermicompost 2t/ha + PSB + Azotobacter, T4: 75 % RDF +FYM 5t/ha, T5:75 % RDF + Vermicompost 4t/ha,T6:75 % RDF + Vermicompost 2t /ha +PSB + Azotobacter,T7: 75 % RDF instant mixture with incubated vermicompost 1t/ha and T8:100% RDF instant mixture with incubated vermicompost 1t/ha. Among the treatments, the treatment T8 recorded maximum plant height (47.08cm, 66.62cm and 85.85cm), plant width (23.73cm, 33.80cm and 44.75cm) at 30DAS, 45DAS and at harvest, respectively. Maximum number of leaves (78.00) was exhibited by T8 and was at par with treatment T3 (77.77). The highest fresh weight (0.92g) and dry weight (0.23g) of individual leaf were recorded by the treatment T6 andT8, respectively. Maximum fresh weight of leaves (68.42 g/plant), fresh weight of stem (90.17g/plant), plant weight (158.59 g/plant) and leaf to stem ratio (0.76) was exhibited by T3. Among different treatments, the treatment T8 showed maximum stem girth (2.4 cm), number of branches (6.79) and days to harvest (54 days). The highest leaf yield (14.25t/ha), stem yield (18.78t/ha) and total crop yield (33.86t/ha) was observed in the treatment T3.

Effect of growth hormone on runner production in strawberry in agro-climatic of Bihar

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Strawberry is now successfully grown in agro climatic condition of Bihar with high yield and good fruit quality. Farmers of the state are taking up this crop due to high return in short span of time. But the plant multiplication due to lesser number of runner production and plant survival are the major challenges due to high temperature followed by heavy rainfall after completion of harvest i.e. from April onwards. Thus, an experiment was conducted in experimental plot of Bihar Agricultural University, Sabour, Bihar to promote runner production in strawberry with foliar application of different doses of BA (75ppm &150ppm), GA (25ppm and 50 ppm) and their combinations in two commercial varieties of strawberry Camarosa and Nabila which are now commercially grown in the state. The experiment was laid out in RBD with eight treatments with three replications. The treatments were applied during 3rd week of February and in2ndd week of March during fruiting season 2020-21 as foliar feeding. Effect of treatments was found significant in increasing plant growth and application of BA (75 ppm) + GA3(50ppm) exhibited maximum plant height (24.21cm) , plant spread (33.32cm)and maximum internodal length (12.61cm) with GA 50ppm application. Regarding runner production treatments behaved differently to chemicals as significant effect of treatments were noted in increasing runner production in Camarosa but it could not reach to level of significance in variety Nabila.

Influence of growth promoting chemicals on growth, flowering and yield in narcissus

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An experiment was conducted to study the influence of growth promoting chemicals on growth, flowering and yield in narcissus. Growth promoting chemicals used were benzyl adenine and gibberellic acid at different levels including control. Diseased free and healthy bulbs of single cultivar of Narcissustazetta were selected and planted in the month of December in well prepared land. Foliar application of benzyl adenine (100, 200, 300 and 400 ppm) and gibberellic acid (50, 100, 150 and 200 ppm) including control (distilled water) was done 25 days after planting in morning hours. Experiment was laid out in Randomized Block Design which was replicated five times. Application of benzyl adenine and gibberellic acid resulted in significantly positive results on growth, flowering and yield in narcissus. Application of BA at 400 ppm was found best for various growth parameters followed by GA3 at 200 ppm, whereas, GA3 at 200 ppm was found best for bulb and root parameters. Application of BA (400 ppm)

significantly increased length of leaf, width of leaf, width of scape, plant height, early opening of 1st flower and increased number of roots/plant, however, it also resulted in late opening of flowers. BA at 300 ppm resulted in shorter plant height and leaf length. Lower dose of BA (100 ppm) significantly increased number of buds/plant and number of open flowers/plant. Highest level of GA3 (200 ppm), considerably delayed opening of the last floret, increased duration of flowering, number of bulbs/hill, root diameter and fresh and dry weight of roots. However, a lower dose of GA3 (50 ppm) achieved maximum bulb weight and root length.

Effect of vine management on morpho-physiological characters and yield of Pumpkin

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A study was carried out at the Instructional cum Research Farm, Department of Horticulture, Biswanath College of Agriculture, Assam Agricultural University, and Biswanath Chariali with an aim to study the morpho-physiological characters and yield influenced by vine management. The treatments were: T1 (Trimming of growing tip of the primary vine at 8th node stage), T2 (Trimming of growing tip of the primary vine at 10th node stage), T3 (Trimming of growing tip of the primary vine at 12th node stage), T4 (Trimming of growing tip of the secondary vine at 6th node stage), T5 (Trimming of growing tip of the secondary vine at 8th node stage), T6 (Removal of all tertiary vines), T7 (Retention of two tertiary vines) and T8 (control without pruning). The study revealed that among the treatments, T4 recorded the highest primary vine length and inter-nodal length of primary vine at 60, 90 DAS and at 1st harvest. Number of primary vine was found to be highest under T5 while T3 recorded maximum number of secondary vines, inter-nodal length of secondary vines, the highest total leaf chlorophyll content, relative leaf water content, leaf area index and maximum fruit yield. Therefore, after studying different characters it was concluded that trimming of growing tip of the primary vine at 12th node stage can be used as a vine management technique in pumpkin to get maximum yield.

Studies on the effect of plant growth regulators on physical parameters of sapota *[Manilkara achras (mill.)* Forsberg] cv. Cricket ball under agro-climatic condition of Chhattisgarh plains

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The present investigation was undertaken during the year 2020-21 and 2021-22 at experimental field of Horticulture instructional Farm, Department of Fruit Science College of Agriculture, IGKV, Raipur (C.G.). The experiment was conducted on twenty years old trees of sapota cv. Cricket Ball with foliar spray of different concentrations of plant growth regulators applied at 50 per cent flowering and pea stage of fruit growth. The experiment was laid out in Randomized Block Design having twenty five treatments, which replicates thrice. Physical parameters of fruit viz., fruit weight (126.36 g), fruit volume (121.59 ml), fruit diameter (6.69 cm), fruit length (6.92 cm) and pulp weight (112.61 g) of sapota fruits were increased considerably with the treatment GA3 @ 150 ppm, while, the peel weight (8.79 g) was reduced under the same treatment. The specific gravity (1.045 g ml-1) was recorded maximum under the treatment ethrel @ 1000 ppm. However, a reduction in number of seeds per fruit (4.50) and seed weight (4.38 g) was observed by the foliar feeding of NAA @ 100 ppm treatment.

Effect of impregnated bags on chemical properties and quality of Mango *(Mangifera indica L.)* cv. Mallika

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The investigation entitled, on “Studies on the effect of impregnated bags on quality of mango (Mangifera indica L.) cv. Mallika was conducted at (AICRP) on irrigation and water management, VNMKV Parbhani. from February to June in the year 2016-17. Fruit at 30 days after the fruit set is selected for bagging. The size of the bags was 25*20 cm, while, bagging the filter paper bags impregnation with different insecticides, pesticides, and chemical solutions. The impregnated bags were stapled properly so that it will not fall down as well as there will not be open space for entry of any insects or rain etc. which constituted the various im pregnated bags (filter paper bags) of different seven treatments undertaken in randomized block design viz., T1 Methoxam treated bag, T2 decis treated bag, T3 Potassium meta bisulphite treated bags, T4 Methoxam + Decis treated bags, T5 Potassium meta bisulphite + Decis treated bags, T6- Untreated bags, T7- Control (no bagging), Mango fruits

were subjected to seven treatments with three replication at 30 days after the fruit set. We have studied quality attributes up to 12 today after harvesting fruit with 3rd, 6th, 9th, and12th day intervals at the ripe stage. The maximum TSS (21.92 %), reducing sugar (7.14 %), non-reducing sugar (12.72%), total sugar (20.47%), β- Carotene (15395 g/100g), and ascorbic acid (20.60 mg/100g) were, recorded significantly superior in T3 (KMS treated bag). Further, the highest shelf-life was noticed in T3 (10.73 days) similarly whereas minimum (plw) was noticed (7.14%). While comparing average sensory score showed top ranking performance in the same treatments were improved at the ripe stage over control. These results could help to improve the quality of mango found the best result at 9th days after harvesting of fruits.

Studies on physico-chemical properties of physiologically disordered (Wai-bar) Nagpur mandarin fruits

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Problem of fruit oblongation arises in Nagpur mandarin fruits from last decades and it are dominantly increasing from last 4 to 5 years in Nagpur mandarin growing regions of Akot, Amravati, Wardha, Nagpur and some part of Madhya Pradesh. The present investigation was carried out at Post Harvest Technology Laboratory, Department of Horticulture, Dr PDKV, and Akola in order to study the physico-chemical characteristics of physiologically disordered nagpur mandarin fruits. Samples of physiologically disordered fruits and normal fruits were collected from twenty-five orchards of five different locations (viz., Ruikhed, Anjangaon, Paratwada, Jittapur, and Akot). It was found that the physiologically disordered fruits have low TSS (5.45 to 7.82 o Brix) , ascorbic acid (8.43 to 14.97 mg 100 ml -1), reducing sugars (1.96 to 2.75 %), non-reducing sugars (2.33 to 3.65 %) and juice content (34.15 to 47.36 %) with more acidity (0.73 to 0.80 %), length breadth ratio (1.10 to 1.20), rind thickness (3.57 to 3.98 mm), pomace content (24.68 to 28.35 %) and rag content (11.31 to 13.65 %) as compared to normal fruits TSS (9.46 to 12.78 o Brix) , ascorbic acid (32.15 to 42.57 mg 100 ml -1), reducing sugars (3.15 to 4.75 %), non-reducing sugars (4.26 to 5.56 %) juice content (49.16 to 52.24 %), acidity (0.64 to 0.69 %), length breadth ratio (0.85 to 0.90), rind thickness (3.57 to 3.98 mm), pomace content (24.68 to 28.35 %) and rag content (11.31 to 13.65 %) respectively.

Different canopy shape management in mango (Mangifera indica l.) Cv. Dashari with reference to yield and quality characters under high density planting system and micro irrigation in east Champaran district of Bihar

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A field experiment was conducted with an objective of improving yield and quality of mango Cv. Dasheri (Ten-year-old) under different canopy shape management and polyethylene mulching in high density planting (5.0 x 5.0 m) in farmer's field of E. Champaran during 2020-2021. The experimental plot was irrigated with a drip irrigation system having four emitters per plant of eight LPH capacity based on four irrigation levels (50, 75 and 100%) of pan evaporation (PE) replenishment and one ring basin irrigation method (control). The black polyethylene mulching (100 thicknesses) was used to cover 40% area of tree canopy. Recommended dose of fertilizer was applied at different phenological stages. The impact of different canopy shape viz. Central Leader System, Modified Leader System, Open Centre System on flowering and fruiting pattern was studied. Enhancement in flowering in tune of 75 to 90%, maximum fruit yield (95.00 kg/tree) in open centre system with polyethylene mulching treatment followed by modified leader system (80.05kg/tree), Central leader system (65.75 kg/tree) and minimum yield (60.50 kg/tree) in control (un mulched basin irrigation) was recorded. Maximum A grade fruit (35%) was also observed in open centre system with polyethylene mulching by application of irrigation at 75% PE per day per plant whereas minimum A grade fruit (17%) was recorded in the control treatments. Irrigation through drip and fertigation also increased the harvesting period of mango up to one week.

Effect of fungicide and auxin application on pollen viability of tomato *(Solanum lycopersicum l.)* genotypes

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Pollen viability has a direct impact on the rate of fertilization and subsequent fruit development. Pollen of high quality is necessary for producing viable seeds, which are the basis for maintaining and preserving crop genetic diversity. In this investigation the effect of fungicide (bavistin) and auxin (IBA) were studied on the pollen viability of ten tomato

genotypes at College of Horticulture, VCSG Uttarakhand University of Horticulture and Forestry, Bharsar, Uttarakhand. Pollen grains were collected from plants sprayed with bavistin (2g/L) and IBA (75mg/L) at an interval of 15, 25, 35, and 45 days after transplanting. Results showed that the application of bavistin reduced the pollen viability by 18.66% whereas, IBA application slightly enhanced it by 3.31% as compared to the control group. The highest percentage of viable pollen was recorded in the genotype 'San Marzano' (96.69%)in the auxin (IBA) group while the lowest percentage of pollen viability was recorded in the genotype 'Arka Samrat' (59.77%) in the fungicide (bavistin) group.

Impact of vermicompost and FYM on growth and yield of cucumber (Cucumis sativus l.)

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A field experiment was conducted during 2022 at the experimental farm, Department of Horticulture, AAU, Jorhat to study the effect of organic nutrients on growth and yield of cucumber. In the experiment the variety used was Kashi Nutan. The experiment waslaid out in a randomized block design (RBD) consisting of seven treatments in three replications. The treatments were T0: Control, T1: FYM 10t/ha, T2: FYM 5t/ha, T3: FYM 5t/ha+ Microbial consortium, T4: Vermicompost 5t/ha, T5: Vermicompost 2.5t/ha and T6: Vermicompost 2.5t/ha + Microbial consortia. Among different treatments maximum plant height (1.94m and 3.44m) at 30 DAS and at first flowering were observed in T4 and T6, respectively. The highest internodal length (12.03cm and 12.27cm) at 30 DAS and at first flowering were recorded in T0. Maximum number of primary branches (2.70 and 4.70) at 30 DAS and at first flowering was exhibited by the treatments T1 and T6, respectively. Minimum days for appearance of first male flower (47.33days), first female flower (54.33days) and the lowest node for appearance of first female flower (6.45) were observed in the treatment T6. The female flowers per plant (13.98) were the maximum in the treatment T1. The highest fruits per plant (10.92) were exhibited by the treatment T4. Maximum fruit length (23.10cm), fruit weight (267.67g), fruit volume (304.91cc) and shelf life (8.17 days) of fruits were recorded in T4. The highest fruit yield per plant (2.92kg) and total yield (24.33t/ha) were recorded in T4.

Principles and practices of zero budget natural farming

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Using conventional techniques in agriculture is like cancer for our soil and health as well. It does not only make the soil barren, but eventually the farmer goes into debt. After witnessing the harmful effects of chemical farming and the concerning economic situation of the farmers, there is a need to adopt agricultural practices that can alleviate these problems. Among various alternatives, the most economical and only way to deal with this ever-rising problem is Zero Budget Natural Farming (ZBNF). The word 'budget' refers to credit and expenses; thus, the phrase 'Zero Budget' means without using any credit and without spending any money on purchased inputs and 'Natural Farming' means farming with nature and without chemicals. Moreover, the principle methods ofZBNF prescribes the 100 percent elimination of synthetic chemical inputs (fertilizers and pesticides) and encourages the use of locally sourced inputs, such as natural concoctions and inoculums prepared with cow dung, cow urine, jaggery, green chillies, neem paste, etc. In addition to this, there are 4 pillars of ZBNF: Jivamrita (which helps to increase the population of microbes in soil), Bijamrita (which helps in seed treatment), Acchadana (the use of mulching), and Whapasa (moisture). One of the major components of this farming is rearing of Indigenous cattle whose urine and dung are critical ingredients of Jivamrita and Bijamrita. Therefore, the implementation of this farming practice aligns perfectly with our agricultural objective, which aims to obtain the maximum output with the minimum use of inputs.

Principles and practices of organic farming

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In India, organic farming has become a top focus in order to support environmental sustainability and food security. Organic farming now occupies just 1.5% of all agricultural land, so there is a great deal of possibility for growth. Organic farming, an ecologically responsible kind of horticulture, places an emphasis on growing fruits, vegetables, flowers, and other horticultural crops using natural methods and resources. Artificial fertilizers, pesticides, and genetically modified organisms (GMOs) are avoided with this technique, promoting

sustainable agricultural practices that are beneficial to both the environment and human health. Without utilizing artificial inputs, it depends on biological processes, biodiversity, and cycles that adjust to local conditions .Biological pest management, crop rotation, organic manures, and green manures are among the conventional techniques used in organic farming in place of synthetic fertilizers and pesticides. Produce that is organic fetches a higher price, which boosts farm profits. Organic farming approaches improve soil health, protect biodiversity, minimize pollution, and mitigate the effects of climate change. Costs associated with transition, certification requirements, a lack of knowledge, supply chain deficiencies, and a lack of institutional support are among the problems. Through farmer incentives, market expansion, and extension services, government programs to mainstream organic farming have had a favorable effect. Farmer collectives, public-private partnerships, participatory guarantee systems, and additional governmental assistance may all work together to unlock the full potential of organic farming and develop sustainable food production systems in India.

Scheduling of N, P and K nutrients using fertigation method for sustainable production of pomegranate *(cv. Bhagawa)*

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To standardize the dose of N P and K macro-nutrients in Pomegranate (cv. Bhagawa) a fertigation experiment is carried out with 18 treatments, viz. N @ 200, 400, 600,800 and 1000 g /plant with control (N1 to N6); P @ 100, 200, 300,500 and 500 g /plant with control (P1 to P6); K @ 200, 400, 600,800 and 1000 g /plant with control (K1 to K6); in RBD with 4 replications is experimented at ICAR-NRCP, Solapur (M.S.) on 3 years old plants during 2021-2023. The drip irrigation and fertigation schedule is adopted in all the treatments using double drip-line irrigation and fertigation for taking Ambia flush. The RDF as par AICRP on fruits is 625: 250: 250 (N: P: K) for full bearing plants andRDF taken for the 3 years is 75 %. The fertigation schedule is scheduled from October (except December stress month) till June. Fertigation is given in 15 equal splits of doses at 15 days interval. The water soluble fertilizers used for the schedule of fertigation are Urea, MAP, MKP and MOP with required combinations. The plant growth of the Pomegranate varied from 1.2-1.58 m, 1.35-1.53 m and 1.10-1.46 m in different N, P and K treatments respectively. The highest fruit yield and quality was observed with fertigation of N-800 g/plant yield (20.13 kg/tree), number of fruits (66), fruit weight (305 g), juice content (40.5 %), TSS (15.6 o Brix) and lowest acidity (0.44 %). The similar observations of yield and quality was recorded withP-300 g/plant as yield (21.35 kg/tree), number of fruits (70), fruit

weight (305 g), juice content (41.0 %), TSS (15.8 o Brix) and lowest acidity (0.43 %). The highest fruit yield and quality of was observed with fertigation of K-600 g/plant as yield (19.7 kg/tree), number of fruits (70), fruit weight (281 g), juice content (42.0 %), TSS (15.9 o Brix) and lowest acidity (0.42 %). Amongst treatments involving all the lower fertigation doses the fruit yield is significantly lower.

Water use efficiency, yield and fruit quality of pomegranate as influenced by different levels of evapo transpiration deficit irrigation schedules and partial root zone drying technique

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To evaluate the concept of deficit irrigation schedule and partial root zone drying with drip irrigation a field experiment was carried out on seven year old fully grown Hasta flush bearing Pomegranate (at different phonological stages i.e. new leaf initiation, development, maturity and harvesting period) at ICAR-NRC on Pomegranate, Solapur during 2018-2021.The treatments consisted of 60, 70, 80, 90 and 100 % evapotranspiration (ETt) for the 7year old fully grown pomegranate trees. The experimental results revealed that, partial root wetting and deficit irrigation water has shown a profound effect on vegetative growth, fruit growth, fruit quality and yield. The moisture content and relative leaf water content in various deficit irrigation treatments varied from 20.45 - 46.34 and 66.74 - 84.57 %, respectively. The fruit yield of Pomegranate and water use efficiency (WUE) under various deficit irrigation were 7.5, 11.3, 19.3, 15.7 and 14.7 t/ha and 2.21, 2.50, 3.33, 2.63 and 2.15 kg/m3 at 60 to 100 % ETt for 7 years old pomegranate. The highest number of fruits (62), fruit weight (310.3 g), juice content (41.8 %), TSS (15.8 OBrix), low acidity (0.41 %) and fruit yield (19.4 t/ha) was observed in deficit irrigation at 80 % ETr followed by 90 % ETr. The irrigation at 80 % ETr is suggested for fruit bearing pomegranate plants and it is recommended as a water saving strategies to water managements of pomegranate orchards when water resources are limited in order to increase WUE while other physiological growth, relative leaf water content, water use parameters and yield are maintained at an acceptable levels.

Effect of different mulches on yield and yield attributing characters of strawberry

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An investigation was carried out for three consecutive years from 2016-17 to 2018–2019 at Assam Agricultural University-Zonal Research Station, Diphu, Assam, India to study the Effect of different mulches on yield and yield attributing characters of Strawberry. The experiment was laid out in a Randomized Block Design (RBD) with six treatments and three replications viz., T1: Raised bed with plastic mulch, T2: Flat bed with plastic mulch, T3: Raised bed with straw mulch, T4: Flat bed with straw mulch, T5: Raised bed without mulch and T6: Flatbed without mulch. The size of a unit plot was 5.0 m x 4.0 m. The distance between blocks and plots were 0.5 m to facilitate different intercultural operations. Well decomposed FYM was applied to the plots at the rate of 5 kg along with 10:7:7 g NPK per square meter area, phosphorus fertilizer should be incorporated before planting while N is to be applied in two split doses at 3 weeks after planting and K fertilizer at flowering stage. Healthy and uniform sized 30-days old strawberry seedlings taken from runners were transplanted on at a spacing of 50 cm x 40 cm. Light irrigation was provided immediately after transplanting by using a watering can. Mulch treatments were applied on the respective plots as per layout before transplanting of seedlings. Data on various plant parameters were collected during vegetative growth and fruiting time.The treatment of raised bed with plastic mulch showed the highest values in the growth and yield parameters. There was significant effect of different mulches on most of the vegetative growth parameters of strawberry. Among all the treatments, highest plant height (17.67 cm), leaves per plant (22.73) and highest yield (22.43 q/ha) was recorded in raised bed with black plastic mulch followed by raised bed with straw mulch. Harvest duration was found to be significantly highest in the treatment of raised bed with straw mulch (68.5 days).

Effect of sterilization and potting mediaon growth of seedlings for grafting in Chilli *(Capsicumannuum L.)*

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The experiment was conducted at Hi-tech unit, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri during kharif season 2021-22. In experiment there was two factors (Non-sterilized potting media (S0) and sterilized potting media (S1)) and

six combination of potting media (M1: 100% Coco peat, M2: 75% Coco peat +25% Vermicompost, M3: 50% Coco peat + 50% Vermicompost M4: 25% Coco peat + 75%Vermicompost,M5:75%Coco peat+25%sawdust,andM6:75%Coco peat+25% Ricehusk). For rootstock seedlings treatment combination S1M4 registered minimum days for seed germination (6.67 days) and number of days (48.73 days) for graftable stage, with maximum seedling height (14.68 cm), diameter at collar region (1.51 mm), number of functional leaves(7.40), length of taproot (6.23cm),number of adventitious roots (17.70), fresh weight (197.13 mg), dry weight (26.97 mg). For scion seedlings the treatment combination S1M4gives best results with minimum days for germination (6.67 days) with maximum seedling height (16.31cm), diameter at collar region (1.48mm), number offunctional leaves (6.27), length of taproot (8.92 cm), number of adventitious roots (27.00), fresh weight (278.30 mg), dry weight (26.47mg), minimum number of days (41.90days) for graftable stage.

Effect of mulch materials and PGR on growth and yield attributing parameter of papaya *(Carica papaya)* cv. Sinta

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Investigation was carried out on “Effect of mulch materials and PGR on growth and yield attributing parameter of papaya (Carica papaya) cv. Sinta” at Experimental Farm, Department of Horticulture, and Assam Agricultural University Jorhat during the period of 2022-2023. For this three mulch materials viz., M1 (Silver black mulch), M2 (Paddy straw mulch) and M3 (No mulch) with six different levels of PGR viz., C1 (GA3 @150 ppm), C2 (GA3 @ 200 ppm), C3 (Ethrel @ 150 ppm), C4 (Ethrel @ 200 ppm), C5 (NAA @ 150 ppm) and C6 (NAA @ 200 ppm) were used and applied at 45, 90 and 145 days interval. The experiment was laid out in Factorial Randomized Block design consisting of two factors viz. mulch material and different levels of PGR. The treatment consist of eighteen treatment combinations viz., T1 (GA3 @ 150 ppm + Silver black mulch), T2 (GA3 @ 150 ppm + Paddy straw mulch), T3 (GA3 @ 150 ppm + No mulch), T4 (GA3 @ 200 ppm + Silver black mulch), T5 (GA3 @ ppm 200+Paddy straw mulch), T6 (GA3 @ 200 ppm + No mulch), T7 (Ethrel @ 150 ppm + Silver black mulch), T8 (Ethrel @ 150 ppm + Paddy straw mulch), T9 (Ethrel @ 150 ppm +No mulch), T10 (Ethrel @ 200 ppm + Silver black mulch), T11 (Ethrel @ 200 + Paddy straw mulch), T12 (Ethrel @ 200 + No mulch), T13 (NAA @ 150 ppm + Silver black mulch), T14 (NAA @ 150 ppm + Paddy straw mulch), T15 (NAA @

150 ppm + No mulch), T16 (NAA @ 200 ppm + Silver black mulch), T17 (NAA @ 200 ppm + Paddy straw mulch) and T18 (NAA @ 200 ppm + No mulch).The observations on growth and yield attributing parameter of papaya were recorded after 180 days after planting. The results of the experiments revealed that maximum plant growth parameters viz., plant height, flowers per plant, fruits per plant and fruit yield (122.20 t/ha) were recorded when papaya plant mulch with Silver black and receiving GA3 @ 150 ppm after 45, 90 and 145 days of application.

Effect of organic amendments on growth, yield and quality of Papaya *(Carica papaya L.)* cv. Vinayak

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The study "the effect of organic amendments on growth, yield, and quality of papaya (Carica papaya L.)" was undertaken during the years 2020-21 and 2021-22 employing different combinations of farmyard manure, vermicompost, panchagavya, and amritpani. The findings showed that T15 (75% RDF FYM + Vermicompost + 3% Panchagavya + Amritpani) showed maximum values for the parameters of plant height, petiole length, and plant spread, whereas To (Control) showed the lowest values. Number of flowers per node and fruit set percentage were recorded highest in T15 (75% RDF FYM + Vermicompost + 3% Panchagavya + Amritpani), while their lowest values were found in To (Control). Under T15 (75% RDF FYM + Vermicompost + 3% Panchagavya + Amritpani), days to first flowering, days to first fruiting, and days from first flowering to fruit maturity were recorded much earlier.The factors for fruit yield and quality were also noted. In the same way, the mean maximum value for the parameters of fruit weight, length, diameter, number of fruits, peel weight, pulp weight, pulp: peel ratio, number of seeds, reducing sugar, total reducing sugar, non-reducing sugar, vitamin C, and TSS (o brix) was recorded under T15 (75 % RDF FYM + vermicompost + 3% Panchagavya + amritpani), while the mean minimum value for each of these parameters was recorded under To (control).

Generative traits of exotic apple cultivars on different scion-stock combinations under high density planting

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Apple cultivation is shifting to lower mid-hills of Himalayas which necessitate the introduction of exotic cultivars. It is therefore, pertinent to idealize the best performing cultivar on different stionic combinations that can provide high yield with good quality fruit production. This study has evaluated horticultural performance of apple cultivars on different scion-stock

combinations. The present investigation was carried out in the Department of Fruit Science, Dr YS Parmar University of Horticulture and Forestry, Solan, Himachal Pradesh during 2021 and 2022. The trial included Scion-stock combinations viz., Jeromine on EMLA111, Red Velox on EMLA111, King Roat on EMLA111, Schelet Spur on EMLA 111, Gala Schniga Schnico on EMLA111 and Gala Schniga Schnico on EMLA 9. The plants were spaced at 2.5 x 2.0 m with planting density of 2000 plants/ha.EMLA111 rootstock performed better in terms of vegetative growth indices, yield contributing traits, physiological parameters and leaf nutrient status compared to EMLA 9 rootstock. Gala Schniga Schnico on EMLA 111 performed better in terms of generative characteristics. The cultivars, Jeromine and Gala Schniga Schnico performed better with respect to fruit set, fruit yield, fruit quality parameters and photosynthetic efficiency. Higher total carbohydrates content was observed in non-fruiting shoots than that of fruiting shoots, while, King Roat recorded highest total carbohydrate content compared to others. The study concluded that Jeromine on EMLA111, Red Velox on EMLA 111, King Roat on EMLA 111, Gala Schniga Schnico on EMLA 111 and Gala Schniga Schnico on EMLA 9 rootstock can be a suitable alternative for commercial cultivation under mid hill conditions of Himachal Pradesh.

Response of organic amendments on yield of Radish *(Raphanus sativus L.)* and on soil health properties

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Radish (Raphanus sativus L.) under the family Cruciferae is a popular root vegetable grown all over the world. Radish is grown for its tender roots which are eaten as raw as salad or cooked vegetable. Abundant use of chemical fertilizers coupled with continuous cropping results in deterioration of innate soil fertility as well as crop quality. The present investigation was carried out to find out suitable organic amendments to improve yield of radish and on soil health. The experiment was carried out at experimental farm, Department of Horticulture, Jorhat during the year 2018-19 and 2019-20. Pooled data over two years revealed that T8 (80:60:60kg NPK + 10t FYM ha1) recorded the yield of Radish 191.45q ha-1 which was followed by 169.73q ha-1 under T7(Enriched compost 5t ha). Soil physico-chemical and biological properties showed significant difference among the treatments. The T7 [(T1+ Enriched compost (5t ha-1)] recorded for the best soil parameters viz., highest soil pH (5.54), highest organic carbon (0.86%), highest available K (137.24 kg ha-1) and highest available P (64.02 kg ha-1). In case of biological properties of soil, T7 was found to be statistically superior in respect of highest microbial biomass carbon (277.70). Further, highest available nitrogen (271.66 kg ha-1) and highest B: C ratio was found in T8 (RDF 50:50:100kg NPK ha-1) + FYM @10t ha-1). Hence, considering the positive effect on yield and soil health, T7 is considered the best organic treatment to earn good.

fect of different sterilization treatments on explants decontamination and plant regeneration in onion

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Explant plays an important role in tissue culture, and ensuring its sterilization is critical, especially when it is collected from field conditions with a high microbial load.Therefore, this study determined the effect of different sterilants including bavistin, mercuric chloride, sodium hypochlorite, ethanol and hydrogen peroxide, alone, or in combination constituting a total of thirty-two treatments for different duration on explants viz., seeds and unopened flower buds of PRO-7 onion cultivar. The whole experiment was repeated thrice by culturing explants on MS medium and data for different treatments and traits were recorded on 4th and 8thdays. Among different treatments, mercuric chloride at concentrations of 0.1% and 0.5%, either alone or in combination, exhibited remarkable efficacy with maximum decontamination in explants, and showed good results for survival or seed germination and opening rate of flower buds at 4thand 8th day. Emerging radicles obtained from decontaminated seeds were subjected to callus induction, shoot regeneration and root induction. Modified MS medium (MS medium + 30 g/L maltose+ 500 mg/L casamino acids+4 g/L clarigel, pH 5.8)supplemented with1 mg/L 2, 4-D and 2mg/L BAP+0.1mg/L NAA was most conducive for the induction of callus and regeneration of shoots respectively, while ½ MS medium supplemented with 0.1mg/L NAA for root induction. This study optimized the effect of sterilants on explants of onion and can be utilized further to carry out the experiments of DH development and genome editing.

Effect of different non-chemical fertilizers on yield and yield attributing traits of Pea var. Azad Pea 1 in wet temperate region of Himachal Pradesh

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Pea is one of the most important commercial vegetable crops in wet temperate region of Himachal Pradesh. Crop matures in the month April and May and farmers earn good remunerative price of their produce due to its off-season availability in plains. Monocropping and non-judicious use of chemical fertilizers have drastically declined the productivity of crop in the region due to degradation of soil structure; imbalanced nutrient status and pathogen inoculum build up. To improve the soil structure, balance the soil nutrient status and increase the yield of pea three different formulations viz. granular, powder and liquid were tested in different combination for yield and yield attributing traits of Pea var. Azad Pea-1 in farmers'

field at village & PO Thunag, District Mandi falling under the wet temperate zone of the state. Experiment was laid out in randomised block design with seven treatments in three replications. Treatments were T1:Granular biofergenic fertilizer @ 25 kg/ bigha (Half basal dose + half at the time of weeding , T2:Powder biofergenic fertilizer @ 80 kg/ bigha), T3 Liquid biofergenic fertilizer as seed treatment @10 ml/ litre + 1 ml/ Litre at 30 days interval thrice during cropping season, T4:Granular biofergenic fertilizer @ 25 kg/ bigha + 10 ml/ litre seed treatment liquid biofergenic fertilizer + 1 ml/ Litre at 30 days interval thrice during cropping season, T5:Powder biofergenic fertilizer @ 80 kg/ bigha + 10 ml/ litre seed treatment liquid biofergenic fertilizer + 1 ml/ Litre at 30 days interval thrice during cropping season, T6: Granular biofergenic fertilizer @ 25 kg/ bigha + Powder biofergenic fertilizer @ 80 kg/ bigha + 10 ml/ litre seed treatment liquid biofergenic fertilizer + 1 ml/ Litre at 30 days interval thrice during cropping season) and T7 :Control: No Treatment. Treatment 6 recorded the highest yield of 257.40 q/ha followed by T5 (249.60 q/ha), T2 (210.60 q/ha), T1 (201.60 q/ha) and T1 (194.40 q/ha) which were statistically at par with each other and Treatment 3 recorded the lowest yield of 151.10 qt/ha. These non-chemical fertilizers formulations were prepared by FPO of Haryana.

