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EXECUTIVE SUMMARY

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The Indian Himalayan states are bestowed with climatic conditions suitable for growing many crops especially temperate crops which in turn is the backbone of economy of farmers in hilly states and it is the major source of livelihood.ICAR- Central Institute of Temperate Horticulture, Srinagar (J&K)along with its two Regional Stations Mukteshwar(Uttarakhand) and Dirang (Arunachal Pradesh) has focused on generation of need based technologies/ varieties in different temperate horticultural crops to boost the productivity of quality produce in horticultural crops because the productivity in temperate horticultural crops in India is still low as compared to advanced countries. To fulfill this requirement of temperate region, Institute is carrying out research on various aspects like crop improvement, crop production, crop protection &post-harvest management since its inception. Institute has nowbecameas a technological hub in various temperate horticultural crops. To cater the need of farmers associated with temperate horticultural crops, the research and extension work carried out by the Institute and its Regional Stations during 2023 are briefly summarized below:

Crop Improvement

ICAR-CITH, Srinagar is National Active Germplasm Site for temperate fruit crops. To utilize the available diversity in temperate horticultural crops as well as its conservation for future use, ICAR- CITH , Srinagar along with its regional stations is continuously enriching germplasm wealth. Continuous efforts are going on for collection, evaluation, characterization and documentation of germplasm in temperate horticultural crops.During 2023, 53 germplasm of different fruit, vegetable & ornamental crops were collected and introduced at ICAR- CITH, Srinagar in the form of plant/ scionwood/ bulbs/ runners/seeds etc. Similarly the germplasm was also added at ICAR-CITH Regional Station, Mukteshwar&Dirang and work on establishment of mother orchards is going on. The evaluation work was also carried out in different crops to screen out the elite genotypes for commercial cultivation. Some of the introductions made few year back planted at ICAR-CITH, Srinagar started fruiting in different crops and many seems to be promising for commercial cultivation in future.

In apple, eight varieties namely Gala Redlum, Super Chief, Red Velox, Golden Delicious Reindeers, Elstar, Jona Red Prince, Pinnova and Golden Delicious Clone B were evaluated on Tall Spindle System. Highest TSS was noticed in Golden Delicious Clone B (16.033 B) and lowest (12.6 B) in Super Chief. Highest yield (86.5 t/ha) was recorded in apple variety Gala Redlum.In evaluation of 4 columnar apple cultivars for physicochemical characteristics, it was found that Moonlight is having maximum consumer acceptability (higher TSS/acidity) and market demand (higher firmness; 72.5 RI). GWAS analysis in apple for fruit size and TSS was also carried out and it was observed that fruit size trait 5, 14 and 11 chromosomes more significantly. In another study,58 apple genotypes were evaluated for nine fruit traitsand molecularly characterized using 53 SSR markers for diversity analysis.Population structure analysis revealed 2 sub-populations within the diversity panel . Association analysis using three different models revealed total three significant marker-trait

associations; out of which, only one SSR marker GD6 was consistently found to be significantly associated with fruit length trait. The SSR marker data developed in this study shall assist in saturation of the genotype-by-sequencing (GBS) data based GWAS study which is underway shall help identification of more significant marker-trait associations, marker-assisted breeding and genotype construction.

In seven asian pear varieties highest recorded values for fruit weight (158.68g), fruit length (77.01mm) and fruit diameter (64.79mm) while among 10 European pear cultivars maximum fruit weight. (181.92 g) was recorded in Max Red Bartlett.

In apricot, 70 genotypes including two new selections made during 2023 were evaluated and CITH A 1 produced fruits weighting about 92.94g. Two new selections were made during the year which have better fruit characteristics and both of these apricots produced fruits having sweet kernels. Among these 70 genotypes, 24 produced fruits with bitter kernel and 46 with sweet kernel. Most of genotypes have single kernel but 18 genotypes produced double kernels. The TSS was higher in Genotypes PAS followed by CITH A 33 and CITH A 11.In peach, seven new cultivars (Venture, Victoria, Blazing Star, Loring, Glenglo, Glowing Star and F Fury) were evaluated and maximum yield per plant was recorded in F Fury (5.84kg) followed by Venture (5.65 kg), Victoria (4.91 kg), Glenglo (4.73 kg), Blazing Star (4.02 kg) and minimum in Loring (3.48 kg). Among all cultivars, Glenglo (first week of July), F Fury and Blazing Star(2nd week of July) were early in maturity, Loring, Venture &Glowing Star were mid in maturity (3rd week of July) while Victoria was late in maturity (3rd week of August). Besides this, 21 peach and 4 nectarine cultivars were also evaluated and heaviest fruits were produced by Kanto 5 (116.58g) followed by Nimla (111.37g), Cresthaven (106.55 g), Red Globe (102.37 g) and Glohaven (101.81 g). Among nectarines heaviest fruits were produced by Silver King (94.24 g) followed by Fantasia (91.83 g). In plum, 32 cultivars and 3 cultivars of plumcot were evaluated for various traits. Among plumcots, FlorTsiraj produced heaviest fruits followed by Mirocais and DPRU-0708. The yield was also higher in FlorTsiraj followed by DPRU0708 and Mirocais. Among 32 plum cultivars , heaviest fruits were produced by Au Rosa. Among all cultivars, red Beaut Abundance & Red Plum matures in ending June while Stanley, Mariposa and Angelino mature during August and other cultivars mature during July. In olive, out of 18 cultivars, 14 cultivars fruited and heaviest fruits were produced by cultivar Cipressino (5.18g). Based on average yield, Coratina was found highest yielder followed by Pendolino, Etnea ,Cerigonola , Zaituna and Frontoio. In almond 12 cultivars and 15 selections were evaluated for various nut and kernel traits. Among cultivars highest nut weight (3.61g) and kernel weight (1.87g) were recorded in Primorskij while kernel recovery was more in Non Pareil (58.76 %). Highest average yield was recorded in Darek followed by Merced and IXL. Among selections, nut weight was found to be highest in CITH A 16 while kernel weight was more in CITH A 19.Kernel percentage was more in CITH A 21.

In walnut, 187 genotypes/ varieties were evaluated for floral traits and were categorized on the basis of degree of heterodichogamy. Among all, fifteen genotypes (8.02%) have dichogamy between 0 to 10 percent, 36 genotypes (19.25%) were in group having dichogamy between 11 to 40 per cent, 42 genotypes (22.42%) were in dichogamy group of 41 to 70 percent and 94 genotypes (50.26%) were in group having dichogamy between 71 to 100 percent. In general categorization, 128 genotypes (68.44%) were

protandrous, 55 (29.41%) were protogynous and 4 (2.13%) were homogamous. As far as nut and kernel traits is concerned,260 genotypes including varieties were evaluated. The nut weight varied from 4.77g to 26.76g, kernel weight from 2.64 g to 12.76g and kernel percentage from 29.67 to 72.73 per cent. Fifteen genotypes/ varieties produced nuts having weight more than 18g while 25 genotypes produced nuts having kernel weight more than 8 g.The kernel recovery was more than 50 percent in 69 genotypes. Besides released varieties, the other genotypes which seems to be promising for commercial production and release based on desirable traits are CITH-W-12 & CITH-W-121. For higher yield (no. of nuts /plant), one more genotypes was also identifiedfor further study. In Pistachio, there are total six selections out of which four were female and two were male. The heaviest nut and kernels (0.77g& 0.347 g) were produced by CITH Pistachio 1 while highest kernel percentage was maximum (54.18%) in CITH Pistachio 6. In hazelnut, 9 cultivars were evaluated for various nut and kernel traits and heaviest nuts and kernels were produced by cv Ennis (3.85g & 1.67g) while maximum kernel recovery and minimum shell thickness was obtained from nuts produced by cv. Butler (51.53 % & 1.33mm).

In vegetable crops, the germplasm of kale, pea, root and exotic vegetables wascollected ,maintained and evaluated under field conditions. In kale,CITH-KC-53 performed better.In radish, most of genotypes of the germplasm performed better than check. In turnip, 26 genotypes including two checks Nigeen-1 and PusaChandrima were evaluated and root yield of the germplasm ranged from 201.27 to 525.47 q/ha with 15 genotypes performing better than better check Nigeen-1. Among leafy, exotic and Brassica crops, Chinese cabbage line CITH-CC-1 expressed 378.56 q/ha of net head yield. Broccoli line CITH-Broccoli-1 gave net head yield of 175.69 q/ha while in Swiss chard, CITH-SC-Green and CITH-SC-Red yielded 278.69 and 256.37 quintal leaves per hectare.

ICAR-CITH, RSMukteshwar&Dirang

During the year, seeds of high potential and locally cultivated vegetable vizMeethakarela. (two different types) and French bean (four different coloured seed)were collected from nearby village of Uttarakhand.In apple, 22 apple cultivars belonging to Delicious group, spur type and colour strains were evaluated and maximum fruit weight (167.79 g), fruit diameter (74.67 mm), fruit length (64.16 mm) were recorded in CITH Lodh Apple-1 while maximum fruit TSS was recorded in Oregon Spur and Gloster.Apart from this, total eleven new cultivars were also evaluated in which the highest fruit weight was recorded in Adams apple (190.95 g) followed by Scarlet Spur-II (175.31 g) and Mema Gala (169.76 g). In peach, total five cultivars evaluated and maximum fruit weight (159.08 g), fruit diameter (62.95 mm), fruit length (63.16 mm) were recorded in Reliance and the maximum TSS (10.93 °B) and total sugar (5.06%) were recorded in Red June.In plum, total six cultivars were evaluated and based on the physico-chemical characteristics of fruits, the highest fruit weight were recorded in Santa Rosa. In apricot, total seven cultivars evaluated and highest fruit weight and TSS were found in ChaubatiaMadhu as compared to other cultivars.In walnut, total ten cultivars were evaluated, the maximum plant height was recorded in CITH W-10 , maximum number of shoot/plant was recorded in CITH W-7 ,more nut weight was recorded in CITH W-10 followed by CITH W-9 and CITH W-1 however, the highest number of nut per plant were recorded in CITH W-4 followed by CITH W-5 and CITH W-6 respectively. In kiwifruit total five cultivars

were evaluated and based on physico-chemical characteristics of fruits Hayward, Abbot and Bruno were found superior as compared to other cultivars. The highest fruit weight (75.82 g) was found in Hayward, however, highest TSS werefound in Abbot (15.10 °B) and Bruno (14.5 °B), respectively. At ICAR-CITH, RS Dirang, a survey was carried out for the collection of wild kiwifruitgermplasm and wild raspberries at Mandala Top, Lubrang village around Dirang, West Kameng district in the month of June 2023. Different genotypes of raspberries and both male and female wild kiwifruit plants were identified for further multiplication at ICAR-CITH, RS Dirang.

Under development of superior cultivars/hybrids in temperate fruits through conventional and non-conventional methods, scab resistant Prima x Ambri population was evaluated for morphological and biochemical characteristics. In the preliminary studies, some genotypes have shown good fruit weight (>100g), TSS (>140B), firmness (>75RI), colour and ascorbic acid (24.5mg/100g) in addition to good antioxidant potential. During 2023, seven apple hybrids were evaluated for stability of morphological and biochemical traits. Among these seven hybrids, three are known for scab resistance namely Pride (Prima x Red Delicious) Priame (Prima x Ambri), Pritor (Prima x Top Red), two for quality namely Ambrit (Ambri x Top Red), Ammol (Ambri x Mollies Delicious) and one hybrid namely Golden Snow has pollinizer activity in addition to fruit quality. Pride, Priame and Pritor besides possessing the trait for scab resistance also show higher fruit weight than their parents. Ambrit and Golden Snow have higher ascorbic acid (20.8 and 21.2 mg/100gFw) than their respective parents, Hybrid Priame possess high total phenolic content (2.64mgGAE/gFw) than its parents. Scab resistance in hybrids namely Priame, Pride and Pritor was confirmed by presence of scab resistant genes namely UI400, AL07, AM19 and Rvi6 (Vf) through semi quantitative RT PCR. In Mutant population generated by gamma irradiation (30 & 40 Gy) was evaluated for different physiochemical traits. A total of 93 mutant genotypes bear fruits during 2023 and around 70 mutants were found to be superior to the parent (CITH-Ambri-1) with respect to color and other quality traits . Maximum color (a=39.12) trait was found in mutant AM-179 which was much higher than the parent CITH-Ambri-1(7.14).

In pear, number of crosses was performed earlier years and the population showing superior morphological traits was top worked in the pear breeding block. During the year 2023, five new genotypes viz. CITH-Pear1,CITH-Pear2, CITH-Pear 3 and CITH- Pear 4 and CITH- Pear 5, came to bearing and the fruits of these were evaluated for some fruit and organoleptic traits in comparison to parents. The hybrid population which showed promise initially areCITH Pear 1, CITH Pear 2, CITH Pear 3, CITH Pear 4 and CITH Pear 5.In rootstock breeding of Apple, the previous year's crossing population was evaluated for multiplication by air layering method in pots to reduce the evaluation processes. Based on the rate and ease of multiplication the hybrid populations CITH-A-BP-01, CITH-A-BP-07, CITH-A-BP-08, etc were grouped under the very weak category based on of roots biomass. Roots of hybrid rootstocks CITH-A-BP-03, CITH-A-BP-022, CITH-A-BP-32 etc were categorized as a weak category, CITH-A-BP-04, CITH-A-BP-10, CITH-A-BP-11 etc were categorized under the medium category, while hybrid rootstocks population CITH-A-BP-02, CITH-A-BP-05, CITH-A-BP-06 etc were grouped under strong category. In screening of hybrid population against white root rot diseases (Dematophoranecatrix), six rootstocks viz., BP-1,

BP-51, BP-52, BP-55, BP-56 and BP-61 exhibited some level of tolerance against the disease even after 30 days of inoculation