Precise the space utilization in fruit crops as high density planting

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High density planting is defined as accommodation of the maximum possible number of plants per unit area to get the maximum production and profit. High density planting mean stoin crease the plant population perunita reaf or increasing the production of crops. It is so many types like hexagonal system,triangular system etc. Its component is use of dwarf scion and root stocks,training & pruning, growth regulators etc. In different crops, different types of varities are used for the high density planting and its increase the productivity of the crops, space utilization, quality fruit production etc. Mostly it is used in Mango (Var. Amrapali, Arunika etc.), Banana (var. G-9, Dwarf Cavendish, Basrai etc.), Apple (var. Starkrimson, Red Spur etc.) and Guava (var. Sardar etc.) and by using some important dwarfing rootstock such as in apple and mango etc.

Correlation between the flower bud morphology and developmental stages of the male gametophyte in Onion *(Allium cepa L.)*

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Haploid induction via androgenesis or gynogenesis holds immense significance in the production of homozygous lines in several vegetable crops. While androgenesis has been successfully reported in various plant species, onion has posed a significant challenge in this regard, and despite extensive research efforts, no successful reports have been made yet. In certain instances, callus formation from the anther filament has been observed. The process of androgenesis is influenced by various factors, and among them, one of the most critical factors is the developmental stage of the male gametophyte during anther culture. In the present study, correlation between flower bud morphology (flower bud length and diameter, anther length and diameter) and microspore developmental stages has been studied across ten onion varieties. It was found that all the morphological parameters investigated exhibited positive correlations with the stages of microspore development. The stages that showed the highest responsiveness for anther culture in most crops were the late uninucleate and early binucleate stages. These stages are observed in flower buds with lengths ranging from 2.5 to 3.5 mm and diameters from 2.0 to 2.7 mm. Similarly, anthers with lengths of 1.2 to 1.6 mm and diameters of 0.55 to 0.75 mm were found to contain the late uninucleate and early binucleate stages. Our findings suggest that a combination of flower bud length, diameter, and the green color intensity of anthers can serve as practical, quick, and precise criteria for identifying these stages.

Effect of mulching technology in watermelon production – an innovative approach from Sonitpur district of Assam

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The major problem faced by Assam State is low cropping intensity due to mono-cropping of rice. Moreover, flood problem in summer and water scarcity in winter decreases the possibility of growing more crops. Thus the combined effect of environmental and mono-cropping have led to reduction of agriculture production in the State as a whole and it had become high time for the extension agencies to take up alternative cultivation approaches. Watermelon is cultivated in

different parts of India. In Assam, its cultivation ismainly restricted to Central and Lower-Brahmaputra Valley Zones of Assam. In Sonitpur district, different field trials at KVK farm indicated that the crop flowers as well as fruits in the prevailing agro-climatic conditions. Compared with other crops, watermelon makes higher profit and can be a good source of income. Realizing that cultivation of this crop could be a profitable enterprise during summer season in the paddy fallows, KVK Sonitpur took up the venture of transferring this innovation among farmers of Amolapam village. Since many years ago farmers of this village tried to grow watermelons on rice fallow areas and noticed that watermelons could not be grown here successfully due to water scarcity and weed problem in initial growth phases and heavy rainfall coincide with the crop vegetative as well as reproductive stages. In 2018, under NICRA project, KVK Sonitpur started introducing the agricultural mulching system with raised bed technology among watermelon farmers in this village with variety Red Chief in 1ha area. The result of the demonstration programme was eye catching. Raised bed technology along with black polythene mulching not only suppressed weed growth with moisture conservation during initial establishment period but also helps to survive the crop during water stagnation period. Moreover, the durability of black polythene mulch gave the opportunity of harvesting two crops per year from the single establishment. KVK intervention along with farmer's innovation of sowing second crop after harvesting of the first crop in the same field showed a markedly high yield of 29t/ha and 19.2ton/ha under first and second sowing respectively, giving the farmers good profits compared with the traditional planting techniques

Corm dormancy release in Gladiolus: A crosstalk between temperature, storage duration ABA and GA

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Gladiolus is a bulbous plant with a deep innate dormancy for 2-3 months just after harvest in new corm buds. The present investigation was planned to unravel the underlying cascade of differentials (Gibberellic acid, GA; Abscisic acid, ABA) in regulating corm dormancy release (CDR) in corms of Punjab grown gladiolus varieties (Punjab Glad 3 and Punjab Glance) under different storage temperature (4˚C and ambient) and durations (0-3 months). The per cent sprouting in Punjab Glance was 88% after 3 months of ambient storage and 100% after 2 months of cold storage and in Punjab Glad 3, the per cent sprouting was 43.33% after 3 months

of ambient storage and 96% after 3 months of cold storage. The maximum spike formation was 92% in Punjab Glance and 71% in Punjab Glad 3 after 3 months of cold storage. The endogenous analysis of growth hormones (GA and ABA) was done through High Performance Liquid Chromatography (HPLC). The content of GA and ABA were found to be significantly correlated to sprouting and spike formation as the content of both GA and ABA varied with storage duration and temperature. The GA content was more in cold stored corms than ambient stored corms and ABA content increased with increase in duration of ambient storage in both cultivars with high GA content in Punjab Glance and high ABA in Punjab Glad 3. Thus, CDR is dependent upon endogenous content of GA and ABA that further is regulated by temperature and varied with cultivar.

Integrated nutrient management for maintaining soil fertility status and sustainable production of Aonla *(Emblica officinalis Gaertn.)* in red and lateritic region of WestBengal

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An investigation was carried out at Bidhan Chandra Krishi Viswavidyalaya's Regional Research Sub-Station, Sekhampur, and West Bengal, India during 2019-2021 to investigate the impacts of inorganic and organic nutrient management for feasible production of aonla as well as maintaining fertility status of the soil in Red and Lateritic Region of West Bengal. This investigation was arranged by utilizing Randomized Block Design, replicated thrice along with eight treatments [T1- Control (RDF: 600-300-600g NPK/ plant); T2 - 400-200-500g NPK +20 kg FYM/ plant; T3 - 400-150-450g NPK + 10 kg Vermicompost/plant; T4 - 550-300-600g NPK + 40g Azotobacter /plant; T5 - 600-250-600g NPK + 50g PSB/plant; T6 - 550-250-600g NPK + 40g Azotobacter + 50g PSB/plant; T7 - 350-150-500g NPK + 10 kg FYM + 40g Azotobacter + 50g PSB/ plant; T8 - 350-100-450g NPK + 10kg Vermicompost + 40g Azotobacter + 50g PSB/ plant]. The findings clearly depicted that the highest percentage increase in plant height (25.61%), canopy spread in North-South (13.61%) and East-West (14.50%) direction, maximum volume of fruit (29.28 ml), fruit length (3.64 cm), diameter (3.68 cm), fruit weight (30.20 g), flesh thickness (1.64 cm), TSS (10.81°Brix), ascorbic acid (526.36 mg/100 g of flesh pulp), juice content (49.33%), number of fruits/tree (1065.00) as well as maximum yield/tree (32.29 kg) were observed with the implementation of 550:250:600g NPK + 40g Azotobacter + 50g PSB /plant. The highest available nitrogen (169.85 kg/ha), potassium (147.56 kg/ha), phosphorus (23.78 kg/ha), as well as organic carbon (0.31%) content were observed under same treatment.

Effect of cropping systems on growth, yield and fruit quality of Apple *(Malus× domestica Borkh.)* under high density plantation

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The study was conducted to standardize cropping system module in HDP of apple. Cropping systems were examined for their effects on growth and yield of apple trees cv. Scarlet Spur grafted on MM 111 clonal rootstock. The experiment comprised of 6 treatments replicated four times in a RBD. Combinations of kharif and Rabi intercrops grown along with apple trees. Sole combination of strawberry (T1), garlic + pea (T2), pea + black gram (T3), black gram + french bean (T4), chrysanthemum (T5) and grass mulch (T6). Their combined effects on apple trees were taken into consideration on apple trees. Maximum increase in tree height, spread, trunk diameter, and trunk cross sectional area, canopy area and canopy volume were recorded in the trees that were intercropped with pea + black gram. However, highest yield and yield efficiency was recorded under garlic + pea (T2) intercropped treatment. The treatments T2 and T3 were statistically at par with one another with respect to majority of observations. Thus, intercropping with garlic + pea was respectively the most efficacious treatment and recommended for high density plantation of apple.

Organic cultivation of okra by using organic sources of nutrients

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In present situation our main aim is to reclaim the soil health by popularization of organic farming and minimizing the use of chemical fertilizer. Organic Cultivation of Okra by using organic sources of nutrients has impact on soil health as well as the economic situations of farmers at Baksa District. The study was carried out in 2019-2020 and 2020-2021 at Baksa district under the guidance of KVK, Baksa. Interventions are Organic Practice (T1) was used to compare with farmers practice, where use of random chemical fertilizers, (T2). The result shows the significant effect in terms of yield and economic parameters. The cost of cultivation is higher in T1 (Rs. 137000/-) as compared to T2 (Rs. 116500/-) due to balk amount in organic inputs. Again Gross return was higher in T1 (Rs. 245000/-) compared to T2 (Rs. 195000/-). The yield shows that organic cultivation has contributed higher return as compared to others with 25% more increase in yield. The soil status was also influenced in organic cultivation practices.

The organic carbon, soil pH, Avl. N, Avl. P and Avl. K ranged from0.72%, 5.05 kg/ha, 425.5 kg/ha, 42.2 kg/ha, 150.2 kg/ha in organic product (T1) and 0.52 %, 5.0 kg/ha, 460.5 kg/ha, 30.2 kg/ha, 141.5 kg/ha in inorganic cultivation (T2) respectively. Comparing both the treatment, the study shows that the organic cultivation practices is more profitable than inorganic (1.67) one, contributing higher B: C of 1.78.

Nutrient optimization minisett amorphophallus intercropped in banana

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The high pressure on land with increasing population and the need to augment production compel farmers to intensify cultivation in the availableland, including cropping in the inter spaces of widely spaced crops. Amorphophallus (Amorphophallus paeoniifolius Dennst. Nicholson) commonly called elephant footyam, being a shade tolerant crop has been globally accepted as a profitable intercrop in plantations and orchards. In conventional planting, large corms of 0.75 to 1.0 kg are used as planting material. As a result, a major fraction of the harvested corms has to be kept apart as planting material for the next crop. Non availability of planting materials in adequate quantities, often interferes with the timely planting of the crop. Further, in the conventional method, when the whole corm is cut into setts, wastage of 30-40 per cent of the edible corm is reported. In this context, the minisett/corm technology (100-150 g sized corm pieces) developed by the Central Tuber Crop Research Institute, Sreekariyam, Thiruvananthapuram, assumes significance. Banana (Nendran), Musa spp. one of the most remunerative fruit crops in Kerala, is raised at a spacing of 2 m x2m. The wide interspaces and the slow initial growth offer scope for increased resource capture and use with an adequate spatial distribution of various plant architectures. This paper attempts to evaluate the performance of minisett raised Amorphophallus as an intercrop in garden land banana under varying levels of NPK and to optimize the NPK dose for the minisett crop.

Stage-wise application of nitrogen and potassium in banana

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Banana is an important horticultural crop in Bongaigaon district of Assam. The area, production and productivity of banana in Bongaigaon district are 697 hectare, 8765 MT and 12575 kg/ha, respectively. Banana is a voracious feeder of nutrients; therefore, timely and judicious applications of fertilizers have a major effect on yield potential. Therefore, it is important to apply nutrients at the critical growth stages of crop growth in split doses to minimize loss of nutrients. In view of the above, on farm testing was conducted during 2018-19 to study the effect of stage wise application of nitrogen and potassium in banana (var. Malbhog). The technology consists of application of nutrients (N @ 110 g and K2O @ 330 g per plant) in split doses (60% N at planting to 5 months stage, 20 % at shooting and 20 % at last hand opening to one month before harvesting, 40% K at shooting to last hand opening and 60% at last hand opening to one month before harvesting + P2O5 @ 550 g at planting to 5 month stage). In farmer's practice full amount of N @ 110 g, P2O5 @ 550g and K2O @ 330 g/plant were applied after 3rd month after planting. Results revealed that, higher yield was recorded in the treatment (34 ton/ha) as compared to farmer's practice (27 ton/ha). Higher yield obtained in treatment was attributed to more number of hand (8 nos./bunch), finger (15 nos./hand), finger length (15 cm) and finger diameter (16 cm). In farmer's practice, data on hand per bunch, finger per hand, finger length and finger diameter were 7 nos., 14 nos., 13 cm and 12.8 cm, respectively. Average bunch weight in treatment plots was 15.67 kg as against 13.16 kg in farmer's plot. Bunch harvested from treatment and farmer's plots produced 124 and 106 numbers of fingers respectively. There was 16.0 per cent increase in yield over farmer's practice. Lower soil available nutrients (N: 289 kg/ha, P2O5: 21.5 kg/ha and K2O: 114 kg/ha) at higher level of split application at critical growth stages of the crop when compared with farmer's practice (N: 375 kg/ha, P2O5: 25 kg/ha and K2O: 172 kg/ha) revealed that the applied nutrients were utilized efficiently Net return and benefit cost calculated in treatment was Rs. 540053/ha and 4.6 respectively, whereas, net return and benefit cost ratio in farmer's plots were Rs. 401783.00/ha and 3.9 respectively.

Effect of pinching and plant growth regulators on growth parameters of Fenugreek *(Trigonellafoenum-graecumL.)*

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The present investigation was carried out to study the effect of pinching and plant growth regulators on growth attributes of fenugreek at the Horticultural Research Centre, Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal) Uttarakhand, India. The experiment comprising 18 treatments were grown in Factorial Randomized Block Design with three replications during rabi season, 2020-21. The observations were recorded for 6 different growth parameters. Pinching redirects movement of auxin from the apical part of a plant to lower areas, stimulating the development of lateral branches which increases the potential podding points on a plant thereby increasing the number offruits produced per plant and plant bio-regulators have great potentials to influence plant growth has been used in increasing stalk length, vegetative growth. The results of analysis of variance revealed that the mean sum of square due to treatment was significant at 5% level for almost all the characters. The treatment seed soaking S1 (GA3 50 ppm) was treated as best for the characters like minimum days taken to first germination, significantly maximum plant height at 30, 60 DAS and at harvest was observed with the treatment combination of no pinching with application of GA 350ppm (P0G1) and maximum number of branches 40 DAS and at harvest observed was found best as compared to double pinching at 60DAS and application of GA 350ppm (P2G1).

Fertility and fertilizer's management in fruit crops

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The horticulture sector encompasses a vast array of crops, including fruits, vegetables, root and tuber crops, mushrooms, floriculture, medicinal and aromatic plants, nuts, and plantation crops like coconut and oil palm. This rapidly expanding sector plays a significant role in the Indian economy, with India ranking second globally in horticultural production, trailing only behind China. Horticultural crops, known for their high value, demand substantial amounts of fertilizers and frequent irrigation to ensure robust gr lopment, high yields, and

quality produce. One of the challenges in horticulture is that different crops have widely varying nutrient requirements, and even different varieties within the same crop can have distinct nutrient needs due to genetic differences. Consequently, formulating precise fertilizer recommendations is an ongoing process. To successfully manage fertilizer applications, it's essential to evaluate the nutrient status of soils, including micronutrients. Soil sampling for horticultural crops must align with their specific rooting patterns to accurately assess nutrient needs. Various factors influence the revision and updating of fertilizer recommendations, including nutrient removal or uptake by crops, changes in crop varieties, cultural practices, cropping intensities, and yield targets. Adhering to the "4Rs" principle is critical when supplying nutrients for horticultural crop production. This principle emphasizes using the right rate, right source, right placement, and right timing of fertilizers to ensure the efficient and economical utilization of these valuable resources.

Effect of meta toppling and NAA on direct shoot regeneration from anthers in African marigold *(Tagetes erecta l.)*

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Marigold (Tagetes erecta L.) is one of the widely cultivated commercial flower crop owing to its elegant flowers, longer blooming period, good shelf-life, and major source of lutein. Homozygous parental lines are necessary for commercial hybrid seed production of any crop. A strategic approach for inducing the haploids/doubled haploids could be employed through anther culture by which homozygosity can be achieved in single generation. An attempt was made to study the effect of meta topolin (a naturally occurring cytokinin) and NAA on direct regeneration from anther inoculated on culture media containing these plant growth regulators in different combinations. For this purpose, the flower buds of two heterozygous population of African marigold i. e. Desi Orange and Desi Yellow were used. Anthers excised from unopened flower buds, were inoculated on Enriched MS (EMS) medium supplemented with 4.5% sucrose, 0.25% (w/v) gelrite and different concentrations of meta topolin (0, 0.25, 0.5, 1.0, 1.5 and 2.0 mg/L) and NAA (0, 0.25and 0.5mg/L). Experimental results revealed that meta topolin (0.5mg/L) in combination with NAA (0.25 mg/L) had maximum initial callus induction (58.10 %) and number of shoot buds per anther (1.72). This combination also took minimum days for initial callus induction (16.28 days) and shoot emergence (21.28 days). EMS media devoid of these growth regulators had no shoot emergence.

Response of spacing and plant growth regulators on quality parameters of strawberry *(Fragaria × ananassa Duch.)* Cv. Winter dawn under protected condition

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The modern cultivated octoploid Strawberry (Fragaria×ananassa Duch.) was originated in France. It belongs to the family Rosaceae and subfamily Rosoideae. Despite of perishable nature it is one of the nutritious and delicious fruits with limited climatic adoptability and widely used for its characteristic's aroma, flavor and taste. Use of plant growth regulators may affect its quality to the great extent. Application of Salicylic acid is an important signaling molecules. It enhances tolerance against biotic and abiotic stresses intreated plants thereby improve the nutritional uptake and quality of the fruits. It also plays an important role in plant growth, nutrient transport within plants and ion uptake. Triacontanol also involves in improvement of growth, yield, photosynthetic efficiency, uptake of nutrient and water, nitrogen-fixation, protein synthesis etc. Naphthalene acetic acid (NAA) is also very effective in controlling and directing a number of plant metabolic processes. This present research entitled "Response of spacing and plant growth regulators on quality parameters of strawberry (Fragaria × ananassa Duch.) cv. Winter Dwan under Protected condition is oriented towards improvement in quality of strawberry particularly in cultivar winter dawn by use of different plant growth regulators, was conducted during 2021-2022 and 2022 -2023 at Hi-Tech Unit, College of Agriculture, Ummedganj, Kota (Rajasthan).Experiment was laid out in Factorial Randomized Block Design and replicated thrice which contains eighteen treatment combinations viz., Spacing consisting of Two levels (15×30 cm and 30 ×30 cm) and three levels of each PGR viz., salicylic acid (50, 100 and 150ppm), Triacontanol (5, 10 and 15ppm) and NAA (25, 50 and 75 ppm).Foliar sprays of NAA have been found to control pre-mature drop of fruit and increasing size of fruit in strawberry. While, salicylic acid was found effective on number of fruits, fruit weight and diameter of fruit and thereby yield with most of the quality parameters including total soluble solids, ascorbic acid, acidity and sugar content.

Effect oftime ofpruningonyieldandqualityoflemonvar. Assamlemon *(Citruslimonl. Burm)*

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The investigation was conducted during 2022-2023 to study the effect of time of pruning on yield and quality of Assam lemon and to make the fruits available during lean period. The experiment comprised of 12 treatments was laid out in RBD with 3 replications. Pruning considered as treatments were carried out from 1st May, 2022 to 15th October, 2022 at 15 days interval. The ages of the plants were 9 years old. Average number of hermaphrodite flowers(96.09), male flowers (96.70) and total number offlowers (192.79) were found to be highest in T12 (pruned on 15th October) and plants under this treatment also recorded the highest fruit set(58.44%), fruit retention (92.01%), average number of fruits per plant per month (51.55) and number of fruits per plant per year (360.85). These values were found to be lowest in plants pruned in May (T1 and T2). Plants pruned on 1st May (T1) recorded the highest values of fruit weight (168.33g), volume of fruit (184.83cc) and fruit length (9.21cm) while thinnest peel (2.95mm) and the highest pulp-peel ratio were recorded in T12 (prunedon15thOctober). Among the treatments, T12 (pruned on 15th October) was found to be efficient in terms of quality like highest juice content (35.66%), TSS (6.330Brix) and ascorbic acid (37.95mg/100ml) contents. From the present investigation, it was also evident that mature fruits could be harvested from November onwards i.e. during the lean period from the plants pruned during May-June.

Effect of biofertilizer and their consortia on yield and quality of Lettuce *(Lactuca sativaL.)*

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Lettuce (Lactuca sativa L.), having chromosome number2n=18, isa popular salad vegetable which belongs to family Compositae. The present study was conducted at Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow- 226025 (U.P.), India during Rabi season of 2017-2018. Biofertilizers such as Rhizobium radiobactor, Pantoea agglomerans and their consortia were applied on the lettuce crop in combination with FYM and vermicompost in 10 treatment combinations. Recommended dose

of fertilizers was considered as the control treatment against which the treatments were compared. Pantoea agglomerans, Rhizobium radiobactor and their consortia, considerably improved the root growth of lettuce, both independently and in combination with FYM and vermi-compost. Rhizobium radiobactor was found to be the significantly most effective in improving the root length, root spread, root weight, dry root weight. The different treatments had varying effects on the quality characteristics tested. Rhizobium radiobactor was found to be the most effective in improving the quality parameters antioxidants, nitrate, and carbohydrate on its own. Rhizobium radiobactor + FYM additionally boost flavonoid and protein levels. However, further trials may be needed to substantiate the effect of these PGPR's in improving performance of vegetable crops.

Biochemical profiling of some radish microgreens

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Radish has been considered as an ancient and globally distributed crop. Among the microgreens, radish microgreen is gaining importance due to shorter lifecycle. Nutritional composition of fourteen radish genotypes (Palak Patta, White Cone, Indian Radish China Queen, NBR-Indian Queen, SBS Bahar 32, Kashi Hans, Kashi Adra, Pusa Chetki Long, Improved Radish Rajni, Sundari Lal Aush, Chinese Pink, Local 1, Local 2 and Local 3) were analysed at their microgreen stage. The experiment was performed in a specially designed room fitted with artificial light. Radish seeds were sown in HDPE trays containing a mixture of cocopeat:perlite and vermiculite in 3:1:1 ratio. Significant variation was found among the radish genotypes for different bio-chemical parameters. The study revealed that radish cv. Pusa Chetki Long is rich sources of nutrients (ascorbic acid - 202.33mg/100 gm FW, beta carotene - 19.98 g of carotene/100g FW and carotenoids- 0.32 mg/g fresh leaf) as compared to the other genotypes. On the other hand, Indian Radish China Queen recorded higher total phenol content (145.67mg GAE/100 g fresh weight); Improved Radish Rajni showed maximum total chlorophyll and chlorophyll b and Local 2 showed maximum chlorophyll a as compared to others. Wide variation in nutrients content was found among the different genotypes of radish microgreens, which offers choice for selection of good genotypes. Among the studied genotypes, radish cv. Pusa Chetki Long can be selected for growing nutrient rich microgreens.

The influence of different mulching materials on tuberose *(Polianthes tuberosa l.)* vegetative, reproductive and yield in North Gujarat

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In India, tuberose is grown in a wide range of climatic conditions. In North Gujarat, tuberose is planted during the summer season when the availability of water is scanty. Under such conditions, mulches may be a good practice for tuberose production. 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. Therefore, an experiment was conducted in a randomized block design with three replications and eight mulch treatments viz.,no mulch, black polythene film (50), silver-black polythene film (50), red-black polythene film (50), 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. Mulch materials had significant influence on the growth and tuberose production over control. Maximum plant height and number of leaves per plant, florets perspike, rachis and spike length, spike weight and production of spikes, florets and bulblets was recorded due to mulching with bishop's seed straw (2" thick layer), followed by fennel straw (2" thick layer) and black polythene film (50). The same treatment also exhibited the earliest flowering followed by fennel straw (2" thick layer) and black polythene film (50). This study will provide the farmer with a cost-effective selection of mulching practices, management of spices crop residues and commercial cultivation of tuberose in the upcoming dates.

Influence of planting dates on growth and yield attributing characters of strawberry

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An experiment was conducted to study the influence of planting date on growth and yield attributing characters of Strawberry considering var. Sweet Charlie and Winter Dawn with three different planting dates viz 1st October, 2022, 1st November, 2022 and 1st December, 2022 at farmer's field under Krishi Viyan Kendra, Darrang during 2022 and 2022. Among the planting dates, 1st November planting showed better performance on growth and yield attributing characters of Strawberry followed by 1st October and 1st December planting. The findings

revealed that significant higher number of leaves plant-1 (23.66), plant height (30.50 cm) and number of runner per plant-1 (5.12) in winter dawn followed by Sweet Charlie in November planting Strawberry. The yield attributing character like early flowering (38.66 days), early harvesting from planting period (67.66 days), fresh individual fruit weight (44.45 g) and number of fruits plant-1 (38.66) were found maximum 1st November planting followed by 1st October and 1st December planting Straw berry var. Winter Dawn. The results revealed that fruit yield (13.30 tons ha-1) was also found more in November planting Winter Dawn strawberry followed by variety Sweet Charlie. Thus, different planting time has a great influence on growth and yield attributing characters of Strawberry in both the varieties winter dawn and Sweet Charlie.

Introducing superior cultivars of gladiolus for quality and quantity indexes in Assam

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The present study was carried out to evaluate three gladiolus cultivars for vegetative, floral, corm, and cormel characteristics under rain-fed conditions in Assam during 2020-21. The aim of the study was to find out the suitability of gladiolus varieties for cultivation during 2019-2021. The experiment was arranged in Randomized Block Design with three replications. There were significant differences among the varieties with respect to vegetative, floral, and yield characters. Cultivar Arka Gold is best suited for cut flower and corm production under different locations in Barpeta district.Results indicated that cultivars differed significantly in all studied traits. The highest plant height and the highest number and weight of cormel were observed in Arka Ayush. The highest leaf length (63.13 cm), the leaf width (4.42 cm), the highest corms (39.56 g), the highest corm diameter (4.41 cm) was recorded in cultivar Arka Gold. On the other hand, Arka Tilak exhibited the longest vase life (10.12 days), among the three cultivars. Among the cultivars, floral characters as well as spike characters were significantly higher in cultivar Arka Gold followed by Arka Ayush and Arka Tilak. Arka Gold had the best flower and corm traits. So, Arka Gold is recommended as alternative to some older cultivars as they may have higher marketability in Assam.

Integrated management of gummosis in Nagpur mandarin

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Phytophthora species causes a slow decline of the tree. The disease destroys the feeder roots of susceptible rootstocks, leads to disturbance in uptake of water and nutrients. In Vidarbha region of Maharashtra Phytophthora species can survive in adverse conditions as persistent spores in the soil. The area under citrus cultivation now a day's goes down due to the Phytophthora disease complex. So keeping this severity of disease an experiment on management of gummosis through integrated disease management strategy by using Bio agents was laid out at Regional Fruit Research Station, Katol Dist-Nagpur Maharshtra during the year 2020-21. Different treatments of bio-agents and chemicals with its combinations gave significant reduction in per cent oozing lesion due to citrus gummosis. Maximum reduction (45.30 %) was achieved due to application of Bordeaux paste (1:1:10) on trunk + soil application of Soil application of Trichoderma harzianum @100g + Pseudomonas fluorescens @100g + VAM @100g + FeSo4 + ZnSo4 @ 200g each followed by the treatment, application of Bordeaux paste (1:1:10) on trunk + Soil application of Trichoderma harzianum @ 100g + Pseudomonas fluorescens @ 100g + VAM @100g with carrier base FYM per plant + Potassium phosphite @ 0.1% foliar spray i.e. 40.68% lesion reduction respectively Thus, from the experiment the recommendation, has been given that, applications of Bordeaux paste (1:1:10) at pre monsoon (May) & after monsoon (October) on trunk and soil application of Soil application of Trichoderma harzianum @100g + Pseudomonas fluorescens @100g + VAM @100g followed by spraying of Potassium phosphite @ 0.1% and application of FeSo4 + ZnSo4 @ 200g each at the periphery of Nagpur mandarin.

Association of Vesicular Arbuscular Mycorrhiza with different fruit crops

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Fifteen fruit crops viz., Mango, Papaya, Guava, Lemon, Bael, Orange, Pomogrante, Jackfruit, Aonla, Sweet orange, Banana, Custard apple, Sapota, Ber and Tamarind were investigated to know the arbuscular mycorrhizal association. The results indicated that in all fruit crops Glomus spp. was associated having globose to sub-globose, elongated, irregular shape. In respect of colour, light yellow to bright orange and brown black to dark black observed at

maturity. The maximum number of spores i.e. 39 per 100 g soil was observed in the rhizosphere of sweet orange while maximum percent root colonization (34.8%) was observed in Mango rhizosphere. Regarding Soil Physico-chemical properties, organic matter, available macronutrient N and K showed significant positive correlation with mycorrhizal spore count whereas, soil pH and available micronutrient i.e. Cu, Fe, Mn were found negatively significant with spore count of VAM.

Production of Tomato in summer using Rain Shelter

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Tomato (Lycopersicum esculentum) is the most important vegetable crop as it is cultivated during the Rabi season only but the demand of the crop is remain high throughout the year. The cultivation of this vegetable crop during the rainy season is challenging and therefore an experiment was conducted to study the production potential of Tomato in summer using the rain shelter in Cachar district of Assam. The experiment was conducted in three locations (each 0.01ha) with trial and control plot in during 2021 in rainy season (i.e. April to August). During the crop period the total rainfall 1655mm, Maximum Temperature 32.9℃ (Avg.), Minimum Temperature 24.7℃ (Avg.), Relative Humidity was 85% in Morning hours and 70% in Evening hours was recorded. The result showed that tomatoes grown using rain shelter was found to be higher yield than the control plot. It was observed that the average yield of the trial plot was 0.92 MT whereas it was 0.58 MT in case of control plot. The average no. of fruits per plant was 40.66 in case of trial plot 30.33 in case of control plot with 127.67 days and 114 days crop duration in trial and control plot. The trial plot exhibited low disease and pest incidence as compared to the control plot. It was recorded that the trial plot was showed leaf spot and Aphid incidence whereas the control plot shows Fruit borer, aphid, thrips, leaf spot and fungal wilt. The benefit cost ratio of the experiment was 3.06 in trial plot and 1.77 in control plot. Average fruit weight of tomato was 82.35g in trial plot and 71.09g in control plot.

Technical Session - VII
Urban and Peri-urban Horticulture

Quality planting material generation of inca marigold in greenhouse for higher production and productivity

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An investigation was carried out at Experimental Farm, AAU, Jorhat-13, during rabiseasons of 2018-20 to assess the impact of different nursery media on growth and vigor ofmarigold seedlings and subsequent performance in main field and in polybags. The treatments consisted of four different nursery media compositions taken in protrays under greenhouse condition. viz., M1: Cocopeat (60): Vermiculite (20): Perlite (20), M2:Cocopeat (60):Vermicompost (40); M3:Cocopeat (60): Vermicompost (40): Microbialconsortia, M4:Conventional nursery (Soil: Sand: FYM) in marigold cv. Inca Orange. The treatment combinations were laid out inFactorial RBD with 3 replications. Seedlings raised in the nursery media M3 resulted in earlier seedling emergence (3.16DAS), took least time to reach 2-true leaf and transplanting stage (11.50& 28.81DAS).The seedlings were bigger in height(8.65cm), more leaves/seedling (4.24 numbers) with maximum leaf area and LAI (6.29cm2leaf area and 1.26LAI). Maximum numbers of roots/seedlings (38.23numbers), longer root length (9.39cm), higher fresh and dry weight (0.42g FW and 0.13g DW) also shown in M3. Seedling fresh weightand dry weight (1.57g and 0.40g) along with chlorophyll content (1.57mg g-1FW) and vigor of seedlings were also higher in seedlings grown in M3 media than all the other media compositions. In the main field, the seedlings grown in the same media subsequently showed better performance in flower beds than in polybags, recordinglesstime for seedling establishment (2.02DAT), better growth performance interms of plant height (33.37cm), leaves (83.54nos/plant), higher LAI (1.65) and recorded earlier flower bud initiation, 50% flowering and earlier seed setting. It also recorded more flowers with bigger size (30.22flower/plant and 10.03cm dia) which fade lately (79.19DAT) and recorded longer shelf-life (3.22days).