In characterization and diversity analysis of flowering related gene/ genes in almond, the transcriptome of two almond cultivars Waris and Ferralise were sequenced using the next generation sequencing technology. The data was submitted to NCBI under the Bio-Project accession No. PRJNA898899 (https://www.ncbi.nlm.nih.gov/bioproject/?term=PRJNA898899). GProfiler based gene ontology analysis of the differentially expressed genes revealed key terms, some of which include "intracellular anatomical structure", "organelle organization" and "organo-nitrogen compound biosynthetic process". It is interesting to note that DAVID annotation platform identified Auxin signalling pathway and Cell wall biogenesis/degradation as key terms among the up-regulated genes. DAVID also identified some KEGG pathway genes associated with Pyrimidine metabolism in up-regulated genes like Prudul26B005033, Prudul26B019171, Prudul26B019863, Prudul26B023061, Prudul26B006864 and others. Among the down-regulated genes, key genes associated with phosphatidylinositol signalling system included Prudul26B026001, Prudul26B026197, Prudul26B008531, Prudul26B021755, Prudul26B002429, Prudul26B016492, Prudul26B007113, and others. Primers of following genes were synthesised.From the comparative RNA-sequencing between early blooming (Nonpareil, Shalimar and Waris) and late blooming (Tardy Nonpareil, Ferragnese and Ferralise) cultivars. Upon examination of 52305 coding sequences (CDS), 3311 sequences were identified with SSR with 2-6 nucleotide motifs. Total 184 EST-SSR designed successfully and assessed for their amplification using almond genome sequence data (electronic PCR). Total 70 EST-SSRs primers have been amplified successfully on 13 almond cultivars and polymorphic EST-SSRs have been identified. Under breeding for development of superior varieties/hybrids in Solanaceous crops, 100, 60 and 40genotypes of chilli, capsicum and brinjal were grown for seed production, respectively, however, evaluation for yield and related traits was done only in promising genotypes selected for further evaluation in IET at national level under AICRP-VC. For development of CMS lines in onion (Allium cepa L), the F3M2 progeny obtained from crossing intermediate day and long day onion accessions were evaluated for the following traits in 2023. The predominant bulb color was yellow. The selected bulbs of each progeny were massed again to obtain F4M3 progeny in 2024.

Crop Production

During 2023, During 2023-24, institute has supplied about 18035 plants of different temperate fruit crops besides the supply of 13958 scionwood; 1340plants & 2707 seedlings of flowers; about 30.36 kg vegetable seeds & 1535 vegetable seedlings besides 12 kg onion seedlings to different stakeholders, vegetable growers & research organization etc.. During the year 2023, besides above planting material supplied about 1500 grafted plants of walnut were provided to UFRMP for establishment of mother orchards as well as for planting in farmers field. The revenue generated during the financial year from farm was 60.15 lakhs and overall revenue from all resources was 91.67 lakh.

In assessment of soil carbon dynamics and carbon sequestration potential of selected temperate fruit crops of Arunachal Pradesh, 108 composite soil samples were collected depth wise from Apple, Walnut and Kiwifruit orchards of Arunachal

Pradesh comprising of three elevations were subjected to soil quality assessment along with different carbon fractions. The average pH ranged from 5.82 ± 0.39 to 5.99 ± 0.46 in apple orchards, 6.05 ± 0.81 to 6.20 ± 0.44 in walnut orchards and 5.86 ± 0.41 to 6.14 ± 0.54 in kiwifruit orchards. The pH of surface soils were slightly acidic in nature and was increasing with depth indicating it's shifts towards nuetrality. Irrespctive of depth, the organic carbon content was very high in all orchards. In apple orchards the organic carbon content decreased with increasing depth (2.54 ± 0.18 to 2.50 ± 0.20), while in walnut (2.27 ± 0.28 to 2.4 ±0.21) and kiwifruit (2.1± 0.07 to 2.31±0.14) orchards it was increasing with depth. The primary and secondary nutrients like available nitrogen, phosphorous, potassium, calcium, magnesium and sulphur content were maximum in surface soils of all orchards and were decreased with increasing depth of soils.To study the, impact of combined application of phosphorus and silicon on apple rootstock performance under various soil moisture regimes, three different rootstocks viz., M-9, MM-106, and MM-111 were evaluated for their root proliferation under varying soil moistures regimes in relation to the combined effect of silica and varying levels phosphorous application. Under lower phosphorus levels (P1-15:10:15 NPK g/ pot + 15g silicon) the soil moisture regime of 40 % field Capacity (W2) with rootstock MM-111 recorded highest growth parameters. However, with increased phosphorous levels (@P2 and P3 levels) the soil moisture regime of 60 % field capacity (W3) with rootstock MM-106 recorded the better growth parameters. For development and evaluation of integrated nutrient management module for high-quality temperate vegetables production, a field experiment with organic, inorganic, integrative and natural component treatments was conducted at ICAR CITH farm to study the effect on performance of kale, onion and garlic as well as to assess the soil quality. In Kale crop, the treatment T6 - 50% Inorganic + 50% organic (Trichoderma enriched Vermi-compost) recorded significantly higher yield which was at par with the treatments T8 75 % Inorganic + 25 % organic (T. enriched Vermi-compost) and T9 Jeevamrutha @ 500 litre/ha. In onion and garlic, the treatment consisting of 50% Inorganic + 50% organic (trichoderma enriched Vermi-compost) recorded significantly higher growth parameters and higher yields. To control pre harvest fruit drop by the application of 1-naphthaleneacetic acid (NAA) on three varieties of apple (Golden Delicious, Red Delicious, and Oregon Spur) on MM-106 rootstock; treatments was given two weeks days before harvesting and three concentrations of NAA were used viz. 10ppm, 20ppm, and 30ppm. From the results, it is revealed that the highest extent of fruit drop was noted at control (13.04%) in the case of the Golden Delicious variety. The 30ppm treatment showed a lower fruit drop (3.16%) compared to 20ppm (3.97%) and 10ppm (4.87%). The 30ppm NAA application resulted in the lowest pre-harvest fruit drop (3.02% in Oregon Spur and 3.57% for Red Delicious).

In Development of almond based intercropping system involving saffron, different almond varieties having varied growth habit were tried along with sole saffron crop and effect of various almond varieties was studied on saffron. The highest saffron yield was recorded under spreading type of almond varieties followed by semierect, sole and erect type. The highest almond yield was recorded in spreading type. The highest cumulative yield were recorded under spreading type followed by semi erect, erect type & sole. The crocin, picocrocin and safranal contents were also estimated after two months from harvesting. He crocin was 2.50 % in sole,

2.70% in erect, 2.30 in spreading and 2.20% under semi spreading type of varieties. Similarly picocrocin was 1.52,1.40,1.20 and 1.40 percent in saffron grown under different treatments while safranal was 0.017 in sole, 0.037 under erect, 0.017 in spreading and 0.012 % under semi erect type of varieties. In canopy management and canopy architectural engineering in temperate fruits, two crops viz apple & pear were taken for experimentation at Srinagar . In canopy architectural engineering experiment in apple; six training systems (vertical axis, cordon, espalier, head & spread, spindle bush and modified central leader system) with two cultivars (Oregon Spur & Red Delicious) on four rootstocks (Seedling, MM 111, MM 106 & M 9) were evaluated for various fruit and yield traits. Among all systems, varieties and rootstocks, Among various rootstocks, varieties and training systems, maximum productivity was recorded in Oregon Spur (67.76 t/ha) on MM 106 rootstock.In canopy Architectural engineering in pear experiment, 4 varieties (Red Bartlett, Starkrimson, William Bartlett & Kashmiri Nakh), 2 rootstocks (BA 29 C & Q C) and 4 training systems (Vertical Axis, Espalier, TaturaTrellies and Modified Central Leader System) were used for experimentation. Among all varieties, rootstocks and training systems, highest productivity was recorded in William Bartlett (35.74 t/ha) on BA 29 C rootstock on vertical axis system. For evaluation of integrated nutrient management of vegetables as intercrop in apple orchard, the technology were demonstrated to among farmer under MGMG and SCSP scheme at Sunkiya, Nainital, Gahena, Nainital, Odlohar-Simsyari, Bageshwar villages during 2023 respectively with the aim to promote crop diversification for sustainable production and to utilize better space as well as natural resources per unit area without eroding soil health for enhancing production per unit area.

For development of different techniques for enhancing the multiplication rate of temperate fruits under protected/open conditions, different experiments were conducted. In Air layering in apple rootstocks in greenhouse conditions, 11 rootstocks viz. M9-Pajam, M9-T337, M9-T339, P-22, B-9, M-27, MM-106, CIV P21 and G11 were taken and success was compared. The success percentage varies from 45.9% to 93.02% with maximum percentage in MM-106 and minimum in M9-Pajam..In air layering in apple rootstocks in open field conditions,six apple rootstocksMM-106, M9-T339, M9-T337, M-9 Pajam, MM-111 and M-26 were evaluated. the success percentage varies from 43.05% to 86.37% with maximum percentage in MM-106 and minimum in M9-T337.Air layering in colt (cherry rootstock)and quince (pear rootstock) under polyhouse conditions was also tried for multiplication.In Propagation of apple rootstock through cuttings, two apple rootstocks(MM 106 & MM 111) were tried and MM 106 performed better for various rooting traits.In preliminary trial of propagation through cuttings in other fruit crops (Grapes, Pomegranate, Olive, Hazelnut& Kiwifruit), cocopeat has been used as a rooting medium.. The success percentage was 85% in grapes, 65 % in pomegranate, 45 % in olive, 10 % in hazelnut and 15 % in kiwifruit.In air layering of 4 pear rootstocks(QA, BA 29, BA 29C & QC) , maximum plant height (128 cm) was recorded in Quince-BA-29and root length was maximum in Quince-A. The vertical expansion technology of apple rootstock was also tried at ICAR-CITH, Regional Station, Dirang, (Arunachal Pradesh)on five apple rootstocks (M9 T339, M9 T337, B9, M9-Pajam and M27). The B9 rootstock showed the highest rooting percentage while M9-Pajam and M27 showed less favorable results with success rates.

Crop Protection

The incidence of green apple started from the third week of March as occasional colonies, mostly on spots that did not receive delayed dormant horticultural mineral oil spray. The incidence continued as wingless viviparous females for two generations and by the 2nd week of April, the production of winged spring migrants started. The aphid population peaked from mid-June to July and subsequently decreased towards the third week of August. The spiraea aphid population on Vanhouttespirea bushes reached a peak from May to July and gradually declined afterwards. The production of winged viviparous morphs was highest from June-July and decreased significantly afterwards. The spiraea aphids remained in asexual mode though the year, including winter, and did not undergo sexual reproduction on the Vanhouttespirea bushes. The overwintering survival of green apple aphids was studied on intact shoots on apple trees and on excised shoots Overall, 43.0 ± 2.99% egg survival was observed up to 13-03-2023 after which most of the eggs started hatching. Significant difference was observed in survivor ship of eggs on intact shoots as compared to those stalked on ground.The hatchability of surviving eggs of green apple aphid was studied on intact shoots on apple trees from the first week of March, 2023. The egg hatch started by 7th of March and reached a maximum during the third week of March. The overall hatchability of the surviving eggs was found as 41.25 ± 9.25%. No significant difference was found in the hatching schedule of GAA eggs between the two blocks. The online survey program was continued for the second year to understand the perception of apple orchardists of Kashmir valley about the incidence and management of green apple aphid, Aphis pomi. Growers from all 12 districts of the valley (n = 180) participated in the survey. While as 7.2% of the respondents reported that green apple aphid was not a problem in their apple orchards, the remaining 92.8% respondents reported that green apple aphid has been a problem for the last 1 to 3 years in their orchards.The effect of winter pruning and subsequent application of horticulture mineral oil was evaluated on the incidence of green apple aphid. The standard pruning operation (thinning and head-back) lead to significant reduction (80.90%) reduction in the number of GAA eggs on apple shoots. The percent egg hatch was noted as 9.90 ± 1.91% on HMO treated trees and 46.92 ± 2.28% in untreated trees. The aphid incidence on trees that received winter pruning remained low till the last week of May. Further, the incidence of GAA in HMO treated trees was lower throughout the season in comparison to control. The efficacy of new chemistry insecticides was evaluated against green apple aphids and it was found thatthiamethoxam 25 WG @ 0.02% and thiamethoxam 12.6% + lambda cyhalothrin 9.5% ZC @ 0.04% performed best and provided satisfactory population suppression up to 14 days after treatment. In a second trial, neem oil 1500 ppm @ 0.25% and imidacloprid 6% + lambda cyhalothrin 4% @ 0.06% were found to provide satisfactory control of GAA incidence.

The species diversity of fruit flies was studied with the help of McPhail traps charged with methyl eugenol and protein hydrolysate-based baits and by rearing of fruit larvae from infested fruits of cherry, peach, and apple. In all five species of fruit flies were recovered from the traps and rearing of infested fruits viz., Bactroceradorsalis, Bactrocerazonata, Zeugodacuscucurbitae ,Zeugodacusscutellaris, Zeugodacus tau). The seasonal incidence of Bactroceradorsalis was monitored with the help of McPhail traps charged with methyl eugenol and it was found that the highest fruit fly activity was

noted from August to November. The trapping efficiency of three lures was evaluated against predominate fruit flies in the temperate fruit orchards. The commercial formulation of methyl eugenol was found to trap maximum number of Bactroceradorsalis adults. The yeast + borax trap was able to trap almost equal number of male and female adults of Bactroceradorsalis.