Income generation through low cost partial shade polyhouse

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The soil and climatic condition of the NE India as well as Assam is very suitable for growing various horticultural crops like fruits, vegetables, spices etc. Production of all the horticultural crops is highly remunerative. But unlike fruits and spice crops, vegetable growers have to face lots of problems in selling seasonal vegetables due to market glut, high cost of production and labour intensive operations. Majority of the vegetable growers have to sell their produce at a distress price or they have to throw away their produces either due to lack of market or to avoid marketing cost. As a solution the farmers are advised for offseason vegetable production. Cultivation of high value offseason vegetables under low cost protected structures has been found to be a viable technology for growing vegetables throughout the year. The low cost polyhouse made of UV stabilized 200 micron polythene sheets supported on bamboos with sutli (ropes) and nails. It also act as rain shelter for crops during rainy season. Present study was undertaken during Feb, 2022- Jan, 2023 at Jorhat district of Assam with the objective to analyse the activities undertaken in polyhouses, cropping sequence followed, profitability and constraints of low cost polyhouses. 03 blocks of Jorhat district viz. Kaliapani, Dhekorgorah and Selenghat were selected and from each block, 10 nos. of vegetable growers under low cost polyhouse were selected randomly for the final sample. The sample farmers had partial shade poly houses covering i.e only the upper portion by 200micron UV stabilized polythene sheet. It was observed that the average investment cost in construction of partial shade poly house was Rs. 14550.00 per 100m2 area. The sample farmers undertook mainly two activities in the partial shade net houses viz. seedling preparation and offseason vegetable production. Cropping sequence followed were C1: vegetable seedling production + leafy vegetable (Aug-Oct) - cucumber (Nov-Jan)-capsicum (Feb-July) and C2: vegetable seedling production + leafy vegetable (Aug-Oct) - cucumber (Nov-Jan)- tomato (Feb-July). Average gross income and variable cost per unit were Rs 46,000.00, Rs. 48,900.00 and Rs. 12,500.00, Rs. 12,800.00 obtained by the sample farmers in C1 and C2 respectively. Thus, higher B.C ratio over variable cost was found in C2 (3.82) as compared to C1 (3.68). The sample farmers reported that the major disadvantage faced for expanding crop area is high investment cost.

Nano materials: Tool towards sustainable vegetable farming

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Achieving zero hunger is a matter of sustainability in agriculture. Per capita availability of land has been declining due to population increase, urbanization, climate change, resource depletion, and the emergence of new pests and diseases. Advent of modern nanotechnology tools in the last few years have played a fundamental role in increasing vegetable crop production and yields through reduced inputs such as fertilizers, pesticides, and fungicides to keep up with world demand for food, nutritional and health safety. Nano particles, in conjunction with an increase in plant growth, nutrition, and resilience, are also likely to improve shelf life, decrease damage in harvested crops like cucumber, cabbage, lettuce, etc., and enhance the overall quality. Nano encapsulation can help reduce pollution and safeguard the environment by reducing leaching and evaporation of toxic substances. Nano sensors can be used to monitor soil moisture, pesticide residues, level of nutrients in produce and type of pests for the purposes of precise vegetable farming, while nano tubes can promote germination in tomato, lettuce, turnip, onion, etc., and increase plant photosynthesis. Therefore, intensification of vegetable production can be substantially increased through use of nanotechnology.

Interiorscaping for healthy and happy life

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Today in this concrete jungle we all yearn for the soothing effects of greenery to calm ourselves in our day-to-day hustle. With the increase in urbanisation (1.5% on a year-on-year basis in 2021 in India) and shift towards more indoor focussed activities and living environments (90% in urban areas), our interactions with the outdoors have become increasingly rare and thus often suffer from indoor pollution and other detrimental factors. As a result, interiorscaping has become a vibrant and inventive sector, with trends that respond to beautify our surroundings, health, sustainability, and simplicity. This trend is not merely an aesthetic indulgence but holds a range of practical, psychological and environmental benefits. It offers a lot of benefits like increasing work productivity, promoting innovation and ideas, acting as stress buster and contributing to the well-being of people, air purification, noise reduction,

lowering operations and maintenance cost, aiding in privacy and property protection, acting as a flexible design element, making the building more attractive and welcoming. The latest interiorscaping trends provide limitless opportunities for transforming indoor spaces into appealing and revitalising places. It minimizes negative impacts and increase positive benefits on environmental systems. Interiorscaping can promote environmental sustainability as a significant priority for better and productive life. Hence, it offers a bridge between our innate connection to nature and demands of modern living.

Effect of different growing media on growth, yield and quality of strawberry *(Fragaria x ananassa)* in vertical planting system

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The experiment was conducted during 2022-23 for the assessment of the effect of different growing media on growth, yield and quality of strawberry in vertical system, The experiment was laid out in RBD with 3 replications and 14 treatments i.e. growing media of different components and ratio. Each treatment consisted of 10 plants and accordingly 420 plants of strawberry cv. Winter Dawn were planted for conducting the experiment. The highest plant height (22.47cm), plant spread (29.71cm), number of leaves per plant (19.37), leaf length (5.96 cm), leaf breadth (5.42 cm), days to first flowering after planting (47.97days) and the lowest root length (17.15cm) and crop duration (160.83 days) was recorded under T1 (Soil + vermicompost @ 1:1). The lowest plant height (17.82cm), number of leaves per plant (15.21) and plant spread (25.61 cm), leaf length (5.15cm), leaf breadth (5.11cm), number of crowns per plant (3.18), days to first flowering after planting (37.50days), days to maturity after fruit set (35.30 days) and highest root length (18.82 cm) were recorded in T5 (Soil + vermiculite @ 1:3) and T8 (Soil + Perlite @ 1:3), respectively. The longest fruit (4.79cm), fruit weight (23.66g), non-reducing sugars (2.50%), anthocyanin content (27.77mg/100g) and lowest titratable acidity (0.46%) were recorded under T5 (Soil + vermiculite @ 1:3). The highest fruit diameter (4.48 cm), number of fruits per plant (21.31), fruit production (502.82g/plant), yield (558.69 q/ha), TSS (8.05°Brix), total sugars (7.82%), reducing sugars (5.34%) and ascorbic acid content (39.97mg/100g) were observed under T8 (soil + Perlite @ 1:3).

Standardization of growing media and pot size for rooftop gardening of Salvia var. Scarlet King

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An experiment was carried out on the rooftop of the administrative building of Assam Agricultural University, Jorhat during the year 2021-22, with a view to standardize the growing media and pot size for rooftop gardening of salvia (Variety-Scarlet king). The experiment was laid out in factorial completely randomised block design with three replications. The results revealed that the growth, flower and flowering attributes of Salvia were significantly increased in the media, G6(Sand + cocopeat + Vermicompost +Vermiculite + Perlite) in the ratio of 1:2:2:0.25:0.25 and pot size S3 (30 cm). The highest plant height (34.87cm), plant spread (28.16cm), leaves per plant (51.68), leaf area (38.38cm2), root volume (42.10 cc), root length (24.56 cm) and root number (261.43) was recorded for S3G6.This interaction also recorded the least days to full bloom (68.38 days), and longest flower spike (16.06 cm). It also recorded the highest chlorophyll content (2.023 mg g·1 FW) and net assimilation rate (0.021). Growing media G6, followed by growing media G5: Sand + cocopeat + Vermicompost + Perlite (1:2:2:1)gave significantly better performance in vegetative and floral characters. Among the pot size, S3 (30cm) gave the best results in vegetative, floral, root characters as well as physiological characters. The treatment combination T21: S3G6 gave the highest B:C ratio (1.90). From the observation it can be concluded that the treatment combination T21 was considered to be farmer friendly and best treatment combination in terms of better growth and flowering. There is further scope for refining the rooftop hydroponic technology by using drip irrigation and as leaching of growing media from the pot cause damage to the rooftop research can be done by using specialized container to prevent leaching.

Technical Session - VIII
Horticulture in North-Eastern India

Evaluation of papaya *(Carica papaya)* var. Red lady in some of the agro climatic zones of Assam

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Papaya (Carica papaya L.) is a tropical fruit which can be cultivated successfully in subtropical conditions. The fruit has a high nutritional and medicinal value and is rich in Vitamin A (2020IU/100g) making it very popular among the farmers of Assam. A study was conducted during 2019-2020 using observational and field data of farmers' field under rainfed conditions by Krishi Vigyan Kendra's of Kamrup, Golaghat, Karbi Anglong, Barpeta, Sonitpur and Udalguri under Assam Agricultural University representing four agro climatic zones of Assam. The study revealed that the plant was 252.98 cm tall with maximum fruit weight of 2.18 kg. Additionally, the Fruit Length, Fruit Diameter and Fruit Cavity Diameter were found to be 38.10cm, 32.14 cm and 6.51 cm respectively. Again, from the study it was found that Days to flowering (207 days), Number of fruits per plant (30.09 nos), Yield per plant (69.45 kg), Yield per hectare (208.3 t/ha), B: C ratio (6.68) was found higher against the local varieties in all the locations. From the study, it can be inferred that the farmers may adopt Papaya var Red lady over their local varieties for better yield and returns.

Up scaling watermelon *(Citrullus lanatus)* cultivation in central Brahmaputra valley zone of assam: challenges and the way forward

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The farmers of the Central Brahmaputra Valley Zone (CBVZ) comprising two districts viz., Nagaon and Morigaon have adopted commercial cultivation of watermelon in the recent years. The study was conducted in both the districts applying random sampling design of 180

respondents from 18 villages to identify the challenges faced by the watermelon growers as well as to study the prospects of watermelon cultivation in the region. The valley has huge potential of watermelon cultivation due to presence of markets, growing demands of the people for watermelon, fertile soil and motivation of young educated farmers to adopt entrepreneurial skills in commercial cultivation. The challenges were grouped into two broad categories i.e. production and marketing challenges. The major challenges found from the study were high cost of quality inputs, natural calamities, non-availability of quality seed and poor irrigation facility, lack of credit facility, pest attack and presence of middlemen in marketing practices hindrance the growth of watermelon cultivation in the valley. The study also focuses on the measures needed to be initiated to minimize the constraints to bring prospects in watermelon cultivation in the valley.

Morpho-biochemical characterization of some citrus germplasm of Assam

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There is a vast diversity of wild and semi-wild Citrus varieties in Assam that grow without commercial cultivation or extensive care. Ten genotypes representing each of the five groups of Citrus were collected from AAU-Citrus and Plantation Crops Research Station, Tinsukia and Regional Research Centre for Citrus (CCRI, ICAR), Biswanath Chariali. The fruits were characterized for five morphological traits namely fruit shape, shape of fruit base, shape of fruit apex and fruit weight, and the results indicate the presence of significant variability among genotypes. Biochemical characterization revealed that moisture content ranged from 92.51% to 84.30% in the pulps and from 83.32% to 70.20% in the peels. Juice pH, TSS and titratable acidity ranged from 3.90 to 2.60, 11.40 to 5.30°Brix, and 0.97% to 4.71% respectively in different genotypes.

Constraints faced by the members of farmer producer company in production and marketing of potato in Assam

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The study was conducted purposively in the selected Biswanath and Nagaon districts of Assam due to the presence of two Farmers Producer Companies (FPCs) that are associated with the production of commercial potatoes, namely Satbhani Potato Producer Company limited and Sankar Azan Agro Producer Company limited. A multistage random sampling technique was used for selection of the respondents. Six villages were selected randomly from each of the FPC, and all together twelve villages were selected from both the FPCs. From each of the chosen villages, the respondents were selected randomly using the equal allocation method to get a sample size of 300 farmer members. The major findings of the study revealed that Blight is the major problem, Lack of availability of good quality seeds, Unavailability of fertilizers in planting time, High cost of good quality inputs and labour shortage problem during the planting and harvesting time were the major constrains in production constraints. In case of marketing Lack of proper market place, Lower market price due to import from other states, Involvement of middleman in the marketing system, Low price given by the brokers and Inadequate storage facility were some of the major constraints faced by the members of the FPCs. The study also suggests adequate measures needed to minimize the constraints to bring prospects in potato cultivation to both the members of the FPCs.

Promising traditional pod vegetable cum medicinal plant of Mizoram *(Oroxylum indicum)*

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Oroxylum indicum is a medium-sized, soft-wooded tree attaining a height of 10–16 m. Stem bark is dull brown in colour; leaves are broad, 60–120 cm in length. Leaflets are ovate, wavy, and acuminate. Leaf fall occurs during winter season (January) each year. Inflorescence is generally situated at the apices of branches and its length is about 30 cm or more. Flowers are large, fleshy, violet coloured, and foul smelling with 2.5-cm-long pedicle. Fruit is a follicle, 30–90 cm long and 5–10 cm broad, strap/sword shaped, compressed, and two-valved. Seeds are flattened and winged. Pod are eaten as vegetable and their uses in indigenous medicine include the use of leaf after boiling as an astringent, liver tonic, anti-diarrheal and diuretic etc. The crop yet to be properly identified domesticated and used which is most essential to preserve them; popularization of this crop is required to generate awareness for its cultivation and conservation at farm and community level. The paradigm of being one of the preferred crops in the region due to its medicinal value.

Studies on diversity of insect pest of Ber and their natural enemies in karbi anglong district of Assam

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A field experiment was conducted to investigate arthropods diversity on Ziziphus mauritiana (Lamarck) in Karbi Anglong district of Assam. To study the insect pest of ber and their natural enemies, roving survey and fixed plot survey was conducted at Regional Agricultural Research Station, Diphu, and Karbi Anglong during season 2021 and 2022, respectively. Altogether 49 species of insect species were found to be associated of which 6 species were identified as pests, 12 as natural enemies and 21 species were observed to be casual visitors and 10 species as pollinators. Among the insect pests recorded, ber fruit borer, Meridarchis scyrodes, mealy bug, Maconelli coccushirsutus, fruit fly Dacus correctus were found to be major pests infesting ber. The relative abundance of pests was higher (49.50%) in 2021 compared to 28.36% during 2022. All the natural enemies recorded were predators. The relative abundance of predators was maximum during 2021 (36.20%) compared to 2022 (20.53%), respectively. During the study, 21 species of insects were observed as causal visitors and among the pollinators Apiscerana was observed to be the most dominant forager (38.53%) followed by Apisdorsata (36.74%), Tetragonula iridepennis (12.82%), Xylocopa fenestrata (8.50%), Coccinella septempunctata (8.52%), Vespa cincta (5.12%), Musca domestica (5.10%), Apis florea (4.06 %), Pieris rapae (3.05%). and Xylocopa leucothorax (3.01%), respectively.

Production and marketing of pineapple in ri-bhoi district of Meghalaya

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Horticulture makes a significant contribution to India's economy and agricultural sector. Pineapple is one such horticultural fruit that is widely cultivated in the country. India is one of the leading pineapple-producing countries in the world. The cultivation of pineapples takes place in various states across the country, with the North-Eastern states and Southern states being the major contributors. The study was undertaken to address more specifically the economic analysis of production and marketing of pineapple which was crucial for understanding the financial aspects of growing this fruit in Ri-Bhoi district of Meghalaya. The data pertains to the year 2022-23 and the information was collected with the help of a pretested schedule from a sample of 120 farmers through face to face interview. A multistage random

sampling procedure was followed for selection of the sample households, which were the primary source of data for the study. Cost concept, simple tabular and percentage analysis were used to obtain economics of pineapple production. Economic analysis through Cost concept revealed that pineapple production in the district was financially profitable with high Benefit-Cost ratio in each farm size. The B:C ratio was found to be the highest in the marginal farm (1.71) and the lowest in small farm (1.59). The major marketing channels identified for marketing of pineapple produce in the study area were Channel I (Producer- Consumer), Channel II (Producer-Retailer-Consumer), Channel III (Producer-Wholesaler- Retailer- Consumer) and Channel IV (Producer-FPO-Distant retailer-Consumer). Producer's share and marketing efficiency were found to be the highest in Channel I followed by Channel II due to the absence of middlemen. An average of 31.27%, 26.9%, 26.25% and 15.6% out of the total marketable surplus were marketed in local markets, distant markets, and markets within the state like Shillong market, Jowai market etc. and markets outside the state like Assam, Manipur, and Arunachal etc. respectively. The value added price received from one pineapple was Rs.37 which gave 61.7% more income than one single fruit. As pineapple has high commercial and industrial potential and potential to generate employment and income all throughout the year, the government should take up initiatives for setting up pineapple based industries and processing centres near the pineapple growing areas and proper training should be imparted to the pineapple growers in Ri-Bhoi district, Meghalaya to impart scientific and technical knowledge on pineapple cultivation.

Production and marketing of watermelon in Assam

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Horticulture plays an important part in India's diversified environment, contributing significantly to agricultural growth and economic development. Watermelon is one such horticulture fruit, and India ranks third in the world in terms of total annual production. The study dives into the cost of watermelon production and marketing, particularly in Assam, shedding light on the cost, returns, income, marketing pattern, and marketing efficiency of watermelon cultivation. The economic study included a total of 120 watermelon growers in Nagaon district of Assam. The cost of cultivation of watermelon production in the study area was calculated and it was observed that the results followed an increasing trend, which is, they increased with an increase in farm size. For small farms, the gross income per hectare was calculated to be Rs. 2, 32,063.59. The study's findings revealed that the gross income per hectare was lowest in marginal farms (Rs. 2, 09,464.76 per ha) and highest in medium farms (Rs. 2, 33,512.63 per ha). On average, the net income per hectare for the entire sample was calculated to be Rs. 85,222.04. However, the B:C ratio was

observed to be highest for small farms (1.68), followed by medium farms (1.64) and then marginal farms(1.56). This may be attributed due to better resource and labour management practices adopted by small watermelon farms. Furthermore, a total of four marketing channels were identified in the study area, together with the frequency and percentage of commodities transacted through each channel. Results showed that Channel III had the greatest percentage of commodity transactions followed by Channel II, Channel I, and Channel IV. Although, Channel I showed the highest marketing efficiency followed by Channel III, Channel IV, and Channel II, which had the lowest efficiency. But the quantity sold in terms of quintal was found to be highest in Channel II followed by Channel II, Channel I and finally Channel IV. This may be attributed due to ignorance on the part of the producer or to avoid uncertainties in watermelon marketing. Activities like Investing in research and development specific to watermelon cultivation in Assam, encouraging farmers to use high-quality inputs, facilitating awareness programs for farmers on accessing market information and identification of efficient marketing channels, fostering an environment that encourages farmers to form cooperatives or associations that may collaborate in marketing and production activities, facilitate access to loans and subsidies on inputs for watermelon farmers, implementing crop insurance schemes to mitigate risks associated with crop losses due to natural disasters or other unforeseen events, encouragement, and support initiatives that promote market linkage and value addition activities, among other things, may aid watermelon growers in Assam in lowering production costs and increasing revenues.

Effect of mulching on growth and yield of yellow zucchini in mid-hills of Arunachal Pradesh

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A study was carried out to evaluate the effect of mulching using different substrates viz. 30 Black mulch, Red Oak leaves, Pine Needle & Local Grass on the growth and yield of Yellow Zucchini inside polyhouse at Defence Research Laboratory R&D Centre, Salari, West Kameng, Arunachal Pradesh. Nursery was raised in the month of March and transplantation was done in April 2022 at a spacing of 60 x 60 cm following CRD. Growth and yield parameters viz. Av. plant height, Av. no. of leaves, Av. no. of flowers, Av. no. of mature fruits, Av. leaf size, Av. canopy size, Av. fruit weight, Av. fruit height & Av. fruit diameter were recorded at regular intervals of 30, 60 & 90 days after transplanting. The best growth and yield of Yellow Zucchini, among all treatments, was observed under 30 Black mulch followed by that under pine needle. Since, West Kameng region of Arunachal Pradesh is naturally endowed with abundant pine needle leaves, this locally available bio-resource can be utilized for mulching purpose in the cultivation of Yellow Zucchini.

Is dragon fruit a promising fruit in Assam: an economic feasibility analysis

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In recent times, some parts of Assam have emerged as excellent destinations for the cultivation of exotic fruits like dragon fruits. But, whether this fruit is economically feasible in Assam condition or not, it is important to be analyzed. With this view point, a study was conducted with objectives to examine the economic feasibility of dragon fruit production and identify the problems faced in production and marketing of dragon fruit by the farmers in Kamrup (rural), Udalguri and Dhubri districts of Assam. A total of 35 farmers were selected through stratified purposive snowball technique to collect the different primary data. To find out the economic feasibility of dragon fruit production, discounting measures of project appraisal viz., Net Present Value, Benefit Cost (B-C) ratio and Internal Rate of Return were used. It was observed that, at 6 per discount rate the benefit cost ratio and NPV were worked out to be 3.49 and Rs. 8581855 per ha respectively, and IRR was reported as 87.21 per cent for 15 years of project appraisal. The major problems identified were high establishment cost in the initial stage, high requirement of labour, General unawareness about dragon fruit and their nutritional importance by consumers and low purchasing power of the consumer. Dragon fruit production was found to be profitable to take as an agri business venture. Howe ever, proper training and awareness programmes are very much needed to popularize the fruits among the farmers as well as consumers.

Effect of different spacing and mulching on growth and yield of cherry tomato under polyhouse condition at mid-hill condition of Arunachal Pradesh

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An experimented entitled “Effect of different spacing and mulching on growth and yield parameters of Cherry Tomato (Solanum lycopersicum var. cerasiforme) cv. Roja (Syngenta) under Polyhouse condition” was conducted at Defence Research Laboratory R&D Centre, Salari, West Kameng, Arunachal Pradesh during the September - December in 2022. Total ten treatments viz. T1 (90 X 90 Control), T2 (45 X 45+ 30µ Black mulch), T3 (45 X 45+Red Oak Leaves), T4 (45 X 45+Pine Needles), T5 (60 X 60+ 30µ Black mulch), T6 (60 X 60+Red Oak Leaves), T7 (60 X 60+Pine Needles), T8 (75 X 75+ 30 µ Black mulch), T9 (75 X 75+Red Oak

Leaves), T10 (75 X 75+Pine Needles), were laid out in CRD. Growth and yield parameters were recorded during the cropping period. Treatment T2 was found to be most effective with respect to growth and yield parameters. Highest per hectare yield, gross return, net return and benefit cost ratio was recorded in Treatment T2. Thus, planting of seedlings of Cherry Tomato at a spacing of 45 cm X 45 cm under 30µ Black mulch was found to give higher crop production in mid-hill condition of West Kamneng in Arunachal Pradesh.

Diversification of horticultural sector of Assam: a zonal level analysis

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Assam, one of the north eastern states of India has a very congenial climate for horticultural crops that produces surplus fruits and vegetables. The state produces a vast range of horticultural crops. To study the diversification of horticultural sector of the state five major horticulture sectors such as fruits, vegetables, spices, plantations and tubers were considered. The diversification of the horticultural sector of Assam for the period of 10 years was calculated using various diversification Indices for six agro climatic zones of the state. We have found that the diversification from the year 2009-10 to the recent years 2019-20 which was more or less constant, according to the index value. Nearly 11 major crops which are cultivated in almost all the districts of Assam were considered for the study. Out of these six zones, Hills Zone was found to have comparatively more diversification (0.822) while North Bank Plain Zone recorded the lowest (0.701). In this Hills Zone, due to predominance of jhum cultivation, more crops were found to be grown by the farmers. A well knitted marketing facility should also be developed for better price realization that would enhance the farmers' income. Processing facility at the community level must be created so as to value add to the surplus fruits and vegetables.

Performance of biofertilizers and growth stimulator on germination parameters in endanger Citrus sp. *(Citrus macroptera)* under low-cost hydroponic conditions in Manipur

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An experiment on "Performance of Biofertilizers and Growth Stimulator on Germination Parameters in endanger Citrus sp. (Citrus macroptera) under low-cost Hydroponic Conditions in Manipur" was carried out at the Department of Horticulture, College of Agriculture, Central Agricultural University, Imphal, Manipur during 2022-23. It was laid out in Complete Randomized Design (CRD) comprising of nine treatments and three replications in which seeds were drained and treated with biofertilizers such as liquid Azotobacter (5ml/kg), liquid VAM (5ml/kg), liquid Trichoderma viride (5ml/kg), Powder form of Pseudomonas fluorescens (5g/kg) and growth stimulator Humic Acid 5ml/kg only and in combination with different biofertilizers before sowing under hydroponic condition. Observations revealed that after 4 months of sowing under hydroponic conditions the application of Humic Acid (T8) obtained lowest number of days for 50% germination of seed (59 days); number of days for complete germination of seed (109 days); maximum seed germination % (96.67%); GVI (0.266) and survival % of seed under hydroponic condition (93.33). However, the treatment T4- Trichoderma viride obtained the minimum fungal infection (5%) in the seed germination. Thus, investigation from the present experiment revealed that Humic acid (T8) performed better in seed germination parameters as compared to the other treatments, which can be recommended for low-cost hydroponic seed germination technique for this endanger semi-wild citrus species in the future.

Medicinal and aromatic plants of North-East India: diversity, scope and potential

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North East India, a region comprised of eight states, has emerged as a prominent biodiversity hotspot, with an extraordinary richness of medicinal and aromatic plants (MAPs). The entire North East has a vast reserve of medicinal plants, and a rich culture of folk medicines. Arunachal Pradesh is a home to 464 medicinal plants, while Assam and Tripura each have 169 and 135 species of medicinal plants, respectively. The Meitei community of Manipur uses 39 plants from 29 species and 23 families as therapeutic medicines. Assam accounts for around 88% of the entire area planted with aromatic plants, followed by Meghalaya (0.7%) and

Arunachal Pradesh (0.6%). Indigenous communities residing in North East India have cultivated an intimate understanding of these plants, possessing valuable traditional knowledge passed down through generations. Their profound insights into the medicinal properties of these plants have been crucial in the development of various traditional medicine systems, including Ayurveda, Unani, Naturopathy and Siddha. Three species of aromatic plants being commercially cultivated in the North Eastern region of India are Java Citronella, Lemon grass and Palmarosa. Some well-known medicinal plants of this region includes Brahmi (Bacopa monnieri), Matikanduri (Alternanthera sessilis), Neem (Azadirachta indica), Ram tulsi (Ocimum gratissimum) etc. These medicinal and aromatic plants are the excellent sources of novel bioactive compounds like terpenes, flavonoides, coumarins etc. and essential oils. Taking immediate actions through sustainable practices and conservation efforts is essential to safeguard these invaluable natural resources, ensuring this region's continuous contribution in global advancement of herbal medicines and nature based products.

Scope of underutilized vegetables in Northeast region

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Underutilized vegetables are indigenous vegetables as might be in danger of being replaced by a few cultivated species or genetic variability of which may be lost due neglect or nor. A wide range of plant species growing in Himalayan and sub Himalayan regions in India belonging to genus Solanaceae, Cucurbitace, Brassicaceae, besides various kinds of beans, tubers and roots crops, spices, cole crops as well as some species of leafy vegetables constitute a huge list of underutilized vegetables. Though Indian gene center is rich in biodiversity in vegetable and legume crops, indigenous vegetables are in danger of being replaced by a few cultivated species and are often described with terms such as neglected and underutilized species.In India, there are several lesser known leguminous vegetable crops which have tremendous potential. Beans need attention for improvement includes tree bean (Parkia roxburghaii), sword bean (Cannavalia gladiata) and faba bean (Vicia faba). Higher polymorphism has also been recorded in local landraces. Additionally, Vignaradiata var. sublobata is known for yellow mosaic virus resistance, whereas V. umbellata var. radiata is known for resistance to diseases and insect pests. Jack bean [Canavalia ensiformis (L.) DC.] is also cultivated on a limited scale whereas; winged bean (Psophocarpus tetragonolobus) is confined to the humid subtropical parts. Broad bean (Vicia faba), it is a coolseason crop in high altitude areas, grown on a limited extent in the north eastern region. Wide range of diversity in underutilized vegetable species of solanaceous

family is found in the north eastern region of the country where Solanumm acrocarpon L., S. xanthocarpum, Cyphomandra betacea, Lycopersicon pimpinellifolium, Capsicum frutenscensL., C. Chinenense, Parkiaroxburghii, are found. There are several underutilized cucurbitaceous vegetables, which are grown in various parts of India. These are mainly Cucumis hystrix, Cucumis trigonus, Luffa graveolens, Momordica macrophylla, Momordica subangulata, Trichosanthes cucumerina, Trichosanthes khasiana, Trichosanthes ovata and Trichosanthes truncasa. Wide varieties of indigenous leafy vegetables are also available. These are amaranth (Amaranthus spp.), puroi sag (Basellarubra and B. Alba), sorrel (Rumex rasicarius), etc. Other indigenous leafy vegetables used occasionally are jilmilsag (Chenopodium album) and Kalmou sag (Ipomea reptans). Amaranthus viridis, A. lividus, A.retroflexus and A. spinosusare important leafy types grown in north east India.

Horticulture diversity and their value addition in North-East India

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North East India comprises of eight states viz., Arunachal Pradesh, Assam, Meghalaya, Manipur, Tripura, Mizoram, Nagaland and Sikkim. Northeast India is known for the variety of its topography, soil, and climate. The variety of fruits, vegetables, medicinal & fragrant plants is abundant in this region. Northeast India has the greatest variety of citrus, banana, and jack fruit among the country's commercial fruits. Eastern India and some locations in the area also grow sweet oranges (Citrus sinensis) for commercial purposes. Citrus medica, Citrus assamensis, Citrus macroptera, and Citrus hystrix were reported to occur in the subtropical forests of North-East India and the foothills of the East Himalayas in addition to the most widely cultivated species, Citrus indica Tanaka (Indian wild orange). Other Various genotypes of cucurbits, solanaceous vegetables, ginger, turmeric, bamboo, leafy vegetables, etc. are also abundant in northeast India. The majority of these crops are abundant in vitamins, minerals, and other bioactive compounds useful in the food, medical, and aromatic sectors. These are already standardized preparation methods for products such fast ginger candy, minimally processed ready-to-cook jack fruit, jam, jelly, fermented and non-fermented beverages made from various indigenous fruits, and tuity fruity made from chow-chow. If these value-added goods are created for sale, it will significantly increase the area planted with these crops, boosting farm income and the farmers' nutritional security.

Morpho-metabolic diversity of different local, commercial and traditional banana varieties from North Eastern Region of India

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Banana (Musa L.) is among the most important food crops of the world, cultivated in more than 130 countries in the tropics and subtropics. Limited information's on biomarkers and signature volatiles is available for selecting commercial cultivars. Clonal fidelity is a major contributor to banana yield and aroma; however, there are no useful biomarkers available to validate clonal fidelity. In the present investigation seventeen local and traditional banana genotypes were taken for morpho-metabolic diversity study. Among the varieties plant height was ranged from 406.67 cm (Bhimkul) to 108.33 cm (Kanaibasi), whereas bunch weight ranged from 27.27 kg (KK-2) to Kanai Basi (5.38 kg). Further, principal component analysis revealed that PC1 contributes 59.5% of the total variation and PC2 contributes 18.1% variation. Together PC1 and PC2 contribute 77.6% of total morphological variation. Further, the same plants leaf samples were subjected for LCMS study. A total of one eighty three metabolites covering different biochemical groups viz. alkanes, ketones, aldehydes, esters, flavanone, etc. were identified across the genotypes. Principal component analysis showed the first eight principal components (PCs) contributing 75.366% of total metabolic variation among the genotypes. Characterization of the metabolites by LC-MS revealed complex chemical composition with variety specific metabolites expression, which will be useful for the protection of region specific banana genotypes and the development of climate resilient banana cultivars for future.

Constraints in commercial vegetable production: experiences of small and marginal vegetable growers of Assam

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After China, India is the second-largest vegetable producer in the world. Vegetables are the protective food because of the nutrients, nutraceuticals, and antioxidants they contain. They are the main engine of sustainable agriculture and are most commercialized sector in

agriculture. However, there is still a sizable discrepancy between productivity potential and current output as because vegetable growers are discouraged by a number of obstacles and constraints. Therefore, the current study was conducted in Golaghat and Udalguri districts of Assam during 2021–2022 in order to figure out the numerous challenges experienced by the small and marginal vegetable growers. The study completely depends on primary data, which was gathered through personal interview method with the help of structured schedule on a sample of twenty numbers of growers from each six vegetable growing villages of two districts which makes a total of two hundred and forty numbers of respondents. Appropriate statistical procedure was employed to analyze the data i.e. Garrett ranking technique. Investigations were made relating to constraints associated with technical, labour, economic, marketing and environmental constraints and the study revealed that the lack of suitable varieties in every season was the major technical constraint with garrett score of 78.95 followed by unavailability of inputs at right time (69.05), non-availability of labour during harvesting period (59.07) followed by lack of skilled labour (50.41) as labour constraint, High cost of quality seeds (65.89) followed by high cost of plant protection chemicals (61.25) as economic constraint, Perishable nature of product (68.15) followed by market price fluctuation (66.50) as marketing constraint and lastly insects and pests attack (63.22) followed by heavy incidence of diseases (55.82) as environmental constraint are being claimed by the small and marginal vegetable growers.