In plant pathology, 203 apple cultivars maintained in field gene bank at ICAR-CITH Srinagar, were screened under field conditions for powdery mildew of apple incited by Podosphaeraleucotricha. Based on three year data, out of 203 genotypes, 50 genotypes were found resistant. In Diagnosis, transmission and management of virus/virus like diseases of temperate fruit crops, biochemical characterization of compatible plant-viral interaction- a case study with ApMV/ApNMV-Apple host-pathosystem20 genotypes of apple was carried out.In this study the significantly higher phenolic contents, flavonoid and flavonol, DPPH activity were recorded from mosaic infected apple genotypes and lesser from their respective healthy plants.The significant loss of chlorophyll was observed in mosaic infected cultivars than their healthy ones. Moreover total starch in infected leaves from all genotypes showed a significant decrease in comparison to the leaves taken from healthy apple trees. The significantly higher level of MDA in all mosaic infected plants and lower levels in healthy plants was observed. Significantly higher PAL activity (6.87-15.66mg/g f.wt) was seen in entire virus infected genotypes in comparison to healthy ones (5.45 15.42 mg/g f.wt). Focusing on enzymatic responses, catalase, peroxidase, SOD and PPO activity were significantly different and higher in mosaic infected plants.

In elucidating the diversity, species spectrum and management of Alternariaspp. infecting apple (MalusdomesticaBorkh.), molecular characterization was done for thirty isolates from all the temperate fruit crops. The BLASTn analysis revealed that our isolates showed sequence similarity with four Alternaria species viz., Alternariaalternata, Alternariaangustivovidea, Alternariatenuissima and Alternariacompactainfecting these crops.The Alternaria alternate was abundant and Alternaria species infected all the temperate fruit crops. The Alternaria alternate andAlternariacompactawere found in Himachal Pradesh associated with ALB of apple. Alternariaalternata and Alternariatenuissimawere found in J&K associated with ALB of apple. Evaluation of various spray scheduled for management of Alternaria leaf blotch in apple using various fungicides under field conditions at different intervals of time was also done and among all the 15 spray schedules evaluated, three schedules managed the ALB disease. However, among the three spray schedules, the schedule started on 5th June was managing the ALB better as compared to other schedules.In Bio prospecting of Rhizo-cum-endosphericMicrobiota of temperate fruit rootstocks for management of soil and foliar diseases ,the rhizospheric and endophytic microbial communities of two apple rootstocks (M27 and MM106) were evaluated against D.necatrix. A total of 475 microorganisms were isolated and evaluated using various tests and five bacterial and five fungal isolates were found effective in inhibiting the pathogen under in vitro conditions. To confirm the identity of isolates, two universal primers were used. The 16s rRNA, 27F (5′-AGAGTTTGATCMTGG CTC AG-3′) and 1492R (5′-CGGTTACCTTGT TAC GACTT-3′) in case of bacteria and ITS1-F (5 ′ - TCCGTAGGTGAACCTGCGG-3′) ITS4-R(5′-TCCTCCGCTTATTGATATGC-3′) in case of fungus was using PCR. The 16s rRNA gene was

amplified from all the five bacterial isolates and an amplicon of 1200 bp was obtained after PCR amplification. Similarly, ITS region was amplified from all the five fungal isolates and an amplicon of 750 bp was obtained. Both the fragments from bacteria and fungi were sequenced and analyzed. All the sequences generated were submitted to NCBI Gene Bank and accession numbers were received. Compatibility was checked between bacterial and bacterial isolates, fungus with fungal isolates and bacteria with fungal isolates. All the bacterial isolates were compatible with each other; similarly, all the fungal isolates were also compatible to each other. However, the test results of compatibility test between bacteria and fungus revealed that all fungal isolates were incompatible with Bacillus subtilis.

Post-Harvest Management

In Development of edible coating enriched with anti-microbial bioactive compounds for various stone fruit, extraction and purification of temperate stone fruit-based gummosis was done. The gummosis samples were collected from sweet cherry, peach, nectarine and apricot orchards. The gummosis samples from sweet cherry trees resulted in production of highest quantity of pure gums, whereas least purified gum quantity was obtained from apricot gummosis. Though the quantity of pure gum from apricot trees was less in quantity but the end product had highest transparency. Similarly, peach and nectarines extracted and washed gummosis had presence of darker tints and sweet cherry has transparency in-between transparency of other three gummosis samples. Besides this, the development and value addition of temperate fruits, possibilities of development of value-added products from sweet cherries, preservation of green almond and preparation of green apple pickle were explored. The process of two value-added products from cherries were standardized i.e. sweet cherry marmalade and sweet cherry preserve. Also, preservation of green almond in brine solution for extending its availability during off-season and pickling of green apple were done. Some plum cultivars were also evaluated based on skin and flesh characteristics.

Extension and other activities

Extension and other activities are the regular features of the institute, so ICAR-CITH, Srinagar and its Regional Stations are continuously transferring various generated technologies using various extension means for popularization of technologies. During 2023, about 14 meetings/events were organized. Among them, ICAR-Industry Stakeholder Consultation Regional Meet, World Intellectual Property Day, Expert delegation on Clean Plant Programme (CPP) Meeting etcwere the major events. A five days training programs entitled High value temperate vegetable crops: production and entrepreneurship for the officers from Department of Agriculture was organized at ICAR-CITH, Srinagar and 4 one day visit/ training programmes were organized for scientists, line department officers and administrative staff from various ministries of Govt of India. Five one day training programme on walnut propagation were conducted for forest departmental personnel in various nurseries(Maldevta, Magra, Sony, Silalekh and Ladiyakata in Uttarakhand. A three days trainingprogramme on Identification of Bioagents using molecular approaches was organized for students/ research scholars at ICAR-CITH, Srinagar. Besides this, 14 ond day visits/ trainings were organized for students of different schools, colleges & universities in different states. A three days training program was organized for Air Force Family Welfare

Association (AFFWA), Srinagar on Postharvest processing and value addition of fruits and vegetables. One day visit/ training program was also organized for ladies from Chinar Core & JAKLI. A five days training programme was organized on innovative production technologies of temperate fruit crops for doubling farmers income for the farmers of Himachal Pradesh from 24th to 28th July, 2023 at ICAR-CITH, Srinagar. One day study cum Farm visit of members of Grapes Grower Association, Maharashtra was organized on 15th June, 2023 in which 48 farmers participated. Three one day training/ visits were organized for farmers from Ut of Ladakh. For the farmers of Jammu&Kashmir, 12 visits/ trainings of one day duration sponsored by various agencieswere organized. At ICAR-CITH, RS Mukteshwar, 10 students visit, one training program of 4 days duration on Training on production techniques of apple and pear was organized. Besides this, 15 farmers visit/ training/ demonstration/ awareness programs, field/ diagnostic visits were organized . At RS Dirang, under NEH scheme, 7 trainings organized in Assam & Arunachal Pradesh and farm inputs/ quality planting material of different fruit crops were provided for the farmers of NEH region. In TSP, 6programmes were conducted for the farmers of district Srinagar, Anantnag, Bandipora&Ganderbal of J&K as well as Leh and Kargil district of Ladakhin which farm inputs/ planting material and trainings were provided. The activities were also carried out under MGMG in Uttarakhand in which eight trainings, 2 diagnostic/field visits three demonstrations were conducted and more than 99 farmers of Sunkiya village were benefited. Under SCSP scheme, two programs in J&K and 4 programs in Uttrakhand were organized and farm inputs were provided to the 794 beneficiaries.During the year , scientists of Institute published 31 research papers, 3 review papers, 8 book chapters and 10 Bulletins/ popular articles/ phamplets etc. In addition to various appreciations, the scientists of ICAR- CITH, Srinagar received 3 awards during the year. Besides providing need based information through various social media, scientists of Institute have delivered 17 TV/Radio talks. About 7645 farmers/ visitors visited ICAR-CITH, Srinagar during 2023.Total seven exhibitions were also organized at various occasions