Influence of time and methods of budding in 'Khasi mandarin' *(Citrus reticulata Blanco.)* on different rootstocks in the foothills of Arunachal Pradesh

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Khasi Mandarin (Citrus reticulata Blanco.) is an excellent quality Mandarin grown in North-East India. However, its productivity is quite low as they are mainly of seedling origin. With this background, the present investigation was under taken at College of Horticulture and Forestry, Pasighat, Arunachal Pradesh during the year 2021-22 with 30 treatments executed in Three Factor CRD (Completely Randomized Design) replicated thrice. Different rootstocks viz., Rough Lemon, Rangpur Lime, Khasi Mandarin, Volkamer Lemon and Pummelo and different methods of budding ('T' budding and Modified Chip budding) were used for budding in Khasi Mandarin in February, March and April. Maximum bud take (93.33 %) was observed in Modified Chip budding performed on Rough Lemon and Rangpur Lime during February. Budding success (93.33 %), length (11.30 cm), girth (2.14 mm) and dry weight of sprout (2.95 g), number of

leaves (7.97), Chlorophyll 'a', 'b' and total (0.34, 0.50 and 0.86 mg/g, respectively) were recorded maximum when Modified Chip budding was done on Rough Lemon in February. Fresh weight (5.22 g) was higher in Rough Lemon budded with both 'T' budding and Modified Chip budding during February. Minimum days required to sprout (32.00) and maximum root diameter (8.23 mm) were observed in Khasi Mandarin with Modified Chip budding done in February. Leaf perimeter (18.7 cm), Root length (32.37 cm), fresh weight (22.13 g) and dry weight (16.22 g) were maximum in Volkamer Lemon with 'T' budding done during February. Thus, Modified Chip budding is the best method of budding to perform during February in Khasi Mandarin using Rough Lemon as rootstock with respect to bud take, budding success and growth of sprout.

Impact of foliar application of micronutrients on fruit quality and leaf macro-nutrient status of lemon *[Citrus lemon (l.) Burm.]* cv. Assam lemon

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Assam lemon [Citrus lemon (L.) Burm.] is an important lemon cultivar of Assam. Its large scale cultivation is done in warm southern slopes of the Himalayas in North-Eastern India. As this cultivar of lemon is having an important character of bearing fruits in many flushes throughout the year, it is important to supply adequate amount of nutrition for getting good quality fruits. In the experiment, a randomized block design having twelve treatments with three replications was followed to find out the impact of foliar application of micronutrients on fruit quality and leaf macro-nutrient status during the year 2019. Among all, the treatment T12- $ZnSO_4$ (0.2%) + $FeSO_4$ (0.2%) + Borax (0.2%) + $CuSO_4$ (0.2%) gave the best performance in improving the fruits quality and leaf macro-nutrients content. The highest total nitrogen content, total phosphorus content, fruit fresh weight, fruit length, fruit diameter, juice content, TSS, ascorbic acid, total sugar, reducing sugar, non-reducing sugar with lowest titratable acidity were obtained in T12 which revealed that the fruit quality and leaf macro-nutrients status of lemon depends on the application of different micronutrients.

Traditional home gardens: a source of income generation and livelihood security in North- east India

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Home gardens are well-established land use systems, defined as “small-scale, supplementary food production systems that resemble the natural, multifaceted ecosystem”. These are identified as important social and economic units of rural households in which a range of crops, trees, shrubs, herbs and livestock are managed to provide food, shade, fuel, cash, medicines, construction materials and sociocultural functions. The practice of traditional home garden is an integral component in every society of North-east India as it supplies most household requirements. However, there is a complete lack of in-depth knowledge on species composition, species richness and contribution of species to livelihood security. Most of the villagers (80%) normally pursue multiple livelihood options like jhum cultivation, agro forestry, horticulture and home gardening. Larger the garden, higher will be the number of species and it decreased with the decrease in size of it. This pattern of increasing tree species richness with increasing land holding helps in generating more income for enhancing the livelihood of the people of North-east India. In overall scenario, vegetables (32%) are the major constituents in home gardens followed by fruits (15%), medicinal plants (13%), multipurpose tree species (13%) and species of miscellaneous use (11%), timber (10%) and spice (6%).

Unraveling the economic viability of Assam lemon cultivation in Nalbari district, Assam, India: a case study

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Assam lemon, also known as Kazi Nemu, thrives in its native land of Assam, India, where it is traditionally cultivated and widely cherished. Assam lemon, scientifically known as Citrus lemon and belonging to the Rutaceae family, is an indigenous dwarf cultivar native to the state of Assam. It is particularly well-suited for high density planting. The agro-climatic conditions in Nalbari district of Assam offer an ideal environment for the profitable cultivation of Assam lemon on a commercial scale. Assam lemon cultivation proves to be a straightforward and cost-effective venture, further boosted by its substantial market demand, which serves as a strong incentive for farmers to engage in commercial cultivation. The study involved 100 respondents,

consisting of 40 marginal, 30 small, 20 semi-medium, and 10 medium farmers. The overall farms' establishment cost per hectare amortized over 15 years at a 6 percent yearly rate, average maintenance cost per year, total cost per year, average gross return per year, and net return per year were estimated to be Rs. 4,502.96, Rs. 60,075.27, Rs. 64,578.23, Rs. 2,27,762, and Rs. 1,63,183.77, respectively. The investment appraisal tools, including benefit-cost ratio at a 6 percent discount rate, NPV at 6 percent discount rate, and IRR, were calculated to be 3.8, Rs. 12,01,425, and 66.95 percent, respectively. and showed an increasing trend with the expansion of farm size. Consequently, the economic feasibility test confirmed that Assam lemon cultivation is economically profitable and viable.

Nutrition garden: a sustainable nutria-sensitive horticulture - based model for improved nutrition security of the rural mass of Assam, India

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Food security continues to be a matter of serious concern for all the states of India. Fruits and vegetables grown in nutrition gardens play an important role in filling the gap in nutritional needs by providing access to food that is harvested, prepared and consumed by family members. The KVKs under Assam Agricultural university had conducted 177 numbers of demonstration on nutrition garden at 23 districts of Assam to enhance the food security of farm families following the layout of nutrition garden developed by AAU (2020). Survey was conducted before and after one year of establishment of nutritional garden to analyze the impact of nutrition gardens on

nutritional status of selected families. It has been revealed from the study that average per capita availability of vegetables increased from 89.62 g/day to 243.09g/day after successful intervention of nutrition garden. Crops like cabbage, cauliflower, knolkhol, brinjal, spinach and french bean were produced more than expected yield. Per capita availability of nutrients per day was also recorded to be increased significantly after intervention. It was observed that due to the intervention availability of protein, iron calcium, beta-carotene, vitamin C and folic acid had been enhanced to 26.74%, 44.15%, 32.48%, 341.41%, 132.66% and 56.267%of RDA, respectively. The study also indicated that the availability of vegetables due to intervention had become 81.03% of recommendation level of Indian Council of Medical Research, New Delhi.

Biochemical composition of some important minor fruits of Assam

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Minor fruits also known as lesser- known fruit plants confined in wild or semi wild domesticated conditions in Assam state are known for their nutritional and medicinal value since time immemorial. An investigation was conducted to study the biochemical composition of some minor fruits of Assam viz., Averrhoa carambolaL.(Rohdoi); Chrysophyllum roxburghii(Bl.) D.C.(Bonpitha); Elaeocarpus floribundus Bl. (Jalphai); Phyllanthus acidus (L.) Skeels(Poramlokhi); Spondias mangiferaWild.(Amora); Terminalia chebulaRetz.(Silikha) belonging to six different families. The biochemical compositions of fruits were studied in five numbers of healthy, uniform aged and size of bearing trees for each species from five different districts and data were recorded in four replications in the laboratory. With respect to edible portion, C. roxburghii recorded the highest amount (82.65 per cent) and S. mangifera realized lowest value (63.18 per cent). The moisture content was found to be highest (90.48 per cent) in A. carambola and lowest (64.68 per cent) in T. chebula. The carbohydrate content was found to be highest (93.69 per cent) and lowest (82.80 per cent) in P. acidus and
C. roxburghii, respectively while, energy content was found to be highest in C. roxburghii (406.25 Kcal/100g) and lowest (375.74 Kcal/100g) in T. chebula. A wide range of variation was

observed for TSS-acidity ratio and sugar-acidity ratio and the highest values were shown by A. carambola and the least values by T. chebula for both the characters. The pectin content ranged between 0.58 per cent to 2.64 per cent in P.acidus and C. Roxburghii respectively.

Ethnobotanical studies and qualitative analysis of Artemisia vulgaris l. (Titeypati) collected from different parts of Sikkim Himalayan region

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Artemisia vulgaris L. (Titeypati) is a shrubby aromatic plant found in the hills of India and has unique medicinal value. The plant is known to have medicinal properties and has been described in the Ayurvedic system of medicine. The present investigation is part of understanding the ethnobotanical knowledge about the plant in Sikkim Himalayan region and its qualitative analysis. Present study documented the use of Artemisia vulgaris in management of human and animal ailments, employing structured and semi-structured questionnaires involving different ethnic communities and traditional healers. The leaf extract of the plant was subjected to GC-MS analysis. Some important constituents were detected. One of the major compound was Z, Z-6,28-heptatriactontadiene-2-one which is known to be a vasodilator; another compound was Neophytadiene which is used for cardiological illness; and detected Germacrene-D is known for antimicrobial and anti- insecticidal property. The reported secondary metabolites support the ethnobotanical knowledge of the local population and traditional healers. The study opens a wide field for crop improvement and provides a roadmap for improving crop quality for future use.

Integrated effect of different nutrient sources on Tomato *(Solanum lycopersicum L.)* in new alluvial plains of West Bengal

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Tomato is universally treated as "Protective Food" and is one of the most widely grown vegetable in India and become popular with in the last six decades. Tomato is high value input responsive crop and demands adequate nitrogen throughout growth period. However, in modern agriculture unwanted use of synthetic fertilizers reduce soil fertility, kill the beneficial micro-organisms, and more over these chemicals interfere in our ecosystem. So, for having a sustainable production system the present experiment was carried out in C Block Farm, BCKV, Kalyani, Nadia during the year of 2021-22 to study the effect of organic and inorganic inputs on growth, yield and quality parameters of tomato and to understand the economics of cultivation. The experiment was laid out in Randomized Block Design consisting of eight treatments like- T1 (control), T2 (100% RDF), T3 [100%RDF+ 15 t FYM], T4 [75%RDF+ 7.5 t/ha FYM+ Biofertilizer (PSB+ Azotobacter)], T5 [75%RDF+ 4 t/ha vermicompost+ Biofertilizers (PSB+ Azotobacter),T6 [75%RDF+2 t/ha vermicompost+ Biofertilzers (PSB+ Azotobacter)],T7 [75%RDF+ 0.5 t/ha Neemcake +Biofertilizers (PSB+ Azotobacter)], T8 [75% RDF+2 t/ha Mustard cake + Biofertilizers (PSB+ Azotobacter)]. Trial data showed that significantly maximum values for the vegetative parameters like plant height (84.23cm), maximum leaves number per plant (65.07), maximum number of branches per plant (9.1) and minimum days to 50% flowering (45.33) were recorded in the treatment T6. i.e. in combined application of 75%RDF + 2t/ha vermicompost+ Biofertilzers (PSB+ Azotobacter).The treatment T6 also recorded maximum values for number of fruits per plant (45.89), maximum fruit weight (35.62g), maximum yield per plot (40kg) and maximum yield per hectare (70.08t).Regarding quality parameters maximum values for TSS (4.80Brix), ascorbic acid (24.05mg/100g) and lycopene content (4.69 mg/100g) were noticed in T5 and minimum values of TSS (3.070Brix), ascorbic acid (17.76mg/100g) and lycopene content(2.45mg/100g) were obtained from T1 i.e. in control plots. Highest benefit: Cost ratio (2.8) was recorded in T6. So, from the above findings it may be concluded that soil application of 75%RDF+2t/ha vermicompost+ Biofertilizer may be a viable option for sustainable production of tomato in new alluvial plains of West Bengal.

Study of morphological and biochemical aspects of local species of eggplant found in Northeast India: sustenance and preservation of biological variation

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The genus Solanum is one of the largest genera of flowering plants belonging to the family Solanaceae, having a wide diverse group of species distributed worldwide. All the cultivated or the wild eggplant species are the members of the diversified Solanum genera. The genetic diversity present within a crop wild relative is primary source for improving productivity and quality of agricultural products. States of north-eastern India is blessed with a wide range of physiographic and eco climatic conditions and is considered to house more than seventeen crop species that represent 47% of the crop species diversity available in the country. Additionally, a significant species richness of eggplants has also been reported. Various cultivated, semi cultivated, or wild species viz. Solanum torvum, Solanum xanthocarpum, Solanum indicum, Solanum macrocarpon, Solanum aethiopicum and Solanum nigrum are reported to be found in the region and most of them are highly prized vegetables among various local tribes. The wild relatives of eggplant generally have a spiky plant structure and produce small, bitter, multi-seeded fruits that are nearly inedible on daily basis. Such fruits are rich source of chlorogenic acid, glyco-alkaloids (solanine, solamargine, and solasodine) and other bioactive substances that may be of interest to humans. Recently, bioactive components have attracted great attention due to their role in prevention of several chronic diseases. Wild relatives of cultivated species have often been found as a potential source of harbouring good sources of desirable traits such as abiotic and biotic disease resistance and exhibit a wider genetic diversity. Hence, proper morphological and biochemical characterisation of these highly underutilized or under represented crop will have a significant implication for the conservation and management of genetic resources. In the present study morphological characterisation and biochemical profilingof selected seven eggplant species (S. indicum, S. nigrum, S. torvum, S. aethiopicum, S. macrocarpon, S. xanthocarpon and S. melongena) have been carried out to demonstratethe population structure and genetic richness found in North east India along with their health benefits. The collected species were morphologically characterised using standard descriptors derived from IBPGR, 1990 (International Board for Plant Genetic and Resources). Based on the analyses considerable species-specific differences in most of the morphological, biochemical (ash content, proteins, total sugars) and bioactive (total phenol content, total flavonoids) characteristics were observed. Among all the species Solanum nigrum constituted highest total phenol content (800.07±0.06 mg gallic acid equivalents per 100 g) and total flavonoids

(4100.49±1.13 mg quercetin equivalents per 100 g). The present study highlights the potential attributes of the wild Solanum species to be used as potent nutraceuticals due to the presence of high secondary metabolites. Such source of bioactive compounds through proper profiling could validate the use of these species in drug formulations having several pharmaceutical properties. Besides this the significant differences observed in morphological characters could also paves the way for the genetic utilization of such underutilized species in breeding programmes. Additionally, it will also play a major role in sustainability of the ecosystem and would also open plethora of opportunities for genetic improvement of commercial eggplant varieties and increasing diversity of food security resilience.

Assessment of yield criteria in Cymbidium species found in Sikkim Himalaya through correlation and path analysis

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Cymbidium, an interior ornamental orchid species, garners substantial attention from growers, buyers, and conservationists worldwide due to its high demand. In light of this, a comprehensive investigation was conducted at the National Research Centre for Orchids to explore the morphological diversity exhibited by ten distinct Cymbidium species found in the Sikkim Himalaya region. A comprehensive examination was performed on ten plants per species, carefully chosen for specific quantitative traits, to assess uniformity and investigate path analysis and phenotypic correlations among different Cymbidium species in the Sikkim Himalaya region. Notably, the conversion of the acquired data into binary format revealed a profoundly significant distinction among all the traits scrutinized in this study viz., the assessment of the relationship between yield attributing traits showed that rachis length exhibited a significant positive association with other growth parameters related to yield, such as flower length and flower width. Moreover, through path analysis, it was discovered that both rachis length and peduncle length had a direct positive effect on the yield, specifically the number of flowers. Hence, preliminary selection of these characters could bring improvement in the yield and yield components in future breeding programs.

Introduction of suitable aromatic crops for enhancement of income of the farmers in North East region of India

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North East Region of India comprises eight states viz. Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and Sikkim. These states blessed with temperate, humid sub-tropical climate with moderate, hot, humid summer, severe monsoon, and severe winter. The average temperature between 01- 35 oC and rainfall 1500-3000 mm per year. Tea, Rice, maize, potato, ginger, and mustard are major commonly grown crops in these regions. Mostly small land is available for settled agriculture; jhum cultivation is still practiced in few areas. Due to some factors such as difficult terrains, dense forest, poor transport, inadequate marketing facilities, un-irrigated land, and land tenure systems agriculture is being difficult. As of now, annual income of the farmers was very meager from traditional crops. Hence, introduction of aromatic crops may be proving to enhancement of income as they can be survived easily in above geographically and climatic conditions. Therefore, to enhance the income and productivity per acre, aromatic crops like lemongrass, palmarosa, vetiver, basil, geranium, rosemary, etc. were introduced. After the adoption of these aromatic crops, the farmers realized Rs. 50-55 thousand per acre per annum which was doubled the income as compared to traditional crops. Now, more than 1000 acres of aromatic crops are cultivating in this region in which more than 40,000 kg of essential oils produce and with more than 20000 man-days were generated annually. Hence, the aromatic crops proved beneficial for the farmers of the north east region. This paper discussed about the adoption rate and economics of the aromatic crops in North East Region.

Performance evaluation of Tomato (Solanum lycopersicum) varieties Arka Abhed and Arka Rakshak in Morigaon district of Assam

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An experimental study was carried out to evaluate the performance of tomato varieties namely Arka Abhed and Arka Rakshak as compared to the check variety Rocky in seven different locations in Morigaon district of Assam during the year 2021-22 and 2022-23. During the study, the varieties were evaluated for different growth and yield characters along with the consumer preference based on organoleptic value, shelf life and economics of cultivation. Among the three varieties, Arka Abhed was found to be significantly superior considering majority of the studied characters like number of fruits per plant (27.86), fruit weight (70.73g) and fresh fruit yield per plant (1970.48g). The results also revealed that the variety Arka Abhed was the most preferred variety with a significantly higher organoleptic score of 8.56 in 10 scale as compared to Arka Rakshak and Rocky. The highest yield of 71.21t/ha was observed in case of Arka Abhed followed by Arka Rakshak (68.37t/ha) and Rocky (52.68t/ha). Moreover, Arka Abhed recorded higher shelf life in comparison to Arka Rakshak and Rocky. With these results, this can be inferred that tomato variety Arka Abhed performed better in case of yield, organoleptic score and shelf life, hence may be recommended for commercial cultivation in Morigaon district of Assam.

Exploring the viability of horticultural crops (Pineapple) as an alternative to shifting cultivation in the hills of Meghalaya

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In the North East, shifting cultivation, better known as Jhuming is the primitive “Slash and Burn” system of cultivation and the primary means of livelihood for the people living in the hills. As a result of excessive stress, the soils fail to recuperate fertility for which the farmers get very poor returns from the area allocated to different crops under shifting cultivation. Horticulture sector has an enormous scope in Meghalaya to fit in to the hill agriculture and can increase the employment and income of the hill people on one hand and can also contribute towards protection of soil from run-off, conservation of natural environment and ecological

balance of the region. The objectives of the present paper are- 1. To study the trend of area, production and productivity of pineapple cultivation in Meghalaya. 2. To assess the status of employment and income geneation from raising horticultural crops as against shifting cultivation. 3. To study the problems of commercial cultivation of horticultural crops in the hills and suggest policy implications. The findings revealed that income and employment generation is more in horticultural crops than shifting cultivation in Meghalaya. As such, in the interest of the ecology and economy of the state, it is imperative to encourage raising horticultural crops in general and pineapple in particular as an alternative to shifting cultivation, adequately linked by policy support in terms of creation of processing facilities, other infrastructure and marketing networks.

A case study on the affect of Arka microbial consortium in vegetables at Tinsukia district, Assam

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Recently organic farming has become popular among the farming community as an eco friendly farming practice which enhance the crop yield and sustain the soil health for a longer period. Organic farming is a broad term which includes various forms of bio input sources. Most of the technologies are easier to adopt. Among these sources, uses of biofertilizer are an important one. Keeping this in view, Krishi Vigyan Kendra, Tinsukia introduced a few biofertilizer application technologies among the farming community of Tinsukia District. In the year 2019-20 application of Arka Microbial Consortium (AMC) in vegetable was introduced as On Farm Trial (OFT), which was continued for three years among fifteen farmers at different locations of the district. The results of the trials showed positive impact on both the crop yield and soil fertility. The trials were conducted on two vegetables i.e. tomato and cabbage. It was observed that the per cent increase over yield in tomato was more than 70 per cent with a B: C ratio of 6.50. In case of tomato, under treatment trials' average numbers of cluster and fruits per plant were observed 18 and 55 respectively and in control it was found 10 and 40 respectively. In treatment, the average weight range of a single tomato fruit was observed in range of 65 gm to 200 gm wherein control the weight ranges from 38 gm to 170gm. In cabbage the per cent increase over yield was observed to be more than 10 percent with a B: C ratio of 3.07. In treatment the average weight of a single cabbage was observed 1.48 kg and in control plot it was 0.93 kg. It has been observed that the soils of the AMC treated plots have increases in its organic carbon, NPK, Zn and B values as compared to the control plot.

A comparative study of high yielding French bean varieties ArkaSukomal, ArkaArjun and ArkaKomalin Chirang district of Assam

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A comparative study was carried out in different locations of Chirang district during the period from 2021-22 to 2022-23 to assess the performance of high yielding French bean varieties Arka Sukomal, Arka Arjun and Arka Komal in Chirang district of Assam. From the study over two years it has been revealed that among the three varieties, Arka Sukomal recorded the highest yield (16.6t/ha) with more pod yield per plant (596.3 g) followed by Arka Arjun (14.9 t/ha) and Arka Komal (14.1 t/ha). Further the study revealed that being pole type variety Arka Sukomal has highest plant height (160.6 cm), highest number of fruits per plant (52) and highest pod length (19.2 cm). The maximum average net return per hectare was found to be Rs.1, 73,000.00 from the variety Arka Sukomal with a benefit cost ratio of 3.8. However, other two varieties showed relatively lower value for these studied characters. In addition, organoleptic scores in terms of taste revealed that, consumers preferred Arka Sukomal (7.5) followed by Arka Arjun (7.1). Hence, considering all the factors, it can be concluded that this new variety Arka Sukomal may be adopted for commercial cultivation as it has much potential in market for its higher yield as well as more net return along with consumers' preference.

Assessment on vegetative growth, flower and fruit characteristics of two dragon fruit species in Dibrugarh, Assam, India

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A field demonstration programme was carried out under Krishi Vigyan Kendra (Assam Agricultural University), Dibrugarh to evaluate the performance on growth and yield attributing parameters of two dragon fruit species during 2021 to 2023. The vegetative growth characters like stem diameter (5.20 cm) and stem segment length (98.75cm) were observed more in H. undatusas compared to H. polyrhizus that showed 4.67 cm and 85.50 cm stem diameter and Stem length, respectively. The results also revealed that days taken from flower bud initiation to anthesis were less in case of H. polyrhizus (24.28days) as compared to H. undatus (29.0 days). More number of flowers per plant per flush (8.20 Nos) was observed in H. polyrhizus while the H. undatus produced only 6.30 numbers of flowers per plant in a single flush. Numerous anthers were observed below the stigma with attractive white petals in both

tested species. The fruit parameters like less number of days from anthesis to harvest (31.33), more number of fruit per plant per flush (6.30nos) and lower fruit length (8.85 cm) was observed in H. polyrhizus whereas H. undatus showed more number of days from anthesis to harvest (33.21), less fruit per plant per flush (5.40nos) and longer fruit length (9.30 cm). The average fruit weights 259 gm was observed in H. polyrhizus that significantly differs from the H. undatus (182 gm). Fruit pulp colour was white in H. undatus while red in H. polyrhizus. The edible portions were 79.45% and 85.20% with 12.5% and 11.20 % TSS in H. polyrhizus and H. undatus, respectively.

Strategic Conservation of Medicinal Herbs of North East India

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Wild medicinal plants are assets of conventional medicines and a large number of the advanced drugs are created by implication from plants. For ages medicinal plants are in use for human health management and still today through various scientific assessments. The rich biodiversity of North East India is one of the recognized biodiversity hotspots of the world. The medicinal plants in this region are rich in natural products/ phyto-chemicals and have been used extensively by pharmaceutical industries. The rich biodiversity has placed a spotlight on the region and introduced the world to its affluent traditional knowledge and rare endemic plants. Out of 800 different species of wild edible plants reported in India, around 300 species are utilized by the tribal population of the North Eastern region for food and medicinal purposes, viz., Durun bon, Manimuni, Hour tengesi etc. As many wild edible plants have more nutritional properties than common vegetables; so they are nutrient dense and can be used as an alternative source of nutrients help to achieve nutritional security upto a large extent. Recently, the demand for healthy food and increasing health consciousness among the masses has created renewed global interest in utilizing wild food plants. Strategic conservation of potential diversity for medicinal herbs can be achieved by employing scientific approach by utilizing diversity conservation toolkit e.g. historic graph of the community, map demonstrating access to natural resources etc. and identification of endangered species can be achieved with tools e.g. Simple ranking, matrix ranking, pair-wise ranking and social seed network analysis.

Doubling farmers income through adoption of high yielding potato variety Kufrijyoti and Kufripukhraj in Sivasagar district of Assam, India

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Potato variety KufriJyoti and Kufri Pukhraj were introduced among the farming community of Sivasagar district through farmers participatory mode for enhancing and doubling farmer's income under FLD programme. A total of fifteen demonstration were conducted during 2019-20 in Phulpaniciga, Sundarpukhuri Hulal gaon, Gaurisagar, Nitai pukhuri, and Namti areas of Sivasagar district for disseminating the scientific production technologies of high yielding potato variety Kufri Jyoti (250-300 q/ha) having moderate resistant to early and late blight and Kufri Pukhraj (350-400q/ha), having resistant to early blight and moderate resistant to late blight. Training programmes, regular surveys, monitoring of pest and diseases, diagnostic visits, advisory services etc. ensured scientific management practices viz., application of balance and optimum doses of fertilizers, timely distribution of input for pest and disease management ensured higher yield in Potato variety Kufri Jyoti compared to Potato variety Kufri Pukhraj. Kufrijyoti recorded an average tuber yield of 200 q/ha with an average gross profit of Rs. 4,00,000.00/ha, net profit of Rs. 2,90,000.00/ha and B:C ratio of 3:64 whereas Kufri Pukhraj recorded an average tuber yield of 187 q/ha with an average gross profit of Rs. 3,74,000.00/ha, net profit of Rs. 2,54,000.00/ha and B:C ratio of 3:10. With demonstration of scientific technology through farmer's participatory mode, it could be shown that yield potential and net income from high yielding Potato cultivation could be enhanced to a great extent resulting in doubling of farm income in potato cultivated areas of Sivasagar district.

Peculiarity and marketing potential of indigenous local variety of brinjal "longai" in Karimganj district of Assam

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Barak valley region of Karimganj district bestowed with different indigenous fruits, vegetables and flowers. The agricultural economy of the district depends on agrarian society of rural farmers of the district. Among different agriculture commodities, fruits and vegetable has highest number of different indigenous cultivars found in the district. Brinjal is one of the major

preferred cash crops cultivated during Rabi season (September/October) preferred by rural farmers of the farming community. There are some local cultivars of Brinjal grown in this region however farmers are mostly preferred to grow local brinjal variety "Longai". The name of the variety arises from the Longai River which flows through Karimganj district of the Barak valley region. Being indigenous to this locality, this crop has very high demand in local market. It was estimated and observed that this particular variety of brinjal fetches very high income as compared to other brinjal varieties. The wholesale market during peak season estimated around Rs.40-50 per kg while in retail it was found Rs.70-80 per kg. Peculiarity of this variety revealed that growing season of this brinjal variety starts from September/October while it was ready to harvest during January/February, within 3 months the fruit attains average weight of 300-350 gram. In some cases, weight of the fruit exceeds 500 grams. It also observed that the plant height ranges from 2.5-3 feet. Moreover, it was also observed that single plant produced 10-12 kg fruit per plant and in a bigha approximately 20-25 quintal of brinjal can be harvested. The fruit of this particular variety exhibited oblong shaped with light purple colour having whitish colour on lower portion of the fruit. The inner portion of the fruit was very fluffy with less quantity of seeds mostly preferred as fried. However, to attain more findings on this subject extensive research work should be carried out both in field and lab condition.

Preference and acceptability of local rajmah cultivars in Barak Valley district of Assam

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India is a home of many diverse flora and fauna; it is a land of rich biotic flora constituted many agricultural crops which are very native and not identified yet. Some of the crop cultivars are yet to register as variety of particular crops. Northeastern region considered as one of the biologically diversified hot spot region, belongs to Indo-Burma biodiversity hot spot. Among the Northeastern states, Barak Valley Zones which covers three districts viz., Cachar, Karimganj and Hailakandi, constitutes about 8.82 per cent (6922 sq.km) of total geographical area of the state (78,438 sq.km.). Out of the total geographical area, the net sown area covers 34.01 per cent. The agricultural activities are primarily rice based, which constitutes about 79.03 percent of the total cropped area. Cultivation of Sali paddy is dominant and frequent agricultural practiced in every location of this zone. Almost 80 per cent of the total cropped area is covered by Paddy cultivation during Kharif season. Soon after harvesting of paddy, farmers are going for Rajmah cultivations, local people they are termed this crop as "Phoras". Among all Rabi pulses

farmers of this region preferred this crop because of their quick growing habits, low maintenance and suitability of this crop under soil edaphic and climatic conditions of these regions. Farmers preferred this crop as vegetables during vegetative stage and also consumed as dal when matured. This part of North Eastern Zone bestowed with some different land races of Rajmah beans which are more preferable as compared to other certified varieties viz., HUR-201, HUR-302, Arka Komal, Varun and Arun. The beans of Local races of Rajmah are somewhat bigger in size; colour varies from black, brown to variegated colour. Plants are bushy type, sturdy with bigger pods than other certified varieties. Based on the organoleptic study of farmers of this region it was also revealed that these local land races of Rajmah are tastier, less time required to prepare as dal as compared to designated varieties of Rajmah. However, it is mandatory to mention that extensive research should be carried out both in field and lab condition of these local land races of Rajmah crop to reveal its peculiarity and also to register as certified varieties from this part of Assam.

Potentiality of mandarin production and marketing in Karbi Anglong district of Assam

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Karbi Anglong has a favorable agro climatic condition for the development of various plantation and horticulture crops. The major horticultural crops of the district which accounts 6.83 percent of the State's area under these crops while the production contributes 7.5% to the total production of these crops in the State. Mandarin occupies 16.4 per cent of the total area under fruits next to pineapple and banana and the production accounts for 21.6% of the total production of fruits in the district. Mandarin are being exported outside the district to other neighbouring districts and States Considering the importance of mandarin in Karbi Anglong the present study was conducted to find out the economic profitability of the crop and analysed the present marketing pattern and to find out the various constraints faced by the farmers in the production and marketing of mandarin. The study was conducted in Nilip Development Block of Karbi Anglong District in Jongpha area. Out of 14 villages 5 villages were selected for the study and 30 farmers from each village. The average area of mandarin cultivation was recorded to range from 0.5bigha to 15bighas per farmer and production varies from 1000-1500 fruit per tree and the benefit cost ratio was estimated to be 9.2 per hectare of mandarin plantation. Altogether five marketing channels were identified in the study area. The major constraint was found to be low price and lack of processing unit in the vicinity area.

Enhancing farmer's income through introduction of HYV of potato KufriJyoti in Nagaon district of Assam, India

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Potato is one of the most important and widely cultivated vegetable crops of Assam and ranks fourth in terms of area covered in the state. Area under Potato in the state is 103441 ha with production 761843 MT and productivity 7365 kg/ha (Statistical Handbook Assam, 2022) which is much lower than India's national average. Therefore, HYV Potato variety KufriJyoti was introduced among farmers of Nagaon district under ICAR-NEH programme during 2019-22 to increase production as well as to boost up farmers income. A total of seventy-five field demonstrations were conducted in various villages of the district for dissemination of potato variety KufriJyoti. Scientific managemental practices were provided by KVK, Nagaon which included training, periodical monitoring, diagnosis and management of pest and diseases to ensure higher yield in potato var. Kufri Jyoti in the district. Potato var. Kufri Jyoti revealed an average tuber yield of 265.33 q/ha with average gross profit of Rs. 4,02,000.00/ha, net profit of Rs. 2,73,666.00/ha and B:C ratio of 3.13. With demonstration of improved technology through farmer's participatory mode, it could be shown that the yield potential and net income from cultivation of HYV variety of Potato could be enhanced to a great extent resulting in upliftment of farmer's livelihood.