INTRODUCTION

2

The horticultural scenario of India is changing at a faster rate year after year and country is the second largest producer of horticultural crops in the world. It became possible due to varied agro climatic conditions suitable for growing of a large number of horticultural crops. Total horticulture production in the year 2022-23 is estimated to be 355.48 million tons with an increase of about 8.30 million tones (2.39%) as compared to the year 2021-22. The globally fruit crops covered an area of about 68.05 million ha, producing 867.77 million MT annually. India's fruit production is about 110.20 million MT from an area of 7.03 million hectare with an average productivity of 15.682 t/ha. Indian Himalayan region offers vast opportunities for cultivation of temperate horticultural crops including fruits, vegetables, ornamental crops and medicinal and aromatic plants. The predominant fruit crops include apple, pear, peach, plum, apricot, cherry, almond and walnut. The Indian Himalayas lies between latitudes 26o20' & 35o40' N and between longitudes 74o50' & 95o40' E starting from foot-hills in the south (Siwalik's) towards the region extends to Tibetan plateau in the north (trans-Himalaya) comprising about 95 districts of the country. The fragile mountains contribute about 16.2% of India's total geographical area, and most of the area is covered by snow-clad peaks, glaciers of higher Himalaya, dense forest cover of mid-Himalaya.

Temperate fruits growing in India are spread over mainly in Jammu & Kashmir, Himachal Pradesh, Uttarakhand, Ladakh, Sikkim and Arunachal Pradesh having major share in production of temperate fruit. With relative advantage in the region due to climate, a large number of temperate fruits are grown. There are several dozens of temperate fruit crops from pome, stone, nuts, berries and other groups. However, only 25-30 fruits/nuts are commercially grown around the world for fresh fruits as well as processed products. Due to less chilling requirements, some temperate fruit crops are also being grown in subtropical/ warmer climate areas, hence some low chilling crops and varieties are also grown in other states also. The total temperate fruit production in India is 3417.91 thousand metric tons from an area of 520.92 thousand hectares. The average productivity is 6.56 t/ha and ranged from 1.20 t/ha (West Bengal) to 21.09 t/ha (Punjab). The maximum productivity among the different states was recorded in Punjab (21.09 t/ha) followed by Haryana (14.27 t/ha), Tamil Nadu (14.27 t/ha), Madhya Pradesh (11.54 t/ha), Manipur (10.45 t/ha), J&K (8.28 t/ha), Nagaland (6.99 t/ha), Himachal Pradesh (4.51 t/ha), Chhattisgarh (4.05 t/ha). The low productivity levels are mainly from high chilling areas (J&K, HP, UK and Arunachal Pradesh) as compared to low chill areas located in Punjab, Haryana and Tamil Nadu.

Although there is increase in area and production after independence due to various R&D activities but it is not sufficient to feed the increasing population and there is sufficient scope for its expansion. During 2022-23, among the temperate fruit crops, the maximum average productivity was recorded in apple (9.13 t/ha) followed by pear (7.74 t/ha), peach (6.37 t/ha), plum (3.61 t/ha), kiwifruit (3.6 t/ha). However, the minimum productivity levels generally recorded in nut crops viz. almond (1.2 t/ha) and walnut (3.25 t/ha). The commodity based largest producer's states are

J&K for almond, apple and walnut; Arunachal Pradesh for kiwi fruit; Punjab for pear and peach; Himachal Pradesh for pecan and Uttarakhand for plums. The data regarding apricot is not available; however, Ladakh is the largest apricot producing area in the country. The maximum area is covered by apple (315 thousand ha) followed by walnut (97 thousand ha), pear (35 thousand ha), plum (18 thousand ha), peach (16 thousand ha), almond (10 thousand ha) and strawberry (2 thousand ha). Similarly in production, the largest volume is made up of apple (2876 thousand MT) followed by walnut (316 thousand MT), pear (271thousand MT), peach (102 thousand MT), plum (65 thousand MT), kiwifruit (18 thousand MT), strawberry (19 thousand MT) and almond (12 thousand MT). Similarly the area of vegetable crops is estimated as 11309 thousand ha with production of 212548 thousand MT, flower crops as285 thousand ha with production of 3097 thousand MT, plantation crops 4531 thousand ha with production of 17049 thousand MT, spices 28438 thousand ha with production of 355482 thousand MT. The productivity the temperate horticultural crops is low as compared to advanced counties and there is a great scope to enhance the productivity through research & technological support.

Keeping in view the importance of the temperate horticultural crops with respect to involvement of major population and their contribution towards national economy, a separate institution i.e ICAR-Central Institute of Temperate Horticulture, Srinagar with its two Regional Stations at Mukteshwar, (Uttarakhand) and Dirang, (Arunachal Pradesh) is playing a great role in designing and developing research programmes on crop improvement, production, protection and post-harvest management for achieving economic and nutritional security in the entire Himalayan region by enhancing the productivity of quality produce. Institute is mainly focussing on research and development in temperate fruits, nuts, vegetables, ornamentals, medicinal & aromatic plants and saffron. To overcome the production constraints and to improve quality of produce, the research on temperate horticultural crops is being carried out both at main campus Srinagar and at its Regional Stations with the following mandate and objectives:

Mandate

- To act as national repository of germplasm and scientific information on temperate horticultural crops.
- To undertake basic, strategic and applied research on temperate horticultural crops in collaboration with national and international agencies to enhance productivity and quality.
- To serve as centre of training for human resource development and transfer of technology.

Objectives

- Establishment of field gene bank and management of genetic resources and scientific data base of temperate horticultural crops.
- Genetic improvement of temperate horticultural crops for yield, maturity, quality, resistance to biotic and abiotic stresses through conventional breeding methods and biotechnological tools.
- Standardization of nursery management and high tech propagation techniques of temperate horticultural crops.
- To device efficient and cost effective production technologies and cropping systems for increasing productivity and improving quality of temperate horticultural

crops.

- To develop eco-friendly integrated diseases/pest management modules and diagnostics.
- Post-harvest value addition, product diversification and waste utilization for increasing availability and returns.
- To work out economics of production and impact assessment of technologies.
- Commercialization and transfer of technologies and skilled manpower development.

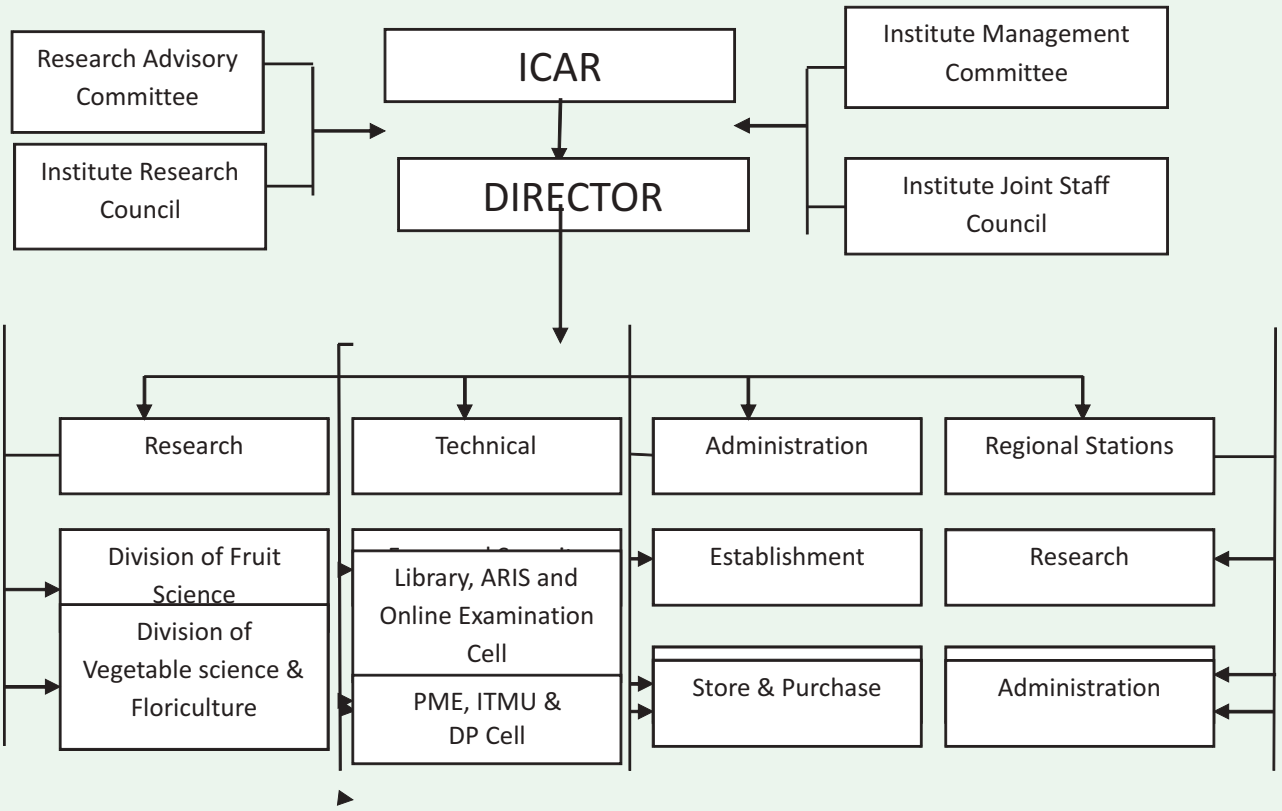
Staff Position (as on 31st December, 2023)

Category	Sanctioned	Filled (as on 31st December, 2023)	Vacant (as on 31st December, 2023)
Scientific	33+1RMP	18+1	21+1 RMP
Administrative	19	11	8
Technical	16	9	7
Supporting	11	11	0
Total	79+1RMP	43	36+1RMP

Financial Statement (2023-24)

S. No.	Sub-Head	Expenditure (Rs in Lakhs)
1	Capital	120
2	Establishment Charges	666.54
3	T.A.	44.55
4	Research & Operation Expenses	345.70
5	Administrative Expenses	288.35
6	Miscellaneous Expenses	6.40
7	Pension	6.43
8	Loans and Advances	1.50
	Total	**1479.47**

ORGANOGRAM OF CITH



RESEARCH ACHIEVEMENTS

3

I. Crop Improvements

The varied climatic conditions of the India offer a great scope for cultivation of a large number of crops especially horticultural crops. Horticulture is considered as one of the fast growing and high returning enterprise and important source of economy and nutritional security.Total horticulture production in the year 2022-23 is estimated to be 355.48 million tons with an increase of about 8.30 million tones (2.39%) as compared to the year 2021-22.The commercial production and the returns of any crop largely dependent upon the genetic potential of the variety/ genotypes. Hence the, crop improvement which leads toproduction of elite genotypes through various breeding methods and tools plays an important role for quality production of produce. Breeding of genotypes in fruit crops with desirable traits is a complex and time consuming process due to long juvenility period. The Himalayan states are suitable for cultivation of large number of temperate fruits, vegetables, ornamentals, medicinal and aromatic crops as well as much other horticulture based enterprises. In these area many temperate fruit crops like apple, pear, plum, apricot, cherry, peaches, walnut, almond, kiwifruit, persimmon, strawberry and other minor temperate fruit & nut crops are being grown. But as far as area, production and share is concerned; apple, walnut and up to limited extent pear have monopoly in area and production followed by plum, peach, almond and kiwi fruit. The productivity of temperate fruits crops in India is low as compared to other advanced countries due to many reasons and superior cultivar with high productivity potential is one of them. ICAR-CITH, Srinagar along with its Regional Stations situated at Mukteshwar (Uttarakhand) and Dirang (Arunachal Pradesh) are continuously engaged for identification/ production of superior cultivar/ genotypes and have played a great role in past by recommending region specific cultivars for boosting farmers economy. The research work carried out during 2023 at main campus and its regional stations is presented project wise below:

Survey, collection, evaluation, characterization and documentation of temperate horticultural crops

The temperate horticulture is the backbone of farmers of hill region and the plant genetic resources are among the precious resources of any country to cater their present and future need. India is country having diverse climatic conditions offers suitability for growing a large number of horticultural crops and has great diversity in many crops. But the diversity in some exotic crops in india is less as compared to indigenous crops.ICAR-CITH, Srinagar is National Active Germplasm Site for temperate fruit crops. To utilize the available diversity in temperate horticultural crops as well as its conservation for future use, ICAR- CITH , Srinagar along with its regional stations is continuously enriching germplasm wealth. Continuous efforts are going on for collection, evaluation, characterization and documentation of germplasm in temperate horticultural crops.During 2023, 53germplasm of different fruit, vegetable& ornamental crops were collected and introduced at ICAR- CITH, Srinagar in the form of plant/ scionwood/ bulbs/

runners/seeds etc. The details of new germplasm added in various categories is presented in Table1. To enrich the germplasm status of ICAR-CITH, Regional Station, Mukteshwar and Dirang, germplasm banks were enriched. Evaluation work was carried out in different crops on various parameters and some of them seem to be promising for future use.