Mushroom farming: A mean of sustainable livelihood development in Morigaon district of Assam

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Mushroom farming is emerging as a popular sustainable agricultural approach in the present scenario of Indian economy. The horticulture sector contributes around 28% of the GDP from about 13.08% of the area and 37% of the total exports of agricultural commodities. With the introduction of new crops like mushroom, bamboo and honey bee further potentiality of the sector has increased.The present study aims at analyzing the market potentiality for mushroom growers on the basis of the factors influencing the competition of mushroom with other products and level of awareness among the farmers and consumers in Morigaon district of Assam. Datas are taken from the questionnaires and interviews with the farmers, dwellers and

consumers. Strengths, Weaknesses, Opportunities and Threats (SWOT) analysis was done to identify the agro industry conditions, at the end to generate information and hypothesis testing is used for mathematical reasoning. From the research, it was clear that much needed financial and technical assistances from the Govt. are required on high priority basis.Mushroom farming could be a attractive and viable source of income for rural and semi urban dwellers of Morigaon district as it does not require access to land and least capital investment is required for a relatively small scale cultivation.

Impact of improved potato cultivation in enhancing the productivity and income of Farmers - a study in Dibrugarh district of Assam India

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Assam is an agrarian state having net sown area and gross cropped area as 2801 and 4060 thousand hectares, respectively and resulting cropping intensity is about 145 per cent. Among vegetable crops potato is the most important crop occupying 115752 hectare area (4.13% of net cropped area) and its average productivity is 8513 kg per hectare. Present study was conducted in Dibrugarh district to know the impact of improved method of potato cultivation in enhancing the productivity and income of farmers during 2020-22. Data for the study were collected in especially designed pre-tested interview schedules from 100 randomly selected respondent farmers from two randomly selected blocks of Dibrugarh district of Assam which was selected purposively due to the prevalence of agricultural activities in the district. The result of the study revealed that the productivity of potato in improved cultivation increased by 9636 kg per hectare (82.11 % increases) over its traditional method of cultivation. The gross return per hectare in improved method of cultivation increased by 45.69 per cent (80424/ha) over its cultivation without the use of improved technology. The net return per hectare in improved potato cultivation increased by 51.18 per cent (67351/ha) over its cultivation without the use of improved technology. The benefit-cost ratios in both improved and traditional method of potato cultivation were 4.46 and 3.96, respectively. Thus, study established the positive impact of adoption of improved technology in potato cultivation.

Assessment of French bean (Phaseolus vulgaris L.) varieties ArkaKomal and ArkaSukomal in Bongaigaon district of Assam

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French bean (Phaseolus vulgaris L.) is mainly grown as a winter crop in India and is also known as “Sunday Special Vegetables”. French bean is used as dry seeds as well as immature tender pods. In the country, the pole type beans are gaining more popularity among farmer for their high yielding attributes along with long yielding periods. Therefore, the present investigation was carried out in the Bongaigaon district of Assam using 2020-21. In order to find out the suitable variety in context to higher yield and other yield attributing characters. Three varieties viz. Arka Sukomal, Arka Komal and Falguni (as check) were evaluated for different yield attributing characters. Based on the findings of the experiments, Arka Sukomal outperformed in most of the characters. The longest crop duration was recorded in Arka Sukomal whereas crop duration the shortest in case of Arka Komal. Similarly highest plant height (187.35 cm), maximum pod length (19.95 cm) and highest pod weight (13.53 g) were also recorded in case of the highest yielder Arka Sukomal. The study also revealed that among the three varieties, Arka Sukomal gave the maximum green pod yield (22500 kg/ha) over a longer cropping duration along with highest B: C ratio (3.90), which makes this variety superior than the other varieties considered in the investigation.

Assessment of ridge gourd variety Arka Vikram in Cachar district (Barak valley) of Assam

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Ridge gourd is the most important vegetable crop which is widely grown in Cachar District of Assam. The farmers’ of the District grows only the low yielding varieties and therefore the yield of the crop is low. An On Farm Trial (OFT) for two consecutive years (2021-22 & 2022-23) was conducted by Krishi Vigyan Kendra, Cachar directly in the farmers’ field covering a total area of 0.78 ha (0.13 ha each plot). The assessment for the performance of the Ridge gourd var. Arka Vikram was conducted in two villages’ consisting 8 nos. of macro field in the village of Sridharpur and Ujangram, Cachar District, Assam. The OFT was conducted by using var. Namdhari as Local Check/Farmers’ practice. From this trial, it was observed that the average

flower initiation of Arka Vikram and Local check (Namdhari) was 29.5 days and 35.5 days. The first picking of assess variety was recorded at 47.5 days and Namdhari at 60.5 days after sowing. The Average Fruit Length, Fruit Diameter and Fruit Weight was 42.59 cm, 3.75 cm and 376.8 gm recorded in case of Arka Vikram Ridge gourd whereas, in case of Local Check variety Namdhari Average Fruit Length, Fruit Diameter and Fruit Weight was observed 38.43 cm, 3.9 cm and 290 gm. Regarding the average yield of the crop var. Akra Vikram (29.86 t/ha) was higher than that of local check (26.90 t/ha). Crop duration also found to be higher in Arka Vikram (72.5 days) than Namdhari Ridge gourd (62.5 days). Average Benefit Cost ratio of two years was 5.53 for Arka Vikram and 4.95 for local check Namdhari.

Performance assessment of Watermelon *(Citrullus lanatus)* variety ArkaShyama in Dhubri district of Assam

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A field experiment was conducted to study the growth and yield parameters of watermelon variety Arka Shyama in the sandy soil and under the agro-climatic condition of Dhubri district of Assam during 2021-22. Three different varieties namely Akra Shyama, Augusta and Local variety Isha were selected for the study. The experiment was carried out in three different locations, two locations were selected in the char areas of the district with sandy soil (more than 80 per cent sand) rich in organic matter and one location with loamy soil (equal percentage of sand, silt and clay). Both the growth and yield parameters were seen to be influenced by the soil conditions. In the sandy soil plants showed faster growth and early flowering; 37 days to 50 days after sowing whereas in loamy soil the plant growth was comparatively slow and flowering was late; took almost three months from sowing. Higher yield of 372.60 q/ha was obtained in sandy soil compared to 267.50 q/ha in case of the loamy soil. The growth and yield parameters were also influenced by the varieties. Arka Shyama started flowering after 37 days whereas Augusta took 50 days and Isha took 39 days. Average weight of the fruit was highest in case of Isha 8.00 kg and lowest in case of Augusta 3.64 kg, in case of Arka Shyama it was 4.14 kg. Highest fruit yield of 372.60 q/ha was obtained from Arka Shyama followed by 330.00 q/ha from Isha and 273.00 q/ha from Augusta.

Assessment and adoption of pheromones trap and lure for fruit fly, *Bactrocera dorsalis* in cucurbits at Sivasagar district of Assam, India

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The Oriental fruit fly, Bactrocera dorsalis (Hendel), is among the most destructive fruit and vegetable pests in India. Because of its widespread distribution, invasive nature resulted economic losses to cucurbits growing areas of Assam. The awareness for fruit fly management in cucurbits was created among the rural farmers of Sivasagar district, Assam by Krishi Vigyan Kendra, Sivasagar through training and On Farm Testing (OFT) programmes. The training & OFT programmes were conducted during the year, 2015 to 2022. The study was conducted during Rabi season, 2022-23 among the beneficiaries of OFT. Average 123 numbers of fruit flies caught in methyl eugenol (ME) baited traps/week. The damage percent was reduced from 12.05 per cent to 2.53 per cent as well as 66.6 per cent yield enhancement with the application of pheromone traps was recorded. The adoption was recorded from 100 numbers of beneficiaries following stratified random sampling technique. The data collected by pretested well - structured interview schedule. It is clear from the results that rural youth farmers were more interested to adopt fruit fly management (68.5%). The independent variables like gender, age, education, caste, income and land holding of farmers were the important variables for adoption of fruit fly technology. The study indicates that KVK, Sivasagar was able to motivate the rural youth to adopt the technology with the higher benefit-cost ratio (5.0).

Impact of front-line demonstration on “Improved production technology of Broccoli” on enhancing yield and income of farmers in Nalbari district of Assam

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The present study was carried out at different location of Nalbari district by Krishi Vigyan Kendra, Nalbari during the year 2018-19, 2019-20 and 2020-21. Frontline demonstrations were conducted on improved production technology of broccoli by covering an area of 10 ha and 76 nos of farmers with the objective to transfer improved production technology of broccoli to farmer’s field. The improved technologies included use of improved variety, adequate spacing,

integrated nutrient management, irrigation management, integrated disease and pest management, weed management, micronutrient application etc. The result of demonstration indicates that improved production technology could increase the productivity remarkably and farmers can able to get better income by adopting it. The demonstration recorded average yield of 14404 kg/ha which was 14.43% more than farmer's practices. The technology gap and extension gap were 596 kg/ha and 2079 kg/ha respectively. The average gross return in demonstration plot was Rs 359920 with a benefit cost ratio of 4.36 in comparisons to farmer's practices (3.86). The results indicated that yield and income of farmerscould be improved by adoption of recommended technologies in broccoli.

Biofortified sweet potato varieties- consumer perception and its yield under Dhemaji conditions

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Evaluation of two biofortified sweet potato varieties (Bhu sona and Bhu Krishna) were carried out in Dhemaji district for three years during 2020-21, 2021-22 & 2022-23. Production and consumption of biofortified crops can reduce the hidden hunger and ensure household food security. The orange fleshed sweet potato (var. Bhu Sona) was preferred in terms of organoleptic test and other sensory attributes the preference was more mainly due to its odour and taste, orange and uniform color, soft and watery texture, and smooth appearance. However, the local check with traditional white flesh red skinned variety showed highest yield of 11.56 t/ha while taking minimum days for maturity (105 days). The local check showed 10.46 % yield increase over Bhu Sona and 20.92 % increase over Bhu Krishna. The computation of Benefit Cost ratio showed the highest ratio of 4.13 in the local check var. Dergaon red.

Potentiality of lime as a soil amendment on soil properties and yield of potato in Acidic Soils of North bank plain zone of Lakhimpur district of Assam

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Potato is considered to be the commonly grown tuber crop having high amount of calories from starch in most of the underdeveloped and developing countries. High rainfall leads to high soil acidity in North Eastern India. In North Eastern India, 65 % of the area suffers from severe soil acidity problem having pH below 5.5. This leads to low productivity of potato occurs as optimum soil Ph is 5.5 – 6.5. Deficiencies of phosphorus is another problem in acidic soils. So, to increase productivity, managing soil acidity is very much required. A comparative study was conducted at farmers' field during the year 2022 - 23 to ameliorate the soil acidity by application of lime for increasing the production in potato (Variety - Local) in Lakhimpur District of Assam covering a total area of 0.30 ha. The experiment consists of three technologies which include, TO-1: Lime @ 2 – 4 q/ha + 50% RDF (NPK@ 60:50:50 Kg/ha), TO-2: RDF (NPK@ 60:50:50 Kg/ha)and TO-3: Farmers Practice – only (FYM is applied). The results revealed that application of lime @ 2 – 4 q/ha in furrows + 50% RDF (NPK@ 60:50:50 Kg/ha) recorded higher yield of 93.7 q/ha as compared to the farmers practice of 74.2 q/ha having B:C ratio of 2.33 and 2.10, respectively. The higher soil pH of 5.56was observed in lime treated plot as compared to pH of 4.91 in farmer's practice (TO-3). It has been observed that a linear positive relationship was found between the yield and available phosphorus(r=0.999*). The yield of the crop was positively correlated with pH (r=0.886), organic carbon (r=0.483), available nitrogen (r=0.892) and available potassium (r=0.981).The soil available nutrients were found to be highest in lime treated plot. So, application of lime in furrows @ 2 – 4 q/ha and 50% RDF (NPK@ 60:50:50 Kg/ha) was found to be more economical and profitable for small land holding farmers and maintaining the soil acidity in Lakhimpur district of Assam.

How diversified is Assam's horticulture? A zonal level analysis

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Assam, the doorway toward North East India is one of the biggest States in the North East and is lining seven states viz. Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Tripura and West Bengal and two nations viz. Bangladesh and Bhutan. The concentration and variation

of the horticulture was found by analyzing both temporally and spatially. To study the diversification of the state as a wholesome, five major horticulture sectors such as fruits, vegetables, spices, plantations and tubers were considered. The diversification of the horticultural sector of Assam for the period of 10 years was calculated using various diversification Indices. We have found that the diversification from the year 2009-10 to the recent years 2019-20 which was more or less constant, according to the index value. The values were quite compromising to the range of the index, which means the diversification of the horticulture sector of Assam was found to be high. To understand the pattern of diversification in a more detailed way, the diversification of different agro climatic zones was also calculated using different crop diversification indices. Nearly 11 major crops which are cultivated in almost all the districts of Assam were considered for the study. Out of these six zones, hills zone was found to have comparatively more diversification while North Bank Plain Zone recorded the lowest. In this Hills Zone, due to predominance of jhum cultivation, more crops were found to be grown by the farmers.

Performance evaluation of French bean *(Phaseolus vulgaris)* varieties ArkaArjun and ArkaKomal in Morigaon district of Assam

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A comparative study was conducted to evaluate the yield performance of French bean varieties ArkaArjun and ArkaKomal and compared with a non-descript French bean variety during the Rabi seasons of 2020-21 and 2021-22 in Morigaon district of Assam. The study was based on field observations and farm level data of the varieties under study. During the experiment, the varieties were evaluated for different growth and yield characters. The experiment revealed that number of pods per plant was the highest (24.15) in case of ArkaArjun followed by Arka Komal (23.49) and that of lowest value was observed in check variety (19.56). Moreover, Arka Arjun variety recorded higher values in case of other yield attributing parameters like pod length (15.23 cm) and pod weight (11.97g). However, pod diameter (0.949 cm) and plant height (52.21 cm) was highest in Arka Komal. The fresh pod yield per plant of ArkaArjun and ArkaKomal were 288.40 g and 276.56 g respectively which were higher than the check variety. The green pod yield per hectare was also highest in case of ArkaArjun, i.e., 17.18 t/ha. Based on the results of the study, it was observed that Arka Arjun performed better followed by Arka Komal in terms of yield and yield attributing characters in comparison to the farmer's check variety and hence, Arka Arjun can be recommended for commercial cultivation in the farmers' field of Morigaon district of Assam.

Increasing toria yield through Integrated Nutrient Management (INM) in Sonitpur district of North Bank Plain Zone (NBPZ), Assam

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A field experiment was carried out as frontline demonstration (FLD) in Sonitpur district of Assam in the year 2020-21 and 2021-22. The experiment was conducted at different locations of Sonitpur district to evaluate the effect of integrated nutrient management (INM) on yield of toria and soil health. The variety used was TS 67 and it was found out that yield of toria was higher (19.3% more in 2020-21 and 20.1% more in 2021-22) in INM plots over farmer's practice. Soil properties also showed considerable improvement in INM treated plots than Farmer's plots.

Effect of bulb size and soaking treatment on growth and flower production of tuberose *(Polianthes tuberosa l. Cv. Suvasini)*

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A field trial was laid out with three bulb sizes (1.25-1.75, 3.00-3.50 and 4.00-4.50 cm diameter) and six bulb soaking treatments i.e., thiourea (500 ppm), paclobutrazol (10 ppm), GA3 (200 ppm), NPK consortium (10 ppm), Novel (5 ppm) and control in a randomized block design in factorial arrangement with three replications to study the individual and interaction effect on growth, flowering, and yield parameters in tuberose. The results revealed that bulb size had a significant influence on all the parameters studied. Bulbs of1.25 to 1.75 cm diameter recorded earliest sprouting, while the plant height and number of leaves per clump, weight of spike, number of florets per spike and spikes, florets and bulblets yield per hectare was maximum in4.00-4.50 cm diameter sized bulbs. This treatment also showed the earliest emergence of spike and opening of floret and maximum longevity of intact spike and duration of flowering. Bulb soaking in thiourea (500 ppm)solution resulted in the early induction of bulb sprouting, whereas, GA3 (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. Same treatment had the early initiation of flowering. The interactions of 4.00 to 4.50 cm diameter sized bulbs and soaking with GA3 (200 ppm) solution were found superior for the spikes and florets yield.

n assessment of pesticides use in vegetable crops and farmers perception on food safety in Udalguri district of Assam, India

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The study was conducted by Krishi Vigyan Kendra Udalguri in the year 2021-22. Total 120 farmers belonging to 3 vegetable growing villages where pesticides were predominantly use was selected for the study. Data collected on use of pesticides, per hectare cost incurred in pesticides use, percentage of respondent using optimum dose, Source of technical information, farmer's awareness, education and practices related to pesticide use and farmer's knowledge about misuse of pesticides. Data were collected through pretested schedules and the data were analyzed by simple tabular and percentage analysis. The results revealed that the expenditure incurred on pesticides is very high. To control the insect pest incidence, the majority of the farmers in the study area used their own spraying schedules and pesticide dosages. More than 50 % of the respondents do not follow the optimum dose in agro ecosystem. Greater number of the literate farmers had strong perception on the negative impacts of pesticides on soil, water, air, biodiversity and beneficial organisms. Only 16.66 % of the respondents obtained their information on plant protection aspect from the agricultural extension officer and the majority of the farmers (58.33 %) rely on input dealers for crop protection. Only 4.16 % farmers had knowledge about misuse of pesticides. According to respondents chemical means of pest management are extremely successful in eradicating significant pest infestations. In these areas, it is crucial to promote both Integrated Pest Management techniques and other non-chemical approaches in order to lessen the reliance on pesticides.

An innovative concept for enhancement of income through establishing agro-tourism centres in the river bank of Nalbari district of Assam

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Agro-tourism become popular in present day context among the urban people and many farmers are establishing agro tourism centres in their farms to earn additional income. As the economy of India is dependent on agriculture, there is huge scope to apply the concept of agrotourism in the agricultural sector of India. The study was conducted by using case study

method in two agritourism centre based on organic farming of pumpkin situated in the bank of pagladia river of Nalbari district of Assam namely Jyoti Krishi Farm and Sankardev jaibik krishi Farm during the year 2020-21 and 2021-22. In the study issues related to agro-tourism operations are discussed in depth. Mainly focused on scope, challenges and sustainability were discussed to get the first hand information regarding types of service provided like accomodation, food, education, entertainment etc. and sustainability of the centres to get additional income out of the farm activities. Regarding the 1st case Jyoti Krishi Farm which was established in the year 2015. They earned Rs 1850000.00 and Rs 1940000.00 from their farm product. The farm engaged 15 people to work for tourism and farm activities and earning Rs 309000.00 and Rs 327000.00 as entry fees, Rs 253000.00 and Rs 269000.00 from fooding and lodging, and Rs 51500.00 and Rs 53500.00 from boating in the river additionally from the innovation of agrotourism centre in the year 2020-21 and 2021-22 respectively. The 2nd case sankardev Jaibik Krishi Farm which was established in the year 2011 earned Rs 1350000.00 and Rs 1510000.00 from farm product. They also engaged 12 people for both farm and tourism activities and earning additional income of Rs 206000.00 and Rs 236000.00 from entry fees, Rs 183000.00 and Rs 283000.00 from fooding and lodging and Rs 28000.00 and Rs 32000.00from boating. In both the cases major constrains are marketing and lack of popularity among urban visitors. Both the centres are taking helps from Assam State Tourism Department, District administrations and Local media for advertising the centres. Though there are some challenges, it is established from the studies that establishing agrotourism centre on agricultural farm can give handsome additional income and ultimately improved rural livlihood.

Natural farming: A boon for increasing production in vegetable crops in Tawang region of Arunachal Pradesh

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Arunachal Pradesh by default is an organic state, has great potential for natural farming. Natural farming which appears to be disruptive farm practice and consider the major challenge faced by farmers i.e. rising cost of production. It caters the major need of ecological or regenerative farming, where in soil biosystems, application of any chemicals is prohibited. Natural farming relies more on mitigating soil biology and soil chemistry by adopting round the year soil cover, with the help of multicropping and promotion of use of natural organic fertilizers like cowdung, urine, vermicompost and farm yard manure, by increasing the soil microorganisms in soil system. The demand for organic food is constantly rising; according to an estimate 1.78 million hectare area in India is under organic farming. In 2017-18, India

exported organic product of worth $515 million. In India 85% farming population are small holders and they are farming on meagre land of 0.38Hectare. Majority of world hungry population are dependent on tiny farms and struggling for survival on scarce land using low input and low production method (Hazell and Rahman, 2014). The use of innovative technology in Indian agriculture, is only viable solution to cater the present situation. Use of chemical based agriculture, led to increased production cost, decreased factor productivity and depleted environmental resource base (Singh et al., 2011). Continuous application of chemical fertilizers, pesticide and farm residue burning led to environmental contamination (Singh et al., 2021). Usage of chemical fertilizers led to decrease in microflora and microfauna, which ultimately affected, soil enzymatic activities, availability of plant nutrients and C-N ratio in soil (Shaikh and Gachande, 2015). An on farm trial conducted at KVK, Tawang in 2022-23. By use of application of organic fertilizers (Cow dung), vermicompost and Jeevamritha in Garden pea variety Arkel, led to vigorous plant growth and estimated increase in yield of 10-12%.

Impact of scientific management practices on productivity of potato *(Solanum tuberosum)* in Karbi Anglong district of Assam

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Tuber crop cultivation has an immense potential in the Karbi Anglong district of Assam. Out of these, potato is an important tuber crop grown by the farmers all over the district. However, the productivity of the crop is affected by imbalanced fertilizer application, poor water management and inappropriate pest and disease management. In the year 2019-20 and 2020-21, high yielding variety Kufri Jyoti was demonstrated in 4.4 ha areas each under NEH Component following all the scientific management practices. The results showed that productivity of potato increased by 28.44 % where the demonstration plot yielded 108.40 q/ha and that of farmer's plot was 84.4 q/ha in the year 2019-20. Similarly, in the year 2020-21, the tuber yield was 31.67 % higher in the demonstration plot (116.8 q/ha) than that of the farmer's plot (88.7 q/ha). The average weight of tubers was 70.6 g and 72.2 in the year 2019-20 and 2020-21 respectively. Moreover, the gross return obtained from the demonstration plot were higher in both the years (Rs. 130080/ha in the year 2019-20 and Rs. 140160/ha in the year 2020-21) than that of the farmer's practice (Rs. 84400/ha in the year 2019-20 and Rs. 88700/ha in the year 2020-21).

Unraveling relationships: exploring correlation and path coefficient analysis in different genotypes of garden pea (Pisum sativum l.) Grown in foot hill of Arunachal Pradesh

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The pea (Pisum sativum L. var. hortense), a popular green legume vegetable typically cultivated during the cool season. In the rabi season, a comprehensive study was conducted on 30 different genotypes of garden peas at the Vegetable Research Farm located within the College of Horticulture and Forestry, Central Agricultural University in Pasighat, Arunachal Pradesh. Employing a Randomized Block Design (RBD) with three replications, the experiment encompassed a range of 22 distinct characteristics. The collected data was subjected to comprehensive statistical analysis. This analysis encompassed various factors, including correlation coefficients and path coefficients analysis of direct and indirect effect in both phenotypic and genotypic level. The investigation into correlations unveiled significant and positive connections between pod yield per plant and the number of pods per plant, as well as pod yield per hectare, both in terms of genotypic and phenotypic traits. Conversely, there was a notable and inverse correlation observed between green pod yield per plant and factors such as shelling percentage, total sugar content, and non reducing sugar levels. The phenotypic and genotypic path analysis, conducted across 22 different traits, provided insights into their direct and indirect influences on pod yield per plant. Upon scrutinizing the results, it became evident that pod yield per plant had the most substantial positive direct impact on the number of pods per plant, followed closely by the number of seeds per pod.

Assessment of antimicrobial and phytochemicals properties of wild edible Solanum species found in northeast region of India

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In India, brinjal (Solanum melongena L.) is mainly grown for its immature, unripe fruits which are used in various ways after cooking. Brinjal is extensively grown all over the country as a major vegetable crop. There are many types of wild brinjal also found in nature and consumed by the people especially in north eastern region of India. These wild brinjal species are not popular in other part of the country. Other than nutritional and anti- nutritional properties, some medicinal properties also found in these wild brinjal species, due to that local people

consumed unknowingly. In this contest, 12 wild edible brinjal species were collected from NEH region and the study was conducted at College of Horticulture and Forestry, Pasighat, Arunachal Pradesh to find out phytochemicals and antimicrobial potential properties from these wild brinjal. The outcome of this study shows that total phenols and tannins were observed from S. gilo (purple berry) with an amount of 10.93 mg/g ±0.197 and 3.81 mg/g ±0.069 respectively whereas total alkaloids of 15.23 mg/ml ±0.285 was obtained from S. spirale. For antimicrobial activities, S. spirale exhibited broad spectrum of anti-microbial properties both in bacterial and fungal pathogens viz; Salmonella typhimurium, Bacillus cereus, Candida albicans and Cryptococcus neoformans. However, the largest zone of inhibition (21 mm) was recorded from S. gilo (purple) against the pathogen Salmonella paratyphi and minimum zone formation (2 mm) was observed from S. spirale against the pathogen Bacillus cereus. Minimum inhibitory concentration (MIC) was examined over at different concentration of 25 mg/ml, 20 mg/ml, 15 mg/ml, 10 mg/ml and 5 mg/ml. Best MIC value was evident from S. gilo (purple) towards S. paratyphi and S. spirale against C. albicans at concentration of 5 mg/ml. All these positive outcomes, confirm that plant extracts significantly possessed antimicrobial properties and concluded on utilization in the handling of microbial infections.

Technical Session - X
Management of Biotic and Abiotic Stresses

Biological management of bacterial wilt disease of capsicum with biogreen-5

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Capsicum (Capsicum annuum L.) has great importance worldwide for its nutritional characteristics and antioxidant content. Bacterial wilt caused by Ralstonia solanacearumis one of the crucial diseases of capsicum and many other Solanaceous crops such as potato, chilli, tobacco, pepper, tomatoes, brinjal etc. as it can cause severe yield loss worldwide. Many control practices including physical, cultural and chemical method have been employed to combat this destructive disease. However, none of these techniques has been able to control the disease efficiently due to the broad host range and genetic diversity of the pathogen and its prolonged survival in the soil. Biological control is considered as the best approach for human health and environmentally friendly practices. One field experiment was conducted at Darrang district to explore the potentiality of Trichoderma viride based bio pesticide (Biogreen-5) against bacterial wilt disease of capsicum under farmers' field condition. The bio pesticide was applied as seed treatment, seedling root dip treatment and soil application against the disease. Another two treatments were kept for comparison, consisting of seedling root dip treatment and drenching of soil with Agromyzin @ 0.01% (farmer's practice) as check and with no treatment as control check. The results revealed that treatment with Biogreen-5 was able to delay the appearance of the disease and decrease the per cent disease incidence against the check and control check significantly. Moreover, the bio pesticide also significantly increased the yield of crop by 11.85 and 32.14 per cent against those two treatments respectively. Effective management of bacterial wilt of capsicum by Biogreen-5 signifies its vital role in eco-friendly management of the disease in present day context.

Physio-biochemical response of rose (Rosa spp.) Genotypes to salt (NaCl) stress under in-vitro conditions

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The rose is a highly significant ornamental flower and universally admired as 'Queen of Flowers'. Among different abiotic stresses, soil salinity emerges an important stress, showing adverse effects on flower growth, physiology, and overall flower quality. The meager information on response of rose germplasm to the salt stress is available in the literature with reference to Indian conditions. Screening for salt tolerance under natural conditions is difficult because of non-availability of uniformly salt affected fields, time consuming, shortage of lands and labour intensive. Plant tissue culture is reported to be an alternative approach for faster screening and selection technique for abiotic stresses. Therefore, keeping in view the economic importance of rose genotypes and their susceptibility/tolerance to salinity, the present investigation was carried out. Axillary bud explants of five rose genotypes namely Rose Sherbet, Rosa chinensis strain (FLS-RC-1), Pusa Alpana, Pink Parfait seedling, Pusa Lakshmi were inoculated on MS media supplemented with different NaCl concentration (0,50,100,150 and 200 mM) to find out their Physio-biochemical response to salt stress under in-vitro conditions. Proline, SOD, MDA, CAT and GPX activity was found to increase along with increase in NaCl concentration in all the rose genotypes. Proline content was recorded maximum in Rosa chinensis strain (FLS-RC-1) whereas SOD and GPX activity was observed highest in Pusa Lakshmi at 200 mM of NaCl. MDA content was recorded maximum in Pusa Alpana and minimum in Pusa Lakshmi whereas CAT activity was found highest in Rosa chinensis strain (FLS-RC-1) and lowest in Pink Parfait seedling at 200 mM of NaCl. Antioxidant enzymes and proline serve as more reliable indicators of salt tolerance and that is supported by the increased activity of antioxidant enzymes and enhanced growth observed in salt-tolerant plants under NaCl-induced stress.

Insecticidal activity of different plant extracts against aphid *(Lipaphis erysimi)* infestation in brown mustard (Brassica juncea l.)

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Brown mustard Brassica juncea L. commonly known as Indian mustard, Rayo saag or Laha, belongs to the family Brassicaceae is one of the most commonly consumed leafy vegetable mainly in North-Eastern region of India which is a fast-growing cool season crop and yet highly susceptible to mustard aphids (Lipaphis erysimi) that leads to complete destruction of the crop. The present investigation makes an effort to find an alternative way to control insect-pest infestation organically by using different locally available plant extracts with high spray efficacy on mustard aphid in the Sikkim-Himalayan region, India. Neem oil is most commonly being used by the local farmers which are readily available in Sikkim since the state is on complete organic practice. The present experiment was laid out to identify the most suitable control on aphid infestation in Brown mustard using six different locally available plant extracts viz. Chilauni or Makrisal (Schima wallichii), Dokhrey (Datura stramonium), Wild fern (Athyrium filix-femina), Wild betel vine (Piper betle), Utis (Alnus nepalensis), Titepati (Artemisia vulgaris), one control with cow urine spray and check as neem oil in two different concentration (5% & 10%). In the result of this experiment, the significant aphid population control was observed maximum by Schima wallichii (Chilauni) at 5% concentration followed by Artemisia vulgaris (Titepati) @ 5% concentration. Different morphological attributes, yield and quality components were also found significantly superior in the treatment combination Schima wallichii at 5% concentration followed by Artemisia vulgaris @ 5% concentration. The results concluded that Schima wallichii at 5% concentration can be recommended as organic insecticide under organic growing condition in Sikkim Himalayas. This study indicated that the application of recommended dose of plant extract can be used for commercial utilization in the future prospect.

Socio-economic opportunity for horticulture-based tourism in the northern bank of the Brahmaputra in upper Assam

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Horticulture-based tourism promises an opportunity not just for the farmers to generate and increase income but also offer visitors the thrill of enjoyment, learning, and involvement. The Northeastern region is bestowed with a plethora of wild edible plants including rare fruits, herbs, and flowers. The region in the northern bank of the Brahmaputra surrounding the Subansiri and Lohit rivers offers a unique opportunity for horti-tourism. A successful multi-storey cropping system involving Pineapple + Arecanut + Black pepper prevalent in Lakhimpur is documented here as an example of leveraging tourism through horticulture. Other underutilized fruits such as Dillenia indica, Garcinia xanthochymus, Baccaurearamiflora, Elaeocarpus serratus etc. are available abundantly in the region. With improvements in road, rail, inland waterways, and air infrastructures the Northern bank of the Brahmaputra in upper Assam is today more accessible to visitors than it ever has been. New functional airports in the vicinity, rail connectivity, Bogibeel bridge, Bhupen Hazarika Setu etc. have opened up access to the region consisting of Majuli Island, remains of the Ahom dynasty in Sibsagar, hills towns of Arunachal Pradesh and many more to tourists and visitors from far and wide. The Lower Subansiri Hydro Power Project in the region also presents a unique opportunity to include horti-aquaculture-based tourism. In this paper, we present the socio-economic opportunity for Horti-based tourism in the hill-plain interface ecosystem of Upper Assam.