Table 1.Germplasmstaus at ICAR-CITH, Srinagar (2023)

Sr No	Group	Germplasm Status (2022)	Added during 2023	Germplasm Status (2022)
1	**Fruits**	**1396**	**19**	**1415**
	Pome fruits	476	8	484
	Stone fruits	296	11	307
	Nuts	413	-	413
	Others	211	-	211
2	**Vegetables**	**1150**	**22**	**1172**
3	**Ornamentals**	**343**	**12**	**355**
4	**Medicinal and aromatic plants**	**33**	**-**	**33**
Total		**2922**	**53**	**2975**

Apple

Evaluation of apple varieties under HDP on Tall Spindle System of canopy management

In apple, eight varieties namely Gala Redlum, Super Chief, Red Velox, Golden Delicious Reindeers, Elstar, Jona Red Prince, Pinnova and Golden Delicious Clone B were evaluated on Tall Spindle System. Highest TSS was noticed in Golden Delicious Clone B (16.033 B) and lowest (12.6 B) in Super Chief. Highest yield (86.5 t/ha) was recorded in apple variety Gala Redlum. (Table 2)

Evaluation of columnar apple cultivars for physicochemical characteristics

Four columnar apple cultivars viz; Redlane, Goldlane, Sunlight and Moonlight were evaluated for fruit quality traits like TSS, acidity, pH, firmness, ascorbic acid, color and biochemical parameters which include antioxidant potential along with total phenols, flavanoids and flavanols (Table3).The antioxidant potential of these varieties was found to be high (Table 3). Since the consumer acceptability of columnar varieties is the major issue owing to low TSS and high acidity, however in present study TSS range from 10oB (Sunlight) to 14oB (Moonlight) and acidity ranged from 0.24% Redlane) to 0.37% (Sunlight). Among the four varieties tested it was found that Moonlight is having maximum consumer acceptability (higher TSS/acidity) and market demand (higher firmness; 72.5 RI).

Table 2.Performance of apple varieties under tall spindle system

Varity	TSS (°B)	Color			Tint	Fruit weight (g)	Firmness (psi)	No. of Fruits per plant	Yield (t/ha)
		l	a	b					
Red Velox	15.833^{a}	33.62^{e}	21.173^{c}	7.3^{d}	-94.11^{bc}	151.333^{b}	74.333^{ab}	90^{c}	46^{c}
Super Chief	12.6^{b}	35.287^{e}	24.63^{bc}	8.993^{d}	-102.42^{c}	166.333^{b}	78^{a}	95^{bc}	53^{c}
Elstar	15.733^{a}	42.523^{d}	42.03^{a}	20.65^{c}	-163.7^{cd}	142.667^{b}	64.333^{c}	96^{bc}	46^{c}
Pinnova	14.867^{a}	65.223^{b}	26.69^{b}	45.373^{a}	-30.32^{ab}	158.333^{b}	69.333^{bc}	98^{bc}	52^{c}
Red Jona Prince	14.867^{a}	53.18^{c}	39.35^{a}	28.44^{b}	-138.9^{cd}	281^{a}	55^{d}	66^{cd}	62^{b}
Golden Delicious Clone B	16.033^{a}	70.74^{a}	-0.29^{d}	43.683^{a}	-13.2^{a}	144^{b}	74.043^{ab}	56^{d}	27^{d}
Gala Redlum	15.967^{a}	37.94^{e}	42.637^{a}	20.78^{c}	-193.6^{d}	166^{b}	77.667^{a}	156^{a}	86.5^{a}
Golden Delicious Reindeers	15.5^{a}	72.32^{a}	-20.32^{e}	46.87^{a}	-14.85^{a}	132^{b}	15.067^{e}	110^{b}	48.5^{c}

View of HDP with Tall Spindle System and fruiting in different apple cultivars

Table 3.Physico and biochemical parameters of Columnar Varieties

Parameters		Redlane	Goldlane	Moonlight	Sunlight
Weight(g)		55.66^{c}	137.81^{a}	59.58^{c}	81.34^{b}
Length(mm)		45.23^{b}	60.80^{a}	34.67^{b}	57.97^{a}
Breadth(mm)		51.05^{a}	63.76^{a}	42.88^{a}	63.23^{a}
TSS (^{0}B)		12.3^{c}	13^{b}	14.03^{a}	10.3^{d}
Firmness (RI)		60.83^{c}	68.16^{b}	72.5^{a}	69.8^{ab}
pH		3.05^{b}	3.11^{ab}	3.16^{ab}	3.19^{a}
Acidity (%)		0.24^{c}	0.32^{ab}	0.25^{bc}	0.37^{a}
Ascorbic Acid (mg/100g fw)		16.33^{b}	23.33^{a}	18.03^{ab}	18.23^{ab}
Color	l	35.35^{c}	72.25^{a}	52.31^{b}	69.73^{a}
	a	21.89^{a}	-6.46^{b}	17.95^{a}	-8.53^{b}
	b	6.95^{c}	42.46^{a}	23.45^{b}	42.39^{a}
	tint	-91.95^{b}	-4.85^{a}	-63.11^{b}	3.64^{a}
Phenols (mgGAE/gFW)		2.83^{b}	3.43^{a}	2.00^{c}	1.83^{d}
Flavanoids (mgQE/gFW		0.18^{a}	0.11^{bc}	0.17^{ab}	0.10^{c}
Flavanols (mgQE/gFW		0.03^{b}	0.05^{b}	0.08^{b}	0.23^{a}
% Scavenging activity		83.03^{b}	93.41^{a}	92.43^{a}	94.00^{a}

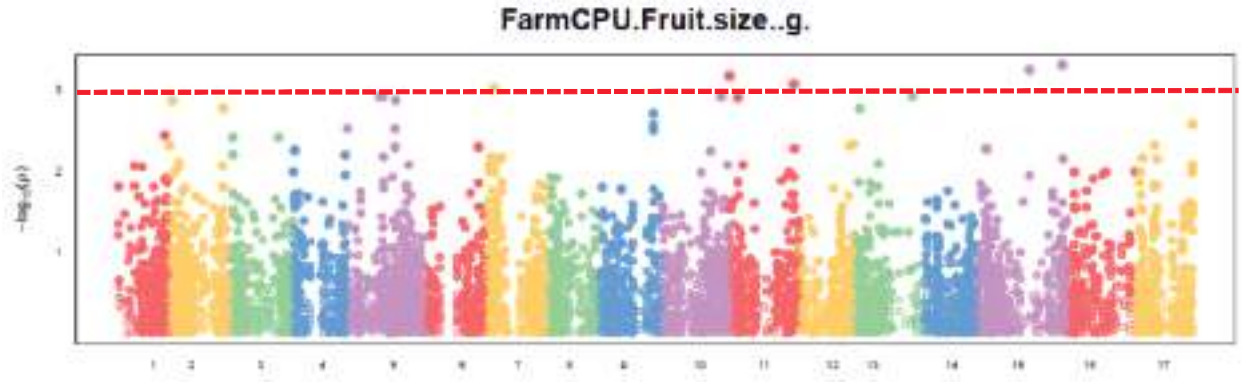
GWAS analysis in apple for fruit size and TSS

GWAS was performed to identify SNPs that are significantly associated with fruit weight and TSS using generalized linear model (GLM) [a], mixed linear model (MLM) [b] and fixed and random model circulating probability unification (FarmCPU) [c] models executed in GAPIT3. It uses the K-PC model that used kinship information together with first three principal components (PC) as covariates for GWAS analysis. GWAS was carried out to locate high-quality SNPs that are significantly associated with fruit size and TSS in apple. Thus, FarmCPU, MLM and GLM models were tested by GAPIT 3. It was observed that total 10 significant SNPs were present. Details of this are provided in Table 4 and are graphically shown in Manhattan plot in Figure 1. It was observed that fruit