Bhramastra-a cow urine based botanical concoction effectively manage the field population peach leaf curl aphid, Brachycaudus helichrysi kaltenbach *(hemiptera: aphididae)* in peach under natural farming conditions

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The present study evaluates the bioefficacy of Bhramastra-cow urine based botanical concoction against peach leaf curl aphid, Brachycaudus helichrysi (Kaltenbach) under natural farming conditions in the sub montaneous region of Punjab, India during the years 2022 and 2023. In Punjab, the low chilling varieties of peach crop viz. Shan e Punjab, Florida Prince, Early Grand, Sharbati, Prabhat, Pratap are cultivated. Most of these are infested severely by peach

leaf curl aphid, B. helichrysi, which suck sap from the leaf whorls resulted in significant losses, if not controlled timely. B. helichrysiin peach is remains active during Feb-May months which coincides with the activity of pollinators and biocontrol agents. Therefore, the investigation was carried out by utilizing a botanical pesticide (Bhramastra) at different dosages (1.0 - 4.5%) to evaluate its efficacy against the B.helichrysi as well as its natural enemies and pollinators on Peach (cv Shan e Punjab). The population of B. helichrysi (5.6 aphids per 10 cm leaf whorl) started appearing on peach during 6th SMW (Standard Meteorological Week) and reached its peak (222 aphids per 10 cm leaf whorl) during the12th SMW. The results of the experiment revealed that two subsequent sprays of Bhramastra at 7 days interval were significantly effective in reducing the aphid population at all the 3 dosages i.e. 1.5, 3.0 and 4.5 per cent, respectively. Maximum reduction of aphid over control (74.01%) was achieved after two sprays with Bhramastra@4.5%. There was natural decline in aphid population after 13thSMW (8.4 aphids per 10 cm leaf whorl). Additionally, the treated plots showed non-significant differences in natural enemies and pollinator's population which ensure that these botanical products will easily make way in formulation of Integrated Pest Management strategies against different insect-pests of different crops under natural farming conditions.

Wai-bar: a ruinous disorder for Nagpur mandarin

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Nagpur mandarin is one of the best mandarins in the world. Production of this fruit crop in the central and western parts of India is increasing every year. Maharashtra is the country's largest producer and exporter of oranges. The area under orange cultivation in the state is about 1.21 lakh hectares and the total production exceeds 7 lakh tons annually. A distortion is being seen in the orange fruit from last few years, which the local people call wai-bar. Since last few years, this distortion is increasing and due to this, farmers suffer a heavy loss. To minimize the incidence of fruit distortion in Nagpur mandarin experiment was carried out at farmer's field at ruikhed of Akola district. Keeping in view the earlier study, 7 modules were prepared which includes soil application of NPK, Micronutrient, Humic acid, Jivamrut, Arka Microbial Consortia, MAU Consortia Biomix, Foliar spray of Potassium sulphate, Zinc Sulphate, Micronutrients (Fe, Mn, Zn, Cu) With integrated pest management. Module 7 is treated as Control (Farmers Practices). Trees treated with Module 4 (At the time of stress release 400 g N + 200 g P + 200 g K + 200 g Plant-1 MAU Consortia biomix + 1000 ppm Humic acid, After 1

month of 1st application (February), 400 g N + 200 g P + 200 g K, After 1 month of 2nd application of 400 g N + Spray of 1% 0:52:34 (N:P:K) + 20g PlantZn+Fe+Mg (Soil application), At pea Stage Foliar spray of NAA 10 PPM + Neem oil 5 %, June – July Spray of Nimbodi ark 5% + 2,4-D 10 ppm, August – September Spray of Ethion + 1 % Potassium nitrate KNO3, 7 doses of Jivamrut 10L Plant-1 was applied at 15 days interval)Shows the minimum incidence of distorted fruits followed by Module 3 (At the time of stress release 400 g N + 200 g P + 200 g K + 200 g Plant-1 MAU Consortia biomix + 1000 ppm Humic acid, After 1 month of 1st application 400 g N + 200 g P + 200 g K, After 1 month of 2nd application, 400 g N + Spray of 1% 0:52:34 (N:P:K) + 20g Plant-1, Zn+Fe+Mg, At pea Stage Foliar spray of NAA 10 PPM + Neem oil 5 %, June – July Spray of Nimbodi ark 5% + 2,4-D 10 ppm, August – September, Spray of Ethion + 1 % Potassium nitrate KNO3, 7 doses of Jivamrut 10L Plant-1 was applied at 15 days interval). Plants treated with Module 4 and Module 3 reduced the losses by 75% and 60% respectively.

Response of Rough Lemon *(Citrus jambhiri Lush.)* Germplasm towards Transient Water Logging Conditions

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Rough lemon (Citrus jambhiri Lush), is an indigenous citrus species of India. Rough lemons exhibit a wide range of variability due to its heterozygosity. Assam is a hotspot for rough lemon germplasm and the fruits are in high demand all over Assam. It is mainly used as a drought tolerant rootstock in Assam as well as other parts of India. Although it is well established as a drought tolerant rootstock, its tolerance to waterlogging has not been studied extensively. Therefore, this study was carried out to study the tolerance of five rough lemon germplasm to two different inundation periods {I1(7 days) and I2(15 days)} and three percentages {F1(75%), F2 (100%), F3 (125%)} of flooding. The germplasm was collected from 4 districts of Assam viz., Jorhat (G1), Nagaon (G2), Karbi Anglong (G3) and Biswanath (G4). Wide variation was observed among the germplasm for percentage of yellow leaves, chlorophyll content, leaf shedding and recovery from flooding stress. An increase in the percentage of yellow leaves and leaf shedding was observed with G3 recording the maximum yellowing and leaf shedding while G4 and G1 are being having the lowest yellowing and leaf shedding percentage respectively. Chlorophyll content decreased with G5 recording the maximum reduction and G4 is being the least effected. G4 showed the best recovery potential with the best root growth among all the germplasm. On the basis of leaf tolerance and recovery potential G4 was found to be the most tolerant to flooding stress among the studied germplasm.

Phenolics signatures in response to salinity stress provide novel insights into physiological basis of salt tolerance in mango *(Mangifera indica l.)*

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The effect of salt stress was evaluated on putative mutant seedlings of three polyembryonic mango genotypes viz., Bappakkai, Nekkare and Kurukkan. Imposition of salinity stress resulted in a decrease in chlorophyll content, relative water content and gas exchange parameters while enhancing the levels of stress markers like Na+/K+ ratio, total phenols and proline. In total, thirteen phenolic acid compounds were identified including eight hydroxybenzoic acids and five hydroxycinnamic acids wherein hydroxybenzoic acid (majorly gallic acid) comprised more than 99% of total phenolic acids. In all the three genotypes, the concentration of protocatechuic acid, 2,4-Dihydroxy benzoic acid, gallic acid, chlorogenic acid and t-cinnamic acid increased with increasing level of salt stress indicating their potential role in mango salt tolerance. Bappakkai recorded higher K+, highest fold increase in proline content (+7.27 fold), highest percent increase in chlorogenic acid (+510%), protocatechuic acid (+750%) and ferulic acid along with lower Na+/K+ ratio and lower reduction in the levels of caffeic and sinapic acid at higher level of salt stress suggesting that putative mutants of Bappakkai were better at tolerating salt stress as compared to the other two genotypes. The present study adds to our current understanding of physiological basis of salt tolerance in mango. Further, besides identifying distinct phenolic acid signatures in response to stresses like gamma irradiation and salinity the results presented here also confirm the potential of physical mutagenesis in breeding salt tolerant rootstocks in mango.

Resistance to Fusarium wilt and genetic diversity of Snapmelon *(Cucumis melo L var. momordica)* accessions

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Fusarium wilt caused by soil-borne fungal pathogen Fusarium oxysporum Schlectend f. sp. melonis (Leach & Currence) Synd. & Hans (FOM) is the most devastating diseases of melon. Indian snapmelon accessions are the wealth of genetic resources for resistance against various diseases, nematodes and insect pests. Fifty one melon accessions, including 43 accessions from momordica group, one genotypes from reticulatus group and one genotype from Inodorous group, three genotypes from cantalupensis group and one wild melon accession were screened through challenge inoculation of FOM. Under field evaluation trial, data were recorded for fruit weight, fruit shape index, cavity length and width, flesh thickness and rind thickness, fruit yield and TSS. The genotypic characterization was also carried out using 301 SSR markers also. Among the microsatellite markers 91 were found to be polymorphic and highly effective in discriminating the 51 melon accessions used in this study. On the basis of percent disease index (PDI) score, cluster analysis was carried out which categorized the 51 genotypes in to six clusters. Cluster V comprised of twelve genotypes with lowest PDI score. Snapmelon lines, SM 2015-1, SM 2013-2, SM 2013-9, SM 2012-11 and SM 2012-1 were identified to be resistant to Fusarium wilt. The round fruited genotypes such as SM 2015-1 and SM-2012-1 were found to be suitable for introgression Fusarium wilt resistance from snapmelon to muskmelon accessions.

Morpho-biochemical basis of yield potential and shoot and fruit borer tolerance in interspecific progenies of brinjal *(Solanum melongena l.)*

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The present study involving interspecific progenies along parents and check aimed at finding the morpho-chemical basis of shoot and fruit borer tolerance in brinjal. The improvement in fruit weight (0.94), number of flowers per cluster (0.84), number of fruits per cluster (0.82), plant spread (0.80), number of fruits per plant (0.78), trichome hair density (0.76), fruit firmness (0.75), and number of secondary branches (0.65), and reduction in plant height (-0.77), days to 50% flowering (-0.69) and days to first harvest (-0.52) enhanced the yield potential of these progenies. Among morpho-chemical traits, days to 50% flowering (-0.90),

number of fruits per plant (- 0.90), trichome density (-0.78), marketable yield (-0.77), fruit weight (-0.75), intermodal length (-0.74), fruit firmness (-0.70), days to first harvest (-0.69), polyphenol oxidase (-0.65), peroxidase (-0.63), total phenol (-0.55) and solasodine (-0.55) reduced the shoot damage percent. The percent fruit damage also associated significantly and inversely with intermodal length (-0.51), days to 50% flowering (-0.89), days to first harvest (-0.65), trichome density (-0.88), fruit weight (-0.85), fruit per plant (- 0.83), fruit firmness (-0.83), marketable yield (-0.68), total phenol (-0.53) and solasodine (-0.65). In conclusion, Solanum insanum based interspecific progenies had significant level of tolerance against the major pest i.e. brinjal shoot and fruit borer was mainly enhanced with a combination of morphological and biochemical traits. The selected progenies can further be utilized to study the plant-insect interactions, genetics and transfer of trait to the elite genotypes and molecular mapping for speed breeding in brinjal.

Morpho-biochemical Expression of Zinc Stress and Toxicity in Mandarin Orange *(Citrus reticulata Blanco)*

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Mandarin orange (Citrus reticulata Blanco) is one of the most widely and commercially grown fruit crop in different countries including India. This fruit is rich source of vitamin A, C, B and plenty of phosphorus as well as digestive fibres. Healthy plant growth of citrus depends on judicious nutrient management with respect to organic manures, inorganic fertilizers and micronutrients as well. Inadequate or excessive levels of zinc can induce stress and toxicity that express as chlorosis, little leaf, mottling of leaf etc. Moreover toxicity of Zn inhibits metabolic activity and stunted growth of plants. To find out the level of concentration at which the deficiency as well as toxicity of zinc occurs in mandarin orange, present study has been conducted with application of different levels of zinc ($ZnSO_4$, $7H_2O$) @ 5.0, 7.5, 10.0, 12.5 and 15 mM/l as pot application of solution. Zinc application increased growth of mandarin orange seedlings up to 10.0 mM/L. Lower growth rate, biochemical deficiency indicators and visual symptoms (viz. chlorosis, mottling) indicated zinc deficiency under control (no zinc application) treatment. Better growth of mandarin orange seedlings, healthy biochemical indicators (lower levels of SOD, proline, phenol, free amino acids, electrolyte leakage, RWC etc.), absence of critical visual symptoms (mottling, wrinkling, scorching of leaves etc.) and zinc content of leaves denoted the optimum nutrition of zinc under in T2 ($ZnSO_4$ @10.0 mM/l)

and T3 (ZnSO4 @7.5 mM/l) (particularly in T3). Poor biochemical indicators, appearance of critical visual symptoms (viz. chlorosis, mottling, wrinkling, scorching of leaves and wilting of plants) as well as excess zinc content in leaves indicated toxicity of zinc in the plants under the treatments T4 (ZnSO4 @12.5 mM/l) and T5 (ZnSO4 @15.0 mM/l).

Survey of mango red banded Caterpillar *(Deanolis sublimbalis snellen)* damage in Bihar

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Mango (Mangifera indica L.) is the top most important fruit crop of India. Its production is hampered by several insect and pests viz., mango hopper, mealy bug, stem borer, fruit fly, shoot gall psyllid etc. But, presently newly emerged pest, red banded caterpillar (Deanolis sublimbalis Snellen) is a very devastating of mango. It caused >60.0% and >50% yield losses in 2022 and 2023 respectively in Bihar. The larval instars causing damage majorly to the seed. They feed internally and damage to mango fruit. The point hole of sap ooze was visible on outer pericarp of the fruits. To study the damage by this disastrous pest, a survey was conducted in the different parts of the Bihar covering >200 local and improved genotypes of orchards. In this survey, the highest (53.5 & 55.5%) attack of red banded caterpillar was noticed in the fruits of 'Fazali' followed by 'Himsagar' (46.5& 45.90%), 'Chauriya' (45.60 & 43.00%), 'Karela' (39.80 & 37.89%) and 'Gulabkhash' (38.80 & 36.78%) in the year 2022 and 2023 respectively. Inspite of huge damage, there were no infection were noticed in the fruits of 'Sipiya', 'Biju','Mallika' and 'Amrapali' variety of mango and a very less infection (1-2%) was found in 'Dushehari' and 'Bathua'. Hence 'Sipiya', 'Biju', 'Mallika' and 'Amrapali' can be used in breeding programme and for rejuvenation of old orchard for successful production of mango in Bihar.

Population dynamics of papaya mealybug, *Paracoccus marginatus* williams and granara de willink and its natural enemies with different weather parameters

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Plant sucking pest, mealybugs are the most serious pest of agri-horti ecosystem and it is very much difficult to control only because of their waxy protective covering. The papaya mealybug (PMB), P. marginatus is also a very notorious pest of papaya. More than 70 plant species are the targets of P. marginatus, besides papaya, such as, cotton, jackfruit, eggplant, mango, guava and jatropha in international context whereas in Indian perspective, P. marginatus can infests over 60 species of plants right from field crop to ornamental. A field experiments was conducted to find out the correlation of different weather aprametrsat Experimental Farm, Department of Horticulture, Assam Agricultural University, Jorhat during 2020-21 and 2021-22. The result revealed that the maximum temperature and minimum temperature showed positive significant correlation with the population buildup of PMB, (P. marginatus) whereas morning relative humidity was negatively correlated with PMB,(P. marginatus) for both the years 2020 and 2021. However, maximum temperature, minimum temperature and evening relative humidity showed positive significant correlation with the population buildup of A. papayae, whereas morning relative humidity was negatively correlated with A. papayae for both the years 2020 and 2021.

Screening of Carrot Germplasm against Alternaria Blight

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Carrot is one of the most popular and commonly consumed vegetable crops belonging to family Apiaceae. It is widely cultivated for its edible tap roots containing various bioactive compounds like carotenoids and dietary fibres which significantly contributes to human health. Alternaria blight caused by Alternaria dauci is one of the most destructive foliar diseases which causes serious damage up to the extent of 45-60% yield loss. Therefore, the present study was undertaken to screen the carrot germplasm against Alternaria blight at Punjab Agricultural University Ludhiana, during 2021-22 and 2022-23 under natural epiphytotic and artificial conditions. The germplasm lines were inoculated with a spore suspension of 2 x 106 conidia per ml and observations were recorded according to 0-9 scale after three weeks of inoculation. The

data was recorded for the different traits and subjected to ANOVA for variability analysis. Out of 60 genotypes, screened under natural and artificial conditions, PC-160, PC-165, P-16 and P-41 were found to be resistant with disease severity less than 10%. Ten genotypes were found to be moderately resistant whereas the remaining genotypes had susceptible disease reaction.

Genetic improvement of vegetable soybean for selected abiotic stress tolerance - drought, water logging, salinity: A review

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Vegetable soybean (Glycinemax (L.) Merr.) is a valuable and nutritionally rich crop that is becoming increasingly popular for human consumption. To promote its cultivation, especially in the face of challenges like drought, water logging, and salinity, it's important to encourage breeding programs that focus on developing varieties resilient to these stresses. Overcoming these challenges requires the development of improved soybean varieties that can tolerate adverse environmental conditions. One way to achieve this is through innovative approaches like creating transgenic plants and utilizing conventional methods. Researchers have used a combination of conventional and genomic techniques, along with bioinformatics tools, to better understand how soybeans tolerate drought stress. This knowledge has then been applied to the development of soybean cultivars with enhanced resilience to abiotic stresses. Selection of drought-tolerant varieties based on their physiological characteristics, aided by genomic methods, is a notable focus. Water logging can lead to yield losses due to factors like root damage, reduced root nodule development, limited water and nutrient uptake, weakened photosynthesis, and plant mortality. Assessing water logging tolerance involves measuring factors like germination capability, plant survival rate, foliar damage, stem elongation rate, yield reduction due to water logging stress and yield attributes. Strategies to enhance salinity tolerance encompass maintaining ion balance, adapting to osmotic stress, restoring osmotic equilibrium, and making other metabolic and structural adjustments.

Management of biotic and abiotic stresses in vegetable crops

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Vegetables are prone to different a biotic and abiotic stress which affects the crop in terms of low yield, Poor fruiting, irregular shape and size of the vegetable crops. Biotic stresses, arising from living organisms such as pests, pathogens, and weeds, pose a substantial threat to vegetable cultivation. Integrated Pest Management (IPM) techniques, including biological control, cultural practices, and the judicious use of chemical pesticides, have been adopted to mitigate pest and disease pressures. Utilization of resistant varieties through conventional breeding and genetic engineering has also shown promising results in enhancing crop resistance against specific pests and diseases. On the other hand, abiotic stresses, caused by non-living environmental factors like temperature extremes, drought, salinity, and nutrient deficiencies, present unique challenges to vegetable crops. The implementation of efficient irrigation systems, such as drip and sprinkler irrigation, helps conserve water and maintain optimal soil moisture levels. Mulching and crop rotation practices aid in enhancing soil fertility and minimizing nutrient deficiencies. Moreover, advancements in precision agriculture technologies have enabled real-time monitoring of environmental parameters and the timely application of corrective measures. The use of protective structures like greenhouses and shade nettings provides a controlled microenvironment, shielding crops from extreme weather conditions and reducing the impact of abiotic stresses. The effective management of biotic and abiotic stresses in vegetable crops necessitates a holistic approach, integrating the latest scientific advancements and sustainable practices. By implementing these strategies, farmers can enhance crop resilience, optimize resource utilization, and ultimately contribute to global food security in the face of an increasingly challenging and unpredictable agricultural landscape.

Breeding for disease resistance in okra *[Abelmoschus esculentus* (l.) Moench]

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The present investigation was conducted at Vegetable Research F-arm, 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) to find out standard heterosis, combining ability of the parents and hybrids as well as behaviour of disease resistance particularly YVMV in okra. The analysis of variance for individual environment as well as for pooled over environments revealed that considerable genetic variation presents 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 × 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.

Inheritance of Yellow Vein Mosaic Virus (YVMV) Tolerance in Okra

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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, 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 (P1, P2, F1, F2, BC1 and BC2) 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 dysgenic 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.

Impact of high temperature stress on germination attributes and *morpho-physiological* parameters of selected tomato genotypes under north Indian plains

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An experiment was conducted in the abiotic stress physiology laboratory of the Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University, BHU-Varanasi to study the impact of high temperature stress on selected tomato genotypes. Two tomato varieties viz. Kashi Aman and Kashi Aadarsh procured from ICAR-IIVR- Varanasi were subjected to normal (250C) and high temperature stress regime (380C) under laboratory conditions. There were significant differences observed with respect to different germination attributes and morpho-physiological parameters of selected genotypes. Percent germination, germination rate, seed vigour index was found to be highly reduced under high temperature regime in both the varieties in comparison to control (under normal temperature condition). Parameters such as radicle length, plumule length, seedling fresh weight and seedling dry weight was also found to be greatly reduced under elevated temperature regime in both the varieties. However, the variety Kashi Aadarsh was found to be more tolerant to high temperature condition than the variety Kashi Aman. Thus, it can be inferred that High temperature stress during the growing season of tomato is highly detrimental for its overall growth and limits the yield potential of tomato in the eastern part of the country.

Identification of rootstock for managing bacterial wilt disease in bell pepper *(Capsicum annuum L.)*

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India is the leading producer, consumer, and exporter of chilli in the world, accounting for 25% of global chilli production. However, the growth of chilli cultivation faces numerous challenges, with one of the most significant being bacterial wilt caused by Ralstonia solanacearum, resulting in substantial yield losses ranging from 30% to 100% in chilli crops. To combat this issue and bolster resistance against biotic stresses, grafting has emerged as an environmentally friendly alternative. In India, grafting practices are still in their early stages due to limited knowledge, awareness, and the absence of identified resistant rootstocks. Grafting offers numerous advantages, including increased disease tolerance and crop vigor, making it an invaluable tool for sustainable horticulture with minimal inputs. Recognizing these benefits, a recent investigation titled "Grafting studies for bacterial wilt resistance in chilli (Capsicum annuum L.)" was conducted at the Central Horticultural Experiment Station (ICAR-IIHR) in Aiginia, Bhubaneswar, Odisha. Through artificial inoculation and sick-plot screening, a highly bacterial wilt-resistant accession IIHR-B-HP-130 was identified, which was then explored as a rootstock for grafting sweet pepper varieties. Evaluation under diseased soil conditions demonstrated that grafted capsicum plants exhibited minimal wilting, ranging from 0% to 8.33%, while non-grafted plants experienced severe wilting, ranging from 73.33% to 93.33%. These results highlight the tremendous potential of cultivating grafted capsicum for commercial production in bacterial wilt-prone areas. By adopting grafting techniques and utilizing resistant rootstocks like IIHR-B-HP-130, India can mitigate the impact of bacterial wilt, reduce yield losses, and ensure sustainable chilli production in the future.

Management of diseases and insect pest in marigold and gladiolus flower

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Gladiolus and marigold being important commercial flowers are fetching high returns to the growers in national and international markets. The occurrence of diseases and insect pest attack in devastating form, has become a limiting its production. The present study was planned with objective to study management of common diseases and insect pest in marigold and gladiolus flower in Punjab in year 2022. Marigold and gladiolus were selected from loose and cut flower category respectively. List of flower growers of the Punjab state was procured from the Department of Floriculture & Landscaping (PAU) and Department of Horticulture, Punjab. From the list, 40 farmers cultivating each flower crop was selected through simple random sampling technique. Thus, 80 respondents were surveyed through face-to-face interviews. The data collected were analyzed and interpreted based on their frequencies and percentages. The findings revealed that 55 per cent of the respondents adopted recommended fungicide (Dithane M-45) for the disease control in marigold. It was further found that 10 per cent of the respondents adopted recommended pesticides but in more than recommended quantity to control insect pest in marigold. To control wilt/collar rot in gladiolus, all of the respondents treated the corms before planting and Corms raised from cormels should be used for planting. An overview of study figured out that gladiolus growers faced the problem of thrips. Only 15 % of respondents used the recommended pesticide Rogor 30 EC (dimethoate) in greater quantities than recommended for controlling the attack of thrips.

Combating fusarium wilt and gummy stem blight in watermelon *[Citrullus lanatus (thunb.)* Matsum & nakai] through rootstock breeding

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Among the cultivated vegetable crops, Cucurbitaceae forms the largest group. Watermelon (Citrullus lanatus (Thunb.) Matsum. & Nakai is one of the most important cucurbitaceous vegetables of the tropics and sub-tropics. Soil-borne pathogens are major production constraints in watermelon, of which fusarium wilt and gummy stem blight are of major

importance. Fusarium wilt, caused by Fusarium oxysporum f. sp. niveum (E.F. Sm.) Synd. & Hans., or FON is the most serious disease globally, causing 100% yield loss. Gummy stem blight (GSB) is an emerging and devastating disease caused by Stagonosporopsis cucurbitacearum (syn. Didymella bryoniae), poses a serious threat to its cultivation. It is reported to be seed-borne, air-borne and soil-borne, causing up to 15-50% yield losses. Management of these diseases has strongly relied on the use of chemical soil disinfestation. However, a shift from chemical to non-chemical means of control is underway to ensure environmentally safer measures to accomplish international regulations. Disease-resistant cultivars were developed to limit damages incited by soilborne fungi. However, so far, no commercial hybrids have shown complete resistant to the race 1, 2 of FON and to GSB. But only sources of partially effective quantitative resistances have been reported in watermelon. So, rootstock breeding is one of the best strategies we can opt for securing yield stability under disease conditions in a sustainable manner. Apart from providing resistance to diseases, grafting is said to increase vegetative growth, plant height and fruit quality compared to the non-grafted ones. Providing resistant rootstocks to susceptible scions prevent primary source of infection, resulting in reduced incidence of disease. Globally, to manage soil borne pathogens through non-host resistance, Lagenaria and interspecific Cucurbita hybrid rootstocks are mostly used for grafting watermelon. Grafting onto former resulted in early flowering while the latter was found to be more vigorous with increased fruit weight, 40% increase in fruit lycopene content and increase in total yield was observed. However, the above-mentioned rootstocks have been reported to have undesirable effect on quality parameters. Thus, to eliminate the problems of incompatibility and the detrimental effects on fruit quality, great efforts have been devoted to find or breed watermelon rootstocks, mainly of Citrullus species, as a result, Citrullus amarus and Citrullus lanatus var. citroides possessing resistance to FON and GSB have been identified. But, till date there are no reports of Citrullus sp. rootstocks showing combined resistance for fusarium wilt and gummy stem blight in watermelon. Therefore, rootstock breeding programs could address the need to develop new hybrid varieties by combining the desirable characteristics such as disease resistance, fruit quality and adaptability to environmental stress.

Evaluation of tomato genotypes for ToLCV resistance, yield and yield attributing traits

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A field experiment on "Evaluation of tomato genotypes for ToLCV resistance, yield and yield attributing traits" was conducted at the experimental block of the Department of Vegetable Science, College of Horticulture, Bagalkot during summer season 2022. Fifty-three tomato genotypes including Solanum pimpinellifolium accessions, selected hybrids and their parents along with the released varieties were evaluated under natural field condition by adapting randomized block design with two replications. The results revealed that among the evaluated genotypes LP 9 was found to be highly resistant since, it was completely free from the virus, whereas LP 12, LP 13, LP 16 and LP 18 were found to be moderately resistant, HUB 3, HUB 43, LP 1, LP 8, LP 10, LP15, LP17, HUB 3 ×DMT 2, HUB 30 × DMT 2, HUB 46 × Arka Vikas, HUB 46 × Arka Meghali and Arka Aditya were reported to be moderately susceptible and all other genotypes were found to be highly susceptible to tomato leaf curl disease under natural condition. Biochemical parameters like total phenol, chlorophyll and defensive enzymes estimation were carried to test the conformity of ToLCV-resistant and susceptible disease reactions. The results showed that there is a positive association between chlorophyll content, total phenols and super oxide dismutase activity with ToLCV resistance and negative association between peroxidase catalase enzyme activity with that of the ToLCV resistance. Among the genotypes for yield and yield attributing traits LP 9 has recorded maximum number of branches per plant and highest plant height. LP 8 and LP 12 were earliest to flower, LP 15 had maximum flowers per cluster, fruits per cluster and fruits per plant, average fruit weight was maximum in HUB 3 × DMT 2, polar diameter was maximum in HUB 43 × DMT 2 and maximum equatorial diameter was reported in HUB36 × Arka Meghali. Highest yield was recorded in HUB 46 × Arka Vikas and HUB 43 × DMT 2, highest pericarp thickness and TSS in HUB 36 × DMT 2 and HUB 36 respectively, maximum number of locules per fruit were recorded in the genotype HUB 13 × Arka Meghali. In addition to this, three ToLCV resistance linked molecular markers Ty-1, Ty-2 and Ty-3 were tested for validation with 10 selected genotypes in which Ty-1 marker was not amplified in any of the genotypes and Ty-2 and Ty-3 though they were amplified but failed to differentiate the resistant and susceptible genotypes.

Screening and biochemical studies on grape genotypes for powdery mildew incidence

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Powdery mildew disease of grape is caused by plant pathogenic fungus Erysiphe necator (Schw.) Burr., is one of the most destructive diseases and causes about 20-40% yield reduction of vineyards. In north India, it appears every year from August to November on leaves and vines of the grapes. In the present study, forty-eight grape genotypes were evaluated for natural incidence of powdery mildew and artificial in vitro leaf inoculation (OIV455-1 scores). Leaves were sampled during April (healthy phase) and mid-August (peak disease occurrence) for estimation of biochemicals, namely, total phenols, MDA content, POD, PPO etc., Vitis parviflora, Male Hybrid and Pusa Navrang were rated as extremely resistant (DSI = 0.65, OIV455-1 score =8.83), highly resistant (DSI = 7.25, OIV455-1 score =8.33) and resistant (DSI = 23.5, OIV455-1 score = 7.67) respectively, while, Pusa Trishar was rated as extremely susceptible (DSI = 80.26, OIV455-1 score =1.67). The total phenols content increased in all genotypes due to fungus infection though the increase was more pronounced in resistant genotypes, V. parviflora (5.42 mg/ g FW), Male Hybrid (5.12 mg/ g FW) and Pusa Navrang (4.70 mg/ g FW) coupled with higher POD and PPO activities. Negative correlations were estimated for DSI and biochemical parameters like total phenols (r = -0.824**), POD (r = -0.782**), and PPO (r = -0.765**), while positive correlations were reported among DSI and MDA content (r = 0.818**). Total phenols, MDA, POD and PPO activities can be used as biochemical indices for screening of grape genotypes against powdery mildew.

Pheromone based integrated approach for management of brinjal fruit and Shoot Borer in the Sonitpur district of Assam

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Brinjal (Solanum melongena), also known as eggplant or aubergine belonging to the family Solanaceae is mainly cultivated for its egg-shaped typically dark purple fruit in several nations of the World. Brinjal Fruit and Shoot Borer (Leucinodes orbonalis Guenee) (BFSB) is a very serious pest of brinjal and is one of the main impediments to brinjal production. It is an internal borer which damages the tender shoots and fruits and causes extremely heavy losses to

the farmers. It can cause up to 90% yield loss and is very difficult to control. This situation has created a very big problem to the farmers in commercial cultivation of eggplant. To formulate a realistic sustainable management module for brinjal shoot and fruit borer (Leucinodes orbonalis) an On Farm Trial was carried out in the farmers field during October 2022 to February 2023 at three locations of Sonitpur district of Assam to evaluate efficacy of eco-friendly IPM strategies with emphasis on use of pheromone traps for management of brinjal fruit and shoot borer (Leucinodes orbonalis Guenee) and to create awareness among the farming community on brinjal fruit and shoot borer management. The module consisted of mainly three components i.e. Spraying of NSKE 5% before flowering at 15 days interval, Installation of pheromone trap @ 40 nos./ha along with changing the lure at 15 days interval and need based spray of chemical pesticide. The shoot damage was reduced on an average by 8.11 per cent compared to 15.29 per cent in farmer's practice (i.e. heavy and injudicious application of insecticides). The fruit damage on an average was also reduced by 13.11 per cent compared to 29.64 per cent in farmer's practice. The average yield levels improved by 34.7 per cent compared to farmers practice (159 qt/ha).

Events of invasive pests in India: current status and management challenges amidst climate crisis

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India is highly diversified in its weather and climate, which supports establishment of various invasive align species (IAS) including the agriculturally important insects from other parts of the world (1). Invasive insect pests are non-native, foreign or exotic species that occur outside their natural adapted habitat due to their high dispersal potential. International Union for Conservation of Nature and Natural Resources (IUCN) defines invasive pest as an alien species which established in natural or seminatural ecosystems or habitat, an agent of change and threatens native biological diversity (2). The invasives insect pests are widely distributed in all kinds of ecosystems. Increased international agricultural trade, movement of seeds as well as other planting materials, and increased movement of humans across the continents has enhanced the risk of entry of invasive insect pests into India. Invasive insect species can act as a plague across the globe, capable of vast expansion with rapid reproduction potential. Invasive pests are exponentially devastating the economy of agriculture, horticulture and forestry resources over very long period, ever since India faced its first invasive pest, the woolly aphid,

Eriosoma lanigerum (Hausmann, 1802) (Hemiptera: Aphididae) in 1889 from China. To date, India has encountered a total of 34different invasive insects with diverse taxonomic orders including 20 species belong to the order Hemiptera, 6 species belong to Lepidoptera, 3 from Coleoptera, 2 each from Diptera and Hymenoptera, and one Thysanoptera (6). The most common expedition of invasive pests includes the passage of sea (shipping), land (surface transport) and air (forceful wind) (11). Recent analysis has indicated that India has lost $127.3 billion (Rs.8.3 trillion) in the last 60 years to invasive alien species, making the South Asian nation the second most invasion-cost bearing country after the United States (10, 13).The spread of Invasive Alien Species (IAS) is now recognized as one of the greatest threats to the ecological and economic well-being of the country. The invasion events by alien pest organisms can be categorized into four consecutive events, including (a) Introduction, (b) Establishment, (c) Spread, and (d) Naturalization, with a series of sequential process. Many organizations involved preventing pest invasions, strict implementation of import regulations and international cooperation in trade and commerce, early detection, and taxonomic identification at the entry points will make India safe and secure from such invasive species. The Directorate of Plant Protection, Quarantine and Storage (DPPQ&S) and National Plant Protection Organization (NPPO) works for India to restrict the entry, establishment and spread of any exotic plant pests into India to safeguard agriculture, horticulture, and forest plantings (3). Plant Quarantine stations are established at various points of entry such as seaports, airports and land frontiers to implement the provisions of PQ Order, 2003 (4, 5). In addition to the alien invasive from across political borders, invasion of pests can also occur from one geographic location to another within the same country (6, 7). These species are causing enormous damage to biodiversity and the valuable natural agricultural systems upon which we depend. Direct and indirect health effects are increasingly becoming serious and the damage to nature and environment is often irreversible (8). The impact is exacerbated by global change and chemical and physical disturbance to species and ecosystems (9). It is therefore necessary to understand the recent invasive pests in order to protect food crops from economic losses and to maintain sustainability of farmers. The existing efforts at management of invasive pests to date often provide short-term effects, requiring constant vigilance, which can be costly as well as labour intensive task. Curiously, effective management system for invasive insects is vital for curbing huge economic losses. The management process of invasive insects involves three discrete action levels including: (a) Preventive measures, (b) Post-quarantine measures and (c) Curative measures (10). These invasive insect pests can be mitigated with the use of biological control agents or natural enemies and quarantine set up need to be upgraded as this could result in the globalization of pests (5,11). Systematic implementation of import regulations and international cooperation in trade and commerce, early detection and taxonomic identification at the entry points will make India secure from such invasive species (12, 13).This paper

highlights the characteristics events of invasive pests covering the aspects of the common passage of entry of the invasive species, the steps involved in the introduction and establishment of new pests from foreign countries, economic impact on agro ecosystems and their sustainable management programme by prevention, eradication and control in India.

Study on *Citrus macroptera* Mont. collected from different districts of Garo Hills, Meghalaya

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Citrus macroptera Mont. is one endangered semi-wild species which have been found to exist in various parts of this region, including Meghalaya. To study its variability in quantity and quality parameter, thirty genotypes of Citrus macropteraMont. Were collected from five differentdistricts of Gar Hills, Meghalaya, i.e., West GaroHills, East Garohills, North GaroHills, South GaroHills and South- West Garo Hills. In the study significant differences were observed among the collected genotypes. The analysis of variance for different parameters such as tree height, tree girth, leaf length, leaf width, fruit width, fruit length, number of fruit segment per fruit, fruit weight, thickness of fruit rind, number of seeds per segment, seed length, and seed width varied significantly among the collected genotypes. Variability among accession collected from different location shows the great scope for genetically potential genotypes for cultivation and also for their exploitation in plant breeding programme.

Identification of greening bacterium *(Candidatus liberibacter asiaticus)* in distorted fruit plant of Nagpur mandarin *(Citrus reticulata Blanco)*

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The problem of fruit distortion in Nagpur mandarin citrus reticulata Blanco has been observed from last two decades. In Marathi language local people called it as ‘waibar’ fruits meaning wasteful fruit because of its irregular shape, size and insipid taste which causes nearly 40 to 50 % losses to the Nagpur mandarin growers. Farmers and researchers believed that the problem of fruit distortion arises due to the greening bacterium (Candidatus liberibacter asiaticus) therefore the primary study was carried out at Plant Pathology Lab, Central Citrus Research Institute, Nagpur with an objective to access the greening bacterium in the affected plant samples collected at different location. Eighteen ‘waibar’ affected Nagpur mandarin orchards

were surveyed and selected for the leaf sample collection. Leaves were collected from 'waibar' affected plants kept in plastic bags in an insulated ice box. All the Nagpur mandarin leaf samples were analyzed for greening bacterium infection through PCR tests optimized at Plant Pathology Lab, ICAR-CCRI, Nagpur. A total of 150 mg of leaf midrib tissue of each test sample was ground in liquid nitrogen using a sterilized pestle and mortar and the total DNA was extracted from midrib and petiole using commercially available Qiagen DNeasy Plant mini kit as per manufacturer's protocol. A set of greening- specific primers were used for the amplification of 16 S rDNA (LasF/ LasR). The PCR reaction was carried out in a Bio Rad T100 Thermal Cycler. The amplified DNAs (PCR products) were analysed on 1.5 % agarose gel stained with ethidium bromide. PCR reaction generally produce an amplified fragment of expected size (500 bp) only in plant samples infected by greening bacterium (Candidatus liberibacter asiaticus), the agent for greening disease. No amplification should be obtained from negative control or DNA extracted from healthy citrus trees. Greening bacterium was not detected in the 'waibar' affected plant samples. From the obtained results it may conclude that greening bacterium is not responsible for the fruit distortion (waibar) in Nagpur mandarin.

Studies on diversity of insect pest of Ber *(Ziziphus mauritiana)* and their natural enemies in Karbi Anglong district of Assam

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Karbi Anglong district is known for its most extravagant biodiversity, geography and agro-environmental conditions. It consists of undulating hilly terrain with numerous rivers and streams. It lies between 92° 50´ and 94° 25´ East longitude and 25° 05´ and 26° 15´ North latitude (Guha 2002). There are various underutilized indigenous fruit crops available in this region among which ber is the most commonly found. An experiment was conducted to investigate the insect pest of ber (Ziziphus mauritiana) and their natural enemies at Regional Agricultural Research Station, Diphu, Karbi Anglong during 2021-2022. Following roving and fixed plot survey, altogether 49 species of insect species were found to be associated of which 6 species were identified as pests, 12 as natural enemies, 21 species were observed to be casual visitors and 10 species as pollinators. Among the insect pests recorded, ber fruit borer, Meridarchis scyrodes, mealy bug, Maconellicoccus hirsutus, fruit fly Dacus correctus were found to be major pests infesting ber. The relative abundance of pests was higher (49.50%) in 2021 compared to 28.36% during 2022. All the natural enemies recorded were predators. The relative abundance of predators was maximum during 2021 (36.20%) compared to 2022 (20.53%), respectively. 21 species of insects were observed as causal visitors and among the

pollinators Apis cerana was observed to be the most dominant forager (38.53%) followed by Apis dorsata (36.74%), Tetragonula iridepennis (12.82%), Xylocopa fenestrata (8.50%), Coccinella septempunctata (8.52%), Vespa cincta (5.12%), Musca domestica (5.10%), Apis florea (4.06 %), Pieris rapae (3.05%). and Xylocopa leucothorax (3.01%), respectively.

Effect of 17 GSM polypropylene bunch bag for management of fruit scarring Beetle Basilepta subcostata *(Jacoby)* in banana var: malbhog in Chirang district of Assam

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Fruit scarring beetle is one of the major pest which decrease the market price of banana fruits across the India. Various management strategies have been developed aiming on improving the quality of banana fruit or suppressing the infection. Insecticide is commonly used to control the beetle, but it does not provide total protection to the fruit against the insect. To find out the effective management of fruit scarring beetle through chemicals and covering the bunch by 17gsm polypropylene bunch bag, a study was carried out in Chirang district during the year 2018-2022. In the study, three treatments were given viz., T1: bunch covering with 17 GSM polypropylene bunch bag, T2: spraying of Chlorpyriphos 20EC @ 2.5 ml/lit and T3: untreated i.e. control. The study revealed that among the treatments, bunch covering with 17 GSM polypropylene bunch bag was found to be best treatment in fruit infestation i.e., 2.4 % followed by 13.53% in Chlorpyriphos 20 EC @ 2.5 ml/lit treated in comparison to the control (42.31%). The plants covered with bunch bag produced significantly higher yield (353.5 q/ha) and highest benefit (Rs.232000/ha) as compared to crops treated with Chlorpyriphos and famers practices.

Bunch covering for management of fruit scarring Beetle *basilepta subcostata (Jacoby)* in banana var: malbhog (AAB) in Chirang district of Assam

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Fruit scarring beetle is one of the major pests which decrease the market price of banana fruits across the India. Various management strategies have been developed aiming on improving the quality of banana fruit or suppressing the infection. Insecticide is commonly used to control the beetle, but it does not provide total protection to the fruit against the insect. To find out the effective management of fruit scarring beetle through chemicals and covering the bunch by 17gsm polypropylene bunch bag, a study was carried out in Chirang district during the year 2018-2022. In the study, three treatments were given viz., T1: bunch covering with 17 GSM

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Study on impact of Fruit Fly *(Bactrocera cucurbitae)* (Coquillett) management tactics in pumpkin

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India is the second largest pumpkin producing country worldwide and Assam is the highest producer of pumpkin among the north eastern states. The fruit fly is a major pest of pumpkin crop which is capable of huge yield loss up to 40-60%. In this context, the present work was undertaken under Krishi Vigyan Kendra, Dibrugarh to evaluate the performance of different fruit fly management tactics over two consecutive years (2018 and 2019) consisting with four different treatments i.e, Use of pheromone trap @28nos/ha; Neem oil @ 3ml/litre, spray of Malathion @2 ml/litre (Farmer's practice) and untreated control. The results revealed that lowest number of ovipositional punctures (1.52 nos. per fruit), lowest fruit infestation (13.64%) could be found out in case of using pheromone trap @28nos/ha as compared to the control that showed significantly higher number of ovipositional punctures (3.79 Nos. per fruit) and highest fruit infestation (47.11%). Maximum yield (267.45 q/ha) and cost benefit ratio (3.05) was observed in the treatment consisting of pheromone trap (@28nos/ha) whereas lowest yield (151.3 q/ha.) and cost benefit ratio (1.93) was found in the control plots. From this study, it was found that the use of pheromone trap is very economic, highly effective and eco-friendly method for the management of fruit flies in pumpkin.

Bacterial wilt resistant tomato variety Arka Abhed- A new hope for farmers

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Tomato is one of the most important vegetables in Baksa District of Assam. Most of the growers witnessing severe yield loss due to bacterial wilt and leaf curl disease. Farmers used to grow hybrid verities of tomato as they have high yield potentiality quite often witnessing serious crop loss in every year due to these two diseases. Spraying of chemicals to control the diseases, the grower's incurred good amount of money resulted in increase in cost of cultivation. To overcome these problems Arka abhed was tasted against the hybrid tomato variety Trishul in farmer's field during 2020-22. The disease incidence was recorded at 50, 60, 70, 80 and 90 days after planting. Wilt disease was recorded as low as 2.05% in Arka abhed where as in tomato variety Trishul the disease incidence was recorded as 36.71%. The cost of production was 13% more in growing of Trishul than the Arka abhed due to use of plant protection chemicals. In respect to yield Arka abhed recorded 56 t/ha whereas yield of Trisul was 35 t/ha.

PGPR: Thenon-chemical magical tools in management of *Fusarium* wilt of tomato cv. Pusa Early dwarf

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Plant diseases pose a significant threat to global food security by drastically reducing the productivity of several vegetable crops. One of the promising non-chemicals, environmentally friendly methods for sustainable agriculture is induced systemic resistance (ISR) in plants against phyto pathogens, which is mediated by rhizo bacteria, the common soil dwellers. Among all the bacterial genera, Bacillus is the predominating soil inhabitant due to their robust endospore forming capacity and some of the representatives can function both as Plant Growth Promoting Rhizo bacteria (PGPR) and bio-control agent. Recent research from West Bengal has revealed two distinct Bacillus spp., Bacillus amyloliquefaciens NC1 and Bacillus velezensis NC2, having broad-spectrum antifungal activity against a variety of phyto pathogens. An effort has been made to comprehend the effectiveness of these antagonists both in vitro and in vivo on the cultivar Pusa early dwarf against Fusarium

oxysporum , the causal agent for the tomato plant wilt disease. Two antagonists invitro interactions with the phytopathogen resulted in grow thinhibition of the pathogen via altered hyphal morphology, hyphal lysis , and deformed spores, among other things. To evaluate the ability ofboth antagonists to prevent the illness, the susceptible tomato plants (45 days old) were treated with each antagonist separately and then challenged by being injected with the pathogen. Disease score was recorded until the 30th day at regular intervals. Simultaneously plant growth promotion (in pots) and yield (in the field) were assessed. Co-treated plants demonstrated a significant decrease in disease incidence after 30 days of therapy. All plant growth-promoting characteristics, including root and shoot length and chlorophyll content, significantly improved under potculture. Field treated plants with antagonists exhibited significant fruit yield. In pot trials, tomato plants treated with antagonists displayed increased defense enzyme activity than control, including peroxidase, polyp henoloxidase, and phenylalanine ammonia lyase, as well as higher phenol buildup. The findings thus reveal that this group of soil bacteria can be used as a remedy to function both as a means of plant disease control and growth promoting substance.

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 2022 to 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, rises up to May (28.8 °C). Early group varieties, showed maximum reduction in days to curd initiation (-31.58%), bolting stage (-28.66%), flowering

termination (-28.71%) in S4sowing 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 S3sowing 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. 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.

Potential of zinc and phenolic compounds as antibacterial agents for management of citrus canker disease in Assam lemon (Citrus limon)

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Citrus is one of the major fruit crops in the world and in India it ranks third in terms of area and production. However, its production is impacted by a number of biotic stresses, among which citrus canker disease caused by Xanthomonas citri pv. citri(Xcc) is a major threat. The disease drastically affects the marketability of the fruits. Conventional bactericides such as antibiotics commonly used against canker possess various disadvantages such as the possibility of developing multi-drug resistant superbugs and are currently not preferred for use in agriculture. Hence, there is an urgent need to explore novel and safe agents against bacterial crop pathogens. In the present study, in vitro assay of four zinc-based (zinc sulphate,zinc oxide, zinc EDTA and zinc nitrate) and two phenolic (thymol and eugenol) compounds were assayed at different concentrations to check their antibacterial efficacy against Xcc and to determine their minimum inhibitory concentration (MIC). Among all the compounds, zinc oxide, thymol and zinc sulphate showed the best results, with a MIC of 200, 100 and 800 ppm, respectively. These compounds were also tested for their in vivo efficacy in Assam lemon plants challenge inoculated with Xcc. Zinc oxide showed the best efficacy among all the treatments with the most reduction in disease incidence (49.80%) followed by thymol (38.58%). The phenol content was also recorded to be highest in plants treated with zinc oxide. Hence, zinc oxide and thymol are potential alternative for the management of bacterial canker disease in citrus.

Understanding the physio-biochemical and molecular networks conferring drought stress tolerance in cucumber *(Cucumis sativus L.)*

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Cucumber is one of the important salad vegetable throughout the world which is highly threatened by drought stress during summer. However, till now drought-tolerant mechanism was poorly understood in Cucumber. With this aim, drought stress was imposed on 100 cucumber genotypes using two methods: i) Water-deficit (WD) method, where seedlings were exposed to air for 4 h followed by recovery under nutrient solution, and ii) PEG (7.5%)-stimulated stress induction method under controlled conditions. However, Pearson's correlation revealed very less significant difference between these two methods. Cluster analysis and Drought Tolerance Matrix Score (DTMS)based on shoot biomass, seedling survivability% ad water content% ranked all the genotypes and these genotypes were again exposed to water stress for 15 days under field conditions for validation of hydroponic-based ranking through yield responses. Finally, most drought-tolerant genotypes (DGC-21) and most drought-sensitive genotype (DGPC-59) were selected and used to understand the physio-biochemical and molecular mechanism behind the drought tolerance. In response to drought stress, DGC-21 showed higher canopy depression, lower reduction in relative water content (%) and leaf water potential, greater membrane stability and lower membrane injury. Further, stomatal number was also less in DGC-21 than DGPC-59. Under drought stress, rate of ROS production and MDA content was significantly increased in DGPC-59 while, the activity of ROS scavenging enzymes, accumulation of proline, and total soluble protein were significantly increased in DGC-21. Finally, upregulation of relative expression of key genes and transcription factors (TFs) could be used as a potential marker for drought tolerance in cucumber. In conclusion, the drought-tolerant genotypes identified in our study, could be utilized in identifying the genomic regions and selecting candidate genes associated with drought-tolerance.

Unearthing citrus resilience: investigating growth and osmolyte responses in rootstock seedlings under salinity stress

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The present study was conducted at the screen house of the Department of Horticulture, CCS Haryana Agricultural University, Hisar, over two consecutive years, 2018-19 and 2019-20 with an objective to investigate the influence of varying salinity levels on growth parameters and osmolyte concentrations in nine distinct citrus rootstocks. The experimental design followed a Completely Randomized Design (CRD) with three replications, encompassing nine citrus rootstocks (namely Rough lemon, Cleopatra mandarin, Pectinifera, Rangpur lime, Alemow, Volkamer lemon, NRCC-3, NRCC-4, and CRH-12) and five salinity levels [control (0.07), 2.5, 4.0, 5.5and 7.0 dS m-1NaCl salinity].Volkamer lemon exhibited the highest potential among citrus rootstocks, displaying minimal reduction (42.8%, 41.3%, and 18.5%) in plant height, root length, and stem diameter, respectively, compared to the control. Rangpur lime and CRH-12 also showed notable resilience. Growth parameter reductions were relatively limited up to a salinity level of 4.0 dS mm-1; beyond this threshold, a sharp decline was observed.At the highest salinity level of 7 dS m m-1, Rangpur lime demonstrated the most significant accumulation of leaf (12.43 and 17.45) and root (12.15 and 17.42) proline and glycine betaine (g g-1 and mol g-1), respectively. Overall, the study highlighted Rangpur lime as well as Volkamer lemon and CRH-12 as superior performers, exhibiting relatively higher protein accumulation and minimal growth parameter reduction at 7 dS m-1, compared to the control. In contrast, Cleopatra mandarin, Rough lemon, and NRCC-3 displayed a moderate response, while Pectinifera, Alemow, and NRCC-4 demonstrated inferior performance, showing contrasting behaviour at 7 dS m-1with respect to osmolyte levels and growth parameters at the seedling stage.

Assessing the efficacy and residue dynamics of chlorantraniliprole in managing Earias species in okra under field conditions

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Earias species, a major borer pest poses a substantial threat to global okra production, causing significant economic losses. In this study, we aimed to assess the bioefficacy and residue dynamics of chlorantraniliprole 18.5 SC sprays in okra crops under field conditions at Eastern Himalayan

region (EHR). Two different doses (25 and 50 g a.i. ha-1) of Chlorantraniliprole were evaluated for their effectiveness in controlling Earias species infestations and improving marketable fruit yield. Both doses were found to be equally effective, resulting in a significant reduction of this borer population by over 80%. Furthermore, the application of Chlorantraniliprole 18.5 SC demonstrated no phytotoxic effects on the okra plants. This chemical also exhibited a negligible impact on the beneficial spider and coccinellid beetle populations that are vital components of the okra ecosystem. The study analysed chlorantraniliprole residues in okra fruit, extracted them with ethyl acetate, and cleaned them using primary secondary amine (PSA) and magnesium sulphate. The estimated limit of quantitation (LOQ) was determined to be 0.01 mg kg-1, with average percentage recoveries ranging from 83.33% to 89%. The study revealed that Chlorantraniliprole residues in okra fruit had relatively short half-lives of 3.22 and 3.12 days for the 25 and 50 g ai ha-1 treatments, respectively. Additionally, dietary exposure assessments based on average daily consumption revealed that the residues consistently remained well below the maximum permissible limit (MPI). These findings enumerate valuable insights for establishing an effective spray schedule for chlorantraniliprole in Earias management within okra cultivation, ensuring both pest control and food safety.

Molecular characterization of different Brassica species and Brassica napus derived recombinant inbred lines for black rot resistance

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Xanthomonas campestris pv. campestris has been emerged as a major limiting factor in the cultivation of Vegetable Brassicas causing the black rot disease. The pathogen is very devastating that it is reported to cause up to 50% yield loss when provided with suitable environmental conditions like high temperature and high humidity. Exploring the new resistance sources in alien Brassica species and its introgression into Brassica oleracea group is one of the current priority areas for black rot resistance breeding. This study was carried out at the experimental research farm and laboratory of Division of Vegetable Science, ICAR- Indian Agricultural Research institute, New Delhi during 2021 -2022 with the aim to study the black rot disease resistance in diverse Brassica species and to validate black rot linked markers for disease resistance. Artificial inoculation of Xcc race-1 and 4 was performed in 123 genotypes (85 RILs and 38 germplasm)belonging to different species like Brassica napus, Brassica rapa, Brassica carinata, Brassica oleracea, Brassica macrocarpa, Brassica juncea and RILs using cut and dip technique. Among 85 recombinant inbred lines, 32 lines were showing resistance to black rot disease. Five genotypes of Brassica rapa (EC426401, Shalini, YID-1, IC0623820, and Tobin 1), two genotypes of Brassica carinata (NPC-9 and DBC-1), one genotype of Brassica macrocarpa (BMR-1) and one genotype of Brassica juncea (PVDH-01) also showed resistance to both the races throughout the growing period. Molecular characterization of all 123 genotypes was carried out using five black rot liked markers namely ILP At1g71865, ILPAt1g70610,SSR Na14-G02, SCAR-ScOPO-04 and BR6-InDel.Among this an SSR marker, SSRNa14-G02present in B-7 genome couldvalidatebetweenparentallinesofRILs,GSL-1(Susceptible)andBN-2-1 (Resistant).This marker could also validate 34 resistant and six susceptible genotypes in recombinant inbred lines.

A Review on the techniques and tactics used in climate smart agriculture

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The goal of Climate Smart Agriculture (CSA) is to improve long-term development and food security in the face of climate change by restructuring and reorienting agricultural production systems and food value chains. A system or a collection of methods known as "climate-smart agriculture" are not new as it is a more recent method of determining growth paths that can increase agriculture's productivity, sustainability, and capacity for coping with and adapting to climate change. The status of small-scale farmers is frequently disregarded when such synergies exist, and they are unable to adopt new procedures and technologies. Vulnerable-Smart Agriculture (VSA) starts with small-scale farmers and aims to understand the barriers they face in improving their livelihoods, followed by the “participatory” design of intervention programs that help farmers with overcoming these barriers. As a result, the primary goal is to improve CSA by including the often overlooked but crucial feature of "small-scale farmer," and to establish Vulnerable-Smart Agriculture (VSA) as a comprehensive version of CSA. Farmers must comprehend and learn how to use technology in order to employ smart agricultural equipment. This is a significant problem in implementing smart agricultural farming on a wide scale across countries. As a result, this study covers the literature on the application of climate smart agriculture and its problems. This assessment also discusses the measures that will be utilized to improve the implementation of climate smart techniques in agriculture sector.

Efficacy of AAU developed microbial formulations against *Meloidogyne incognita* causing root-knot of okra

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Experiments were carried out during Kharif 2022 in the Net House of Department of Nematology, AAU, Jorhat-13 to evaluate the efficacy of five AAU developed bioformulations viz.,Bio-Veer, Bio-Monas, Biofor-Pf2, Biogreen and AAU Bioguardagainst Meloidogyne incognita in okra under Net house condition. 2000 cc capacity pots were filled with sterilized pot mixture of soil: sand : clay @ 2:1:1. Bioformulations were applied in the pots as per the treatments viz., T1 : Bio-Veer @20g/kg soil; T 2 : Bio-Monas @ 20g/kg soil; T 3 : Biofor- Pf2 @ 20g/kg soil; T4 : Biogreen @ 20g/kg soil; T5: AAU Bioguard @ 20g/kg soil one week prior to sowing the seeds. One untreated control was kept for comparison. Three to four leaved okra

seedlings were inoculated with freshly hatched second stage juvenile of M. incognita 1J2/g of soil. From the experiment it was found that all the AAU developed bio-formulations significantly increased the growth of okra and reduced the nematode infestation. However, Biogreen exhibited the best result in increasing the plant growth parameters and reducing the nematode infestation, followed by and Biofor-Pf2.

Technical Session - XII
Secondary Horticulture

Assessment studies over the identification of anti-microbial peptides (Amps) from Chinese chestnut *(Castanea mollissima)*

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Nut crops are the high value members of fruit crops. Demand for nuts is continually increasingwith the growing population. One of the main constraints in the augmentation of nut crop production ispotential microbial diseases. Chemical method of microbial control reduces their quality and failed tomeet the standards of international market. And the chemical method of management also hascontributed to microbial resistance which is a major threat to plants, animals and human health, andover the time this condition becomes worse worldwide. Hence discovering novel antimicrobial agents gained significant importance. Here comes the relevance of Antimicrobial peptides. Antimicrobial peptides possess several advantages slower development of resistance, broad-spectrum antibiofilmactivity, and the ability to favourably modulate the host immune response which are lacking inconventional antibiotics. The current study was performed to identify potential Anti Microbial Peptides (AMPs) present in one of the whole genome sequenced nut crops (Chinese chestnut). Potential AMPs were predicted using normal blast and Macrel AMP prediction tool. From the overall identified AMP sequences 10% of desirable AMPs that are of low e-value and high identity percentage were filtered out. Categorization of these potential AMPs based onphysicochemical properties be would pay the easy and significant way for the retrieval of desiredAMPs with desired parameters in future studies.

Study on substrate decomposing fungi of mushroom and their management by GRAS chemicals

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Mushrooms cultivation in recent years has gained momentum both at state and National level. It is a rich delicacy with vitamins, minerals and antioxidants having both nutraceuticals and medicinal property useful in minimizing the risk of numerous chronic diseases and boosting immunity. One of the challenges in the cultivation of mushroom is the prevalence of substrate decomposing (SD) fungi during the spawn running period which in turn reduces the production drastically. The present study aims to isolate the substrate decomposing fungi from the mushroom growing farms of the Karbi Anglong district. In an attempt to manage these two SD fungi viz. Trichoderma viride and Aspergillus flavus, five GRAS chemicals namely Boric acid, Calcium carbonate, Potassium bicarbonate, Sodium bicarbonate, Sodium chloride each ranging from 1-5% concentrations along with Chemical check (0.5% Carbendazim 50WP) and Control check respectively were studied both in vitro and in vivo condition to check their efficacy against these SD fungi. Under in vitro condition performance of Sodium Bicarbonate (5%) was found to be the best (0.71cm) followed by Potassium bicarbonate 5% (0.74cm) and Sodium bicarbonate (1.06cm). The growth under chemical check was (0.70cm) and full growth in control plate was observed. Next, based on all the results of the experiment under in vitro condition, this experiment was further carried out in the mushroom house to see the efficacy of these three promising GRAS chemicals against the SD fungi under in vivo condition along with control and chemical check (0.5% Carbendazim 50WP). The Disease incidence was scored on a 0-5 scale. The percent disease index showed that Potassium Bicarbonate (5%) was the best (18.6) followed by Sodium Bicarbonate (5%) (22.6) against both the SD fungi.

Mechanical and microbial extraction of Banana fibre

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An experiment was taken up for extraction of banana fibres using mechanical and microbial means: The easiest method for extraction of fibers is by mechanical means. In this project twenty-one local germplasms of banana from the Northeast India were collected: mechanical extraction of the was done using Raspador (Mechanical fibre extractor) and Physico- chemical, and strength of the fibres were studied. Out of the various banana cultivars studied, the bhim kol recorded the highest values for, ash and moisture content. The highest young's modulus was

recorded in the cv. Dil Naikia followed by Kothia and bhimkol. Fibres from those cultivars may be suitably utilized for producing yarn for use in the textile industry. Fibres with lower value of young's modulus can be used for preparation of various handicrafts, non-woven fabric for use inacoustics, wall panelling carpets, paper etc. For microbial extraction of fibers. Samples were collected from partially decomposed banana pseudo stem from the Horticultural experimental farm. The work on isolation and Plate Screening of Pectinolytic, Cellulolytic Bacteria and Xylanolytic Fungus from Banana pseudo stem samples was done. Compatibility test of the positive bacterial isolate as well the fungal isolate was carried out, so that they can be used as inoculums for the fibre extraction process. Fibres were recovered after inoculating the pseudo stem samples with the positive bacterial isolate and the positive fungal isolate. Optical microscopy of the fibres recovered after the treatment and DNA extraction of the positive bacterial isolates was carried out. Results revealed that the bacterial isolates Kosakonia radicincitans, Enterobacter Sp., strain10LG 16S, Enterobacter cloaca, Enterobacter Sp.ICB38116S and fungal isolate Aspergillus niger showed positive activity toward pectin and negative effect towards cellulose and they can be used for extraction of banana fibre. Fungal isolate Aspergillus niger and bacterial isolate Enterobacter clocae had synergistic effect and their consortium can be used for extraction of banana fibre. Mechanically extracted fibre can be treated with the positive isolates for getting finer fibre material.

Utilization of high value horticultural waste in novel industrial applications

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Fruits and vegetables are the most commonly consumed food products produced by horticultural crops. According to their nature and cooking process, these items are consumed uncooked, nominally cooked, or fully cooked. With changing dietary habits and an increasing population, horticultural crop production and processing have improved exponentially to meet rising demand. Peel waste is generated in large quantities by fruit and vegetable-based industries and household kitchens, resulting in significant nutritional and economic losses as well as environmental issues. Horticultural crops produce the most commonly consumed food products, which are fruits and vegetables. These items are consumed uncooked, nominally cooked, or fully cooked, depending on their nature and cooking process. To meet rising demand, horticultural crop production and processing have improved exponentially in response to changing dietary habits and an increasing population. Peel waste is produced in large quantities

by the fruit and vegetable industries as well as household kitchens, resulting in significant nutritional and economic losses as well as environmental issues. The use of these low-cost waste horticultural wastes to create a value-added product is a novel step towards long-term sustainability. Various types of waste derived from fruit and vegetable peels and highlight their potential applications in the development of edible films, probiotics, nanoparticles, carbon dots, microbial media, biochar, and biosorbents. There is high need to develop consortia of researcher and industrialist to improve the economic potential of these valuable horticultural wastes with a support of initial investment. Moreover, it will aid in promoting the usage of horticultural waste for synthesizing value-added commodities.

Secondary Horticulture

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The prosperity of any nation is dependent on its ability to not only produce enough food but also to use this renewable resource to create new products and services that will create new jobs and grow the agro-based economy. As a result, all industrialized countries have successfully transitioned from primary agriculture to high-value "secondary agriculture" over the last 60-80 years, providing new jobs and wealth. Only 5% of horticultural products are processed, while more than 35% of fruits and vegetables are wasted due to a lack of storage and processing facilities, and only a small number of secondary products (both food and non-food) are created from plants or animals. As a result, India has a significant opportunity if primary agriculture can be turned into secondary agriculture through the use of relevant technologies and the construction of necessary rural infrastructure. Secondary horticulture unique understanding of the value and different uses of plants and nutrition, health, and income. They understand value addition and product preservation through horticulture crops. Food processing with value addition reduces food waste while increasing dietary diversity by providing essential vitamins and minerals. They stored kitchen garden food and processed fruits and vegetables, supplying energy for bodybuilding nutrients. Fresh nutritional content yields are accessible for preserving during the season, which are promptly correctly preserved to improve the quality-of-life rural food processing low cost gives wonderful chance. The improvement of the position of the landless labour class would use this as an opportunity to seek employment in their residence for financial assistance in his families. It was analysed for motivation of rural women for self-employment and income growth by using the above technology for horticultural crop use in secondary horticulture by food processing through value addition. This will meet their daily needs and save them money.

Conversion of horticultural waste into wealth

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Effective management of agro-waste, particularly in relation to agricultural and food processing wastes, is a key component of such interventions. Raw agricultural products such as fruits, vegetables, meat, poultry, dairy products and crops are considered to be agricultural wastes. Material that can benefit man may be contained in the non-product outputs of agricultural production and processing, but whose economic value is less than the cost of collection, transportation and processing for beneficial use.It is difficult to find ingenious solutions for proficient waste management, as breakdown requires special processes that involve time, energy, and expense. We've been seeing that agriculture is helping our people eat and be healthy, and the country is growing economically, but improper management of agricultural waste has been making air, soil and water pollution worse. India produces 350 million tonnes of agricultural waste every year. According to estimates from the Ministry of New and Renewable Energy, this waste could generate more than 18,000 MW of power every year, aside from generating green fertilizer for use in agriculture. Around 1.3 billion tonnes of food products for human consumption are wasted or lost every year and one-third of biodegradable municipal solid waste mainly comprises domestic kitchen waste generated from households. The intern is responsible for generating noxious gases and greenhouse gases, as well as a foul odour, around landfill sites. For example; a single crop of potato is thought to produce 12 million tonnes of potato waste per year, of which 2 million tonnes are made in India. It is important to understand the problem at the beginning of waste production. It is important to think of waste as a valuable resource that can be turned into a variety of useful products. Furthermore, it can be viewed as a process of generating wealth when waste is converted to a product that can be put to primary use. Therefore, the phrase 'Waste to Wealth' is used. The waste-to-wealth concept has been used to address the environmental problem by changing the traditional view of waste as an end product to be disposed of. Environmental awareness and turning it into potential value has been seen as a big dispute for the world. Waste conversion processes can create micro-entrepreneurship fortunes on an enormous scale, given the magnitude of waste generated. The potential of waste to wealth enterprise is very high in India.

From petals to pigments: unveiling the carotenoid profile of Marigold

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Marigold (Tagetes spp.) is a flowering plant renowned for its rich history of medicinal application. Carotenoids are organic pigments responsible for the red, orange and yellow colors found in various fruits, vegetables and flowers. Marigolds are not just ornamental flowers, it is one of the main natural sources of carotenoids, which has been extensively used for the production of food colorants, nutritional supplements, poultry feed additives and in ophthalmology for the treatment of age-related ocular disease like age related macular degeneration. The carotenoids in marigolds encompasses an assortment of compounds, including, lutein, zeaxanthin, beta-carotene and lycopene. The extract of flowers was reported to contain epoxides such as lutein 5, 6-epoxide and other oxidation product of lutein. Some studies demonstrated the predominance of lutein and zeaxanthin (88-92%) out of 17 different separated pigments. The carotenoid composition analyzed by HPLC reported epoxides such as violaxanthin and neoxathin. Various complex biosynthetic and catabolic pathway are involved in biosynthesis of carotenoids and these are synthesized by nuclear-encoded enzymes in plastid membrane. Carotenoids isolation and purification process involves dehydration, solvent extraction, alkali hydrolysis of carotenoid esters with absolute alcohol, crystallization or purification using water, alcohol mixture followed by filtration and drying. Pigments of petals have been separated by the use of multiple fractional extraction and thin-layer chromatography and analyzed by spectral methods. Carotenoids from Tagetes species may lead to future for use of natural supplements in lifestyle and treatment for age related diseases. Thus, potential of broad commercial use of carotenoids should generate further interest in marigold as an alternative crop throughout the world.

Effective Extraction of Phenolics from Leaves and Petals of Rose and Marigold

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Ornamental plants are important to human life since they are connected to every celebration. In addition to having a short lifespan, flowers are widely used in so many different ways that a significant quantity of trash is produced. Although these floral wastes may seem useless, these flower debris are actually a rich source of minerals and bioactive substances. These consist of

secondary metabolites such as phenolic compounds, carotenoids, anthocyanins, antioxidants, essential oils, and others. The objective of this study was to investigate the effects of the extraction procedure on the levels of polyphenols, antioxidant activity, and pigments in leaf (RL, ML) and petal (RP, MP) extracts of both rose and marigold plants. A number of drying techniques, including microwave drying, cabinet drying (at temperatures ranging from 400C to 700C), and shade drying were utilized with 3 different solvents (water, ethanol, methanol) for extraction. The results revealed that the samples that had been microwave-dried retained the highest concentrations of bioactive substances. For RL, ML, and MP, methanolic extracts were shown to have high levels of phenols, and antioxidant activity but water extracts were the most effective for RP. Additionally, this study discovered that the extracts' colour values reduced as the drying temperature increased.

Optimization of coating formulations and packaging perforations to prevent physiological losses of litchi under cold storage conditions

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The coating and packaging method had a substantial impact on the physiological weight loss of coated litchi fruits, which varied from 3.31 to 5.74%. The firmness, a crucial element that determines market acceptance, is connected to the water content and post-harvest metabolic changes in litchi. The coated litchi fruit's hardness in cold storage ranged from 15.51 to 21.89 N, where the minimum (15.51) with experimental conditions of α-Tocopherol 0.5%, 1.5% Chitosan, salicylic acid 1.5 mM, and perforation percentage of 0.3%.

Bio fortification of sweet potato to enhance human health

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Micronutrient malnutrition, sometimes known as "hidden hunger," is highly common among adolescent girls, mothers, and preschool children, and is caused mostly by inadequate micronutrient consumption. Vitamin A deficiency is common in developing-country children and women. Deficiency of vitamin A (VAD) causes night blindness, growth retardation, and

xerophthalmia and increases the susceptibility against epidemic diseases. Bio fortification is the most approved and favoured method for combating malnutrition among researchers, growers, and consumers. Biofortified sweet potato (Ipomoea batatas L.) is global food crop, now being recognized as a functional food due to its highest contribution of beta-carotene, which the body converts into vitamin A and promotes to reduce VAD. Sweet potato as a secondary staple food in the tribal areas of the Eastern and North East Hill Region in India. In 2017, the ICAR-CTCRI released three varieties i.e., Bhu Sona, Bhu Kanti, and Bhu Ja; that were high in beta-carotene. Sweet potato starch and flour processing can generate new economic and employment opportunities for farmers and rural communities while also adding nutritional value to food systems.

Studies on physic-chemical properties of citrus peel powder

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Waste from citrus processing industry can be utilized for preparation of medicinal and cosmetic products. An experiment entitled “effect of different drying methods on physico-chemical properties of citrus peel powder” was carried out during year 2020-21 at Post Harvest Technology Laboratory, College of Agriculture, Nagpur with the objective to study the effect of drying methods on physico-chemical properties of citrus peel powder and to find out suitable drying methods on physico-chemical properties of citrus peel powder. The experiment was laid out in FCRD with two factors-Drying Methods viz.-Sun Drying, Tray Drying and Freeze Drying and factor B Citrus spp. viz., Citrus reticulate cv. Nagpur Mandarin, *Citrus sinensis* cv. Mosambi, *Citrus aurantifolia* cv. PDKV Bahar, *Citrus paradisi* cv. Marsh Seedless and Citrus maxima cv. US pumello-145 and replicated thrice. During study, freeze drying found superior in maintaining minimum pH, ash content and exhibited maximum moisture content, titrable acidity and ascorbic acid, while reducing, total and non-reducing sugar was found maximum throughout storage period by Sun drying in all citrus species respectively. Tray drying recorded minimum moisture content due to high level of temperature during drying. For sensory qualities of citrus peel powder it was found that, overall scores of colour, texture and aroma found to be decreased with the advancement of storage. However, Freeze Drying + *Citrus reticulata* Blanco cv. Nagpur Mandarin stood superior and scored maximum points in respect to colour, texture and aroma and exhibits maximum consumer acceptability.

Anthocyanin: an eco-friendly call to Smart Food Packaging Systems

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Paragraph: Food packaging ensures protection and safety of food, while extending their shelf-life and decreasing food wastage to a great extent. In the 20th century, much advancement in packaging technology had appeared as 'smart packaging systems' including active packaging (viz., oxygen scavengers, carbon dioxide absorbers and emitters, moisture absorbers, the controlled release of antimicrobial agents, antioxidants and ethylene scavengers) and intelligent packaging (viz., sensors, indicators and radio-frequency identification (RFID)). These innovations further improved food quality by interacting with the food and its surroundings to enhance the preservation process and by communicating the conditions within the package to the consumers. These technologies usually involve visual indicators that help in decision making whether the packaged food is consumable or not and therefore the involvement of colourants is admissioned. With the growing concern towards individual and environmental safety, interest in hygiene and better nutrition, use of natural dyes is widely being promoted by consumers as well as food industrialists, while curbing the long time use of synthetic dyes that probe certain residual toxic effects on both health and environment. The relatively easier extraction and processing of natural colourants, especially anthocyanins which are abundantly found in nature, have caught the interest of many researchers in order to achieve quality natural colourant source as means of freshness indicators and intelligent pH sensing packaging films.

Technical Session - XIV
New Initiatives and Developments for Minimizing Post- Harvest Losses

Storage behavior studies of jambhiri seeds

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An investigation on “Effect of storage conditions and containers on storability of jambhiri seeds” was conducted at the Post Harvest Technology Laboratory, Section of Horticulture, College of Agriculture Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, during the year 2018-2019 with the objectives to study the effect of different packaging material on storability of jambhiri seeds under refrigerated condition and to find out suitable packaging material and storage condition for better storability, germination of seed of jambhiri seedling. The jambhiri seeds were stored at 4°C ± 1.7°C ± 1 and Ambient temperature in polybag 200 gauge, cotton bags, plastic container and plastic container with jambhiri juice. The experiment was laid out in Factorial Completely Randomized Design.From the findings it was observed that, the jambhiri seeds stored at 7°C in plastic container showed maximum germination percentage (55.26%), whereas, minimum (20.12%) was observed in seeds stored at 7°C in polybag 200 gauge after 150 days of storage. Minimum days to 50% germination (13.00) was observed when seeds stored at 7°C in plastic container whereas, maximum (16.00) days to 50% germination was observed when seeds stored at 7°C in plastic container with juice after 150 days of storage. Maximum Bartlett’s rate index (0.478). While minimum Bartlett’s rate index (0.449) was observed at 7°C temperature with polybag 200 gauge. Maximum vigour index (394.21) was observed in seed stored at 7°C plastic container and minimum vigour index (116.16) was observed at 7°C polybag 200 gauges.

Effect of edible coating in Assam Lemon *(Citrus limon Burm.)* during storage

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The Northeast region of India is a rich treasure of different Citrus species. Assam lemon is one of the important Citrus species and it is indigenous to Assam. The main storage problems of lemon fruits are browning & shrinking of peel, loss of green colour, loss of firmness, and reduced juice content. Providing non-hazardous edible coating would permit the possibility to reach the distant markets in fresh form. Use of CMC (Carboxyl Methyl Cellulose) as exterior coating along with Sodium Benzoate and Bees wax coating can increase the shelf life of Assam Lemon. An investigation was carried out in the Laboratory, Department of Horticulture, Assam Agricultural University, Jorhat with the objective to find out the suitable edible coating treatment for shelf-life extension. The fruits were stored in corrugated fibre boxes. Analysis was done at every 5 days interval upto the marketable stage. The observations recorded were TSS (°Brix), juice content (%), and physiological loss in weight (%), fruit weight (g). The results of the experiment revealed that the application of treatments had significant effect on various quality parameters of lemon fruit during storage. The treatment T5 (3% CMC + 2% Propylene Glycol + Sodium Benzoate 500 ppm) showed better results in terms of all four parameters during storage. T5 treatment (3% CMC + 2% Propylene Glycol + Sodium Benzoate 500 ppm) was superior as an edible coating and retained better quality with extended storage life as compared to all other treatments.

Postharvest application of 6-benzylaminopurine preserves quality and delays senescence of pointed gourd *(Trichosanthes dioica roxb)* fruit

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The objective of this study was to examine the impact of postharvest treatment with 6-benzylaminopurine on the preservation of quality and enhancement of storability in pointed gourd fruit. The fruits underwent treatment with 6-benzylaminopurine (at concentrations of 1.0 mM, 2.0 mM, and 3.0 mM) using the immersion method. Following treatment, the fruits were stored at room temperature. In contrast, control fruits were treated solely with distilled water. The study monitored weight loss, total chlorophyll, total carotenoids, malondialdehyde

content, ascorbic acid, total phenol, and total flavonoids content at two-day intervals throughout the storage period. In the various treatment groups, it was observed that fruits treated with a concentration of 3.0 mM BAP exhibited a weight loss that was 24% lower and a chlorophyll loss that was 30% lower compared to the control group. Following a storage period of 6 days, the fruits exhibited a notable increase in ascorbic acid content, with a retention rate approximately 21% higher than that of the control group. Additionally, the fruits demonstrated a significant elevation in total phenol levels, exhibiting a 27% increase compared to the control group. Furthermore, the fruits exhibited a substantial increase in total flavonoid content, with a retention rate approximately 28% higher than that of the control group. The application of a 3.0 mM concentration of 6-benzylaminopurine treatment resulted in a significant delay in the senescence process of the treated fruit. This treatment exhibited a reduction of 22% in the accumulation of malondialdehyde and a decrease of 26% in the total carotenoid content, as compared to the control group.

Microbial evaluation across storage of processed Assam lemon *(Citrus limon Burm.)* Juice: GI fruit of Assam

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Assam lemon, commonly known as “Kaji nemu” is an indigenous pride fruit of Assam. Due to the state's favorable climate, Assam lemons are available year-round, with production peaking from April-November (Barua and Bharadwaj, 2017) which causes a market oversupply. Fresh fruit quality degrades and juice content is lost due to prolonged storage. By focusing instead on juice processing, losses incurred by citrus growers due to the aforementioned issues may be reduced. The present investigation was carried out in the Experimental Laboratory Dept. of Horticulture, AAU, Jorhat during 2022-23 to evaluate the microbial load of processed Assam lemon juice across storage. Eight different treatment combinations were prepared in matured (90-110 DAFS) and ripe (120-150 DAFS) lemon fruit juices. Among the treatments T1 and T2 were untreated matured and ripe juice whereas T3 and T4 were treated with KMS, and T5 and T6 were pasteurized. T7 and T8 were preserved by combining both KMS and pasteurization in matured and ripe lemon juices, respectively. All the treatments were stored in refrigerated condition. The microbial evaluation was carried out at intervals of 15 days for 6 months and

sensory evaluation every 30 days. T1 and T2 being untreated juices exceeded the microbial permissible limit (log 7 CFU/ml for minimally processed juices by FSSAI) after 90 days and were discarded. T8 remained within the microbial permissible limit (log 4 CFU/ml) till 180 days, showing an extended shelf life while the rest were discarded. Therefore, T8 can be suggested for commercial processing of Assam lemon juice.

Effect of drying temperatures on physicochemical characteristics of pumpkin pulp powder

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Pumpkin (*Cucurbita moschata* L.) having a high nutritional value (especially carotenoids) and a lower cultivation cost, can be exploited as a functional ingredient in the food processing industry. High moisture content (>80%) and perishability make pumpkin less shelf stable. Drying and powder production can be viable options to increase the shelf life of pumpkin pulp. Blancher cum drier, a modified form of traditional cabinet drier was utilized for drying pumpkin pulp at different temperatures (50°C, 60°C and 70°C) to 13-15% moisture. The physicochemical characteristics viz., moisture content, water activity, colour (l,a,b values), acidity, β carotene, crude fiber, sugars, carbohydrates, total polyphenols and antioxidant activity of pumpkin powders were assessed. The powder produced at 70°C showed least moisture content and water activity. Drying at 50 and 60°C produced lighter coloured powders than those dried at 70°C. Powder produced at 60°C showed the highest l value (88.82) compared to the other powders. a values were positive (3.65 - 7.93) for all the powders with the highest being for the one produced at 50°C. b values of the powders ranged from 20.60 to 26.67. Antioxidant activity (56 to 70%), total polyphenols (4 to 11%) and sugars (40 to 47%) increased with increasing drying temperature. Acidity (0.052%) and crude fiber content (2.35%) were least for the powders produced at 60°C, while carbohydrate (67.7%) and β carotene (53.38 g/100g) contentwere highest for the same.

Blooming brilliance: Enhancing amaryllis vase life with optimal harvesting stage and holding solution

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Amaryllis (*Hippeastrum* species, Amaryllidaceae) is used as potted plant, planted nearby evergreen shrubbery to make pleasing contrast and to create a mass effect in landscaping. It has great potential as cut flower because of its beautiful floral parts, bright-coloured petals, and sturdy stem. Amaryllis blooms are susceptible to mechanical damage during handling, and they take up more space for transporting and storage. An experiment was carried out in the Department of Horticulture, AAU during the year 2023. The objectives of the study were to determine the earliest flower bud stage to harvest and the impact of holding solutions on the quality, flower opening, and vase life. Inflorescences were harvested at three different developmental stages of flower buds which are placed in five different holding solutions. The stems of stage III (1 flower fully opened) placed in distilled water; flowers opened more effectively. Within each stage of bud development, stems placed in T3 (40g sucrose, 100mg Aluminium Sulphate) solution maintained their positive water balance, had higher average solution uptake, higher fresh weight and longer vase life than other holding solutions, while those placed in control were the least. In each comparable solution, stems cut at stage II (1 flower about to open) maintained their positive water balance and had higher average solution uptake, higher fresh weight and longer vase life. Stems cut at stage II and stage III placed in T3 opened more satisfactorily than flowers of stems cut at stage I (closed bud stage) but stage III wilted earlier than those two stages.

Post harvest management of finger drop disorder in banana *(Musa paradisica)* var. Grand naine by controlling its enzyme activity

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An investigation was carried out during 2017-18 and 2018-19 to overcome finger drop disorder in banana var. Grand Naine. Enzyme activity was found to affect the pectin concentration in the banana peel during ripening due to which the peel became soften gradually. As the ripening proceeded, the portion where fingers are attached with stalk became more sensitive that they got detached easily from the stalk of fruits and it hampered the shelf life. Two pre harvest treatments Bunch spray of sulfate of potash2% + calcium chloride 2% and bunch spray of sulfate of potash 2% + micro nutrientTracel 2% were imposed to overcome this problem

followed by six post-harvest treatments i.e. Dipping hands in 1% chitosan solution for 2 minutes, Dipping hands in 30 ppm Benzyl adenine solution for 10 minutes,Dipping hands in 2% calcium chloride solution for 5 minutes, Dipping hands in1% Garlic extract for 4 hours, Dipping hands in Gibberellic acid 150 ppm solution for 1 minute and Hands kept without any treatment. The treatment combination i.e.pre harvest bunch spray of2%Sulfate of Potash + 2% Tracel and post-harvest application of 150 ppm GA3 was appeared to be the appropriate method in controlling finger drop disorder.

Studies on preparation of lime blended mandarin marmalade

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Citrus fruits rank first in the international fruit trade in terms of value. India ranks sixth in the production of citrus fruits in the world. It occupies the third position in the production of fruits in India. Sometimes there is glut in the market and hence, prices are reduced. Hence, there is a need to process these fruits for value addition. There is a wide range of products that can be prepared from citrus fruits. Marmalade is a good source of vitamin C, dietary fibres and minerals which offers numerous health benefits. Marmalade is a product that is prepared from citrus fruits, where the peel of the fruit is suspended. Thus, keeping this objective in mind, the present investigation was done for finding the best suitable combinations of blended marmalade where we have prepared blended marmalade using mandarin and lime in different proportions and stored it for 150 days, and analyzed with respect to physicochemical and sensory parameters. The experiment was conducted at the PHT Laboratory, Department of Fruit Science, Dr. PDKV, Akola during the year 2019-20. The variety Nagpur mandarin and PDKV lime were used. It was observed that the treatment having 40% mandarin juicy vesicles without lime juicy vesicles was found to be best for the parameters TSS, total sugars, reducing sugars and sensory attributes. Whereas, the marmalade having 55% mandarin and 10% lime juicy vesicles for acidity, ascorbic acid, pectin and sodium content which was at par with marmalade having 55% mandarin and 5% lime juicy vesicles.

Effect of modified atmospheric packaging on shelf-life and quality of naturally grown vegetables stored under different conditions

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The natural farming is an agro-ecological farming approach that promotes growing crops in harmony with nature and opposes the use of synthetic fertilizers and is popularly known as “Subhash Palekar Natural Farming” (SPNF) or zero budget natural framing (ZBNF) where zero budget means “no credit or no expense” and natural farming means “chemical free farming. The present study wasconducted to study the effect of modified atmosphere packaging (MAP) and storage conditions as well as period on the shelf-life and quality of vegetables (Tomato, broccoli and cabbage) produced through Subhash Palekar natural farming (SPNF) and chemical farming (CHEM) systems. Freshly harvested vegetables (SPNF and CHEM) packed in LDPE pouches (25.40 µm and 10 pin holes/100 cm2 area) and without packaging were stored under ambient (27±2 °C and 70±2% RH), zero energy cool chamber (ZECC) (17±2 °C and 82 ±2 % RH) and low temperature conditions (5&10±2 °C and 90% RH) for shelf-life studies. The shelf-life comparison was done at every two days’ interval up to 24 days (tomato), 28 (broccoli) and 34 days (cabbage) based on physiological loss in weight (PLW) and spoilage percentage. SPNF and CHEM vegetables were compared for nutritional quality attributes and sensory characteristics. Results revealed that tomato stored in refrigerated condition had significantly (p 0.05) lowest PLW and spoilage incidence and highest sensory acceptability up to 24 days and was at par with ZECC stored tomatoes. Whereas, broccoli and cabbage packed in perforated LDPE pouches and stored under low temperature storage retained higher sensory acceptability for 14-20 days with record extended shelf-life for market purpose up to 18 and 22 days, respectively with minimum PLW (<10%). Further, the quality evaluation indicated that vegetables grown under SPNF system contained a higher amount of total solids, total sugars, ascorbic acid, total phenols and ash content. Conclusively, this study suggests the wider acceptability of SPNF grown commodities with higher nutritional quality and marketable shelf-life with low input cost in comparison to chemical farming produce.

Extraction of bioactive compounds from wild aonla *(Embilica officinalis Gaertn.)* for the development of high antioxidant enriched mango drink

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Wild aonla, known for its extensive nutritional and therapeutic properties due to presence of numerous bioactive compounds including phenolic antioxidants. The study was carried out in the Department Food Science and Technology at Dr. Yashwant Singh Parmar University of Horticulture and Forestry in Nauni, Solan (HP) for the development of high antioxidant enriched mango drink by supplementing it with polyphenolic compounds from wild aonla. Whole fruit of aonla was crushed into powder form of particle size of 425 microns after drying and homogenised with 70 per cent ethanol in the ratio 1:20 followed by ultrasonic assisted extraction at 40 KHz frequency, 50±1 oC temperature for 15 minutes and further the extract was concentrated by vacuum evaporator which was further encapsulated with maltodextrin in the ratio of 1:3 and lyophilized at -70 °C to develop the final microencapsulated product. Presence and concentration of phenolic compounds in the microencapsulated products were confirmed by HPLC and FT-IR analysis. Encapsulated powder could be added to mango drink up to 2 per cent successfully for developing a high antioxidant enriched mango drink. DPPH antioxidant activity and metal chelating activity of normal mango drink could be increased from 22.51 to 79.78 per cent and 10.11 to 52.32 per cent respectively containing 232.56 mg GAE/100 ml total phenolic content, 11.21 mg QuE/100 ml of total flavonoids and 3.54 mg TAE/100 ml total tannin content. Antioxidant activity of mango drink could be retained up to 72.34 per cent in ambient and 75.78 per cent in refrigerated condition after 6 month of storage.

Development and standardization of banana pseudo stem based ready to serve beverage blended with pineapple and roselle

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An experiment was carried out for making blended RTS in the Food Processing Laboratory, Dept. of Horticulture (FST), AAU, Jorhat during the year 2022-2023.The first objective is to standardize the RTS beverage by combining the fruit juices in different formulations viz To (100:0:0), T1 (80:20:0), T2 (80:10:10), T3(80:0:20), T4 (80:15:5) & T (80:5:15) The second objective was to study the biochemical, sensory, & microbial activity of the treatments. All the formulations showed an increase in the total soluble solids (°Brix) & titratable acidity (%) from the initial day to the 60th day across storage. T2 (12.12) showed the highest T.S.S & T3 (0.34) showed the highest titrable acidity on the initial day. pH, ascorbic acid (mg/100ml), total phenol (mg GAE/ 100ml) & total carbohydrate showed a gradual decrease in all the treatments from the day of storage till the 60th day across storage. To (3.51) showed the highest pH on the initial day, T2 (24.95) showed the highest ascorbic content and total phenol content on the initial day whereas T1 (18.2) showed highest carbohydrate content on the initial day. Organoleptic evaluation was done by using XLSTAT software. The microbial growth was seen from 40th day onwards. The study revealed that out of all formulations Treatment-2 (T2)- banana pseudostem 80%: roselle 10%: and pineapple 10% showed the best characteristics on biochemical, microbial, and organoleptic scores.

Effect of chitosan on storage life of Alibag White onion

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The research work entitled “Effect of chitosan on storage life of the Alibag White Onion” was undertaken at the Department of Medicinal, Aromatic, Plantation, Spices and Forest Crops, Faculty of Post Harvest Management, Dr. B. S. Konkan Krishi Vidyapeeth, Dapoli, District Ratnagiri (Maharashtra) during the year 2021-2022. It was undertaken to study the effect of different chemical treatments on Alibag white onion and to study the storage behaviour at ambient conditions. The experiment was conducted in Factorial Completely Randomized Design (F.C.R.D.). The veni (woven onion) of Alibag white onion was weighted and then sprayed with Chitosan @ 1, 2 and 3 ml/lit, Canbendanzim 0.1 %, Sulphur fumigation @ 2 g/kg and Sulphur spray 3 g/lit. The treated as well as control onions were dangled using a bamboo pole in

a closed room at ambient condition. The stored onions were analyzed for physico-chemical and proximate analysis initially and during 90, 180 and 270 days of storage with three replications. The decrease in average weight and diameter of bulb, moisture content values while the PLW, incidence of black mold, sprouting, rotting and dry matter of the Alibag white onion were increased during the storage period. The present study revealed that all the chemical parameters except ascorbic acid, reducing sugars and pyruvic acid of the Alibag white onion increased through the storage period of 270 days at ambient condition. The values of factors grouped under proximate analysis showed an increasing trend. Based on physio-chemical and proximate analysis it is concluded that the Alibag white onion stored up to 270 days at ambient condition with Chitosan (1ml/lit) spray.

Influence of polyamines and bilayer edible coating on postharvest senescence and enzyme activity of bell pepper *(Capsicum annuum L.)* fruit

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The effect of exogenous application of pre-harvest polyamines, spermidine and spermine (1.5 mM) and bilayer coating of chitosan (1%) and carboxymethyl cellulose (0.5%) on weight loss, fruit quality, enzyme activities and malondialdehyde was studied in capsicum stored for 2 months at 10°C. The results indicated that combinatorial treatment of spermine 1.5 mM and bilayer coating was most optimum to preserve fruit quality while extending the storability. Significant differences among treatments on different days were observed. Up to one month of storage, weight loss was observed to be lowered by about 50% in the treated capsicum over the control fruit. On the last day of storage, malondialdehyde content was maximum (12.4 mol/kg fw) in comparison to treated fruit (8.9 mol/kg fw). About three and four folds increase at the end of storage over the value after initial 10 days was noted in electrolyte leakage and malondialdehyde buildup. Peroxidase enzyme activity was significantly higher over the untreated fruit at all intervals of storage. In summary, SPM and bilayer treatment of capsicum increases storability, enhances oxidative stress tolerance by raising antioxidant enzymes activity, and inhibits the accumulation of malondialdehyde. The combined effect delayed the yellowing, shriveling, chilling injury and lengthened the shelf life of capsicum fruit upto 60 days

Technical Session - XV
Exploiting Emerging Trade Opportunities

VOCs in Horticultural crops and their industrial applications

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Volatile organic compounds (VOCs) are chemical organic compounds that evaporate easily at room temperature and are emitted by plants as a consequence of their interaction with biotic and abiotic factors. Plants release wide array of remarkable VOCs to allure pollinators, seed dispersers while enhancing plant defense mechanisms against herbivores, parasites and pathogens. Even a minute deviation in these compounds can modify the flavor and texture of fruits and vegetables thereby altering the consumer acceptance. Though fruits and vegetables are rich in minerals and vitamins, but their flavor and quality is determined by these aromatic compounds. Therefore, VOCs have a great influence on the quality of horticultural commodities. Terpenoids, benzenoids, and fatty acid derivatives are the various classifications of VOCs. Terpenoids also known as isoprenoids are derived from the 5-carbon compound isoprene units including monoterpenes, apocarotenoids, sesquiterpenes, etc. Terpenoids being the most profuse class of volatile compounds are used widely in food and beverages, pharmaceuticals and cosmetic industry. Aroma profiles of these commodities help to better understand their uses for different purposes. Technological advancements in omics have facilitated the isolation of genes encoding enzymes involved in the synthesis of these metabolites thereby resulting in a better overall understanding of the molecular pathways involved in VOC synthesis. Therefore, the cosmetics, pharmaceutical, food and flavour industries can get economic benefits from increasing production of these volatiles. Additionally, metabolic engineering can be utilized to produce crops with improved defensive mechanisms thereby reducing pesticide usage in crop production.

Status and agribusiness opportunities in cultivating indigenous fruits of Assam

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The study seeks to explore agribusiness opportunities in indigenous fruits in the state of Assam with the specific objectives to assess the status of indigenous fruits across the agro-climatic zones of Assam and study agribusiness opportunities in commercial cultivation of indigenous fruits. The study has covered five out of six agro climatic zones of Assam, viz., Lower Brahmaputra Valley, North Bank Plain Zone, Central Brahmaputra valley, Upper Brahmaputra Valley and Hill zone. Data used for the study were both primary and secondary. As primary data, 30 farmer respondents were randomly selected from each development block covering two villages, making it 60 from each agro climatic zone and the total sample size was kept at 300 farmer respondents. The paper describes distribution of different indigenous fruits across the agro-climatic zones along with statistics on the number of trees, production levels, and yields of indigenous fruit crops cultivated by the surveyed farmers. Furthermore, the paper delves into the agribusiness potential for selected fruit crops, taking into account production and the surplus available for marketing. The paper advocates for various policy measures aimed at revitalizing the indigenous fruit sector, with the goal of overcoming challenges such as substantial post-harvest losses, limited production scale, and a lack of awareness on commercialization and market linkages.

Farmers behaviour towards risk in production of fruit and vegetable crops

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Within the horticultural sector, fruits and vegetables differs from each other on the basis of gestation period in production that is expected to influence the risk-taking abilities of farmers differently. In this paper, we assess the risk attitudes of farmers growing fruit and vegetables under the safety-first framework and identify factors determining their risk-taking behavior. The result revealed that vegetable growers are more risk-takers than fruit growers. The risk attitudes of farmers growing fruits and vegetables are explained by income and farm related factors including farm size, access to non- farm income, family size and access to credit. Specifically, access to non-farm income and credit helps farmers to take more risk in their production of high value horticultural crops.

Role of temperate fruits in economic security of India

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India's diverse climate ensures the cultivation of tropical, temperate, sub-tropical and arid fruits in different regions of the country. It ranks second in fruits production in the world, after China. As per National Horticulture Database (3rdAdvance Estimates) published by National Horticulture Board, during 2021-22, India produced 107.24 million metric tonnes of fruits from an area of 7.05 million hectares. Fresh fruits exports have helped the country to earn Rs 6219.46 crore and Rs. 5944.49 crores from processed fruits and juices during 2022-23. Horticulture accounts for 30% of India's agricultural GDP from 8.5% of the cropped area. There has been an increase in demand for fruit crops in both urban and rural areas of India. In the world, there will be nearly 10 billion people by 2050 (about 3 billion more mouths to feed than there were in 2010). Among all the fruit crops grown in the country, cultivation of temperate fruits contributes significantly in employment generation and nutritional and economic security of the region where theses fruits are grown. However, the cultivation of these fruits is confronted with different production problems resulting in low productivity and poor quality as compared to horticulturally advanced countries where these fruits are grown. Increases in import of these fruits from other countries are also posing threat to the future of orchardists cultivating these crops. As incomes rise, people will increasingly consume more nutritious fruits. Thus, scientific ways and means should be employed for sustainable production of temperate fruit crops in the country to raise economic security.

Training needs assessment of vegetable farmers for seed production in Raipur district of Chhattisgarh

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India is the second largest producer of vegetables next only to China. Despite all these, low productivity of vegetable crops is the matter of concern. The main reason for low productivity in vegetables is non availability of quality seeds of improved open pollinated varieties or hybrids and very high cost of hybrid seeds in most of the vegetable crops. Due to technological advancement in vegetable production and its seed production, there is strong need to train the growers to keep them aware about improved technologies for improving their productivity and

increasing income. Thus, for organizing effective training programme, the present study was planned with objective to identify the training needs of vegetable farmers of Raipur district of Chhattisgarh. A sample of 120 farmers was selected through stratified random sample technique as respondents. The selected respondent was interviewed personally with the help of a well-structured and pre-tested interview schedule. The data collected were tabulated and statistically analyzed to interpret the results. The overall training need of farmers have been measured in terms of training need quotient. It was observed that farmers required intensive training on pollination behavior, male female ratio, and time of pollination, nutrient management, water management, plant protection and harvest management in seed crop. Further training need intensity of farmers in other aspect like field preparation, seeds and sowing, inter culture operations was medium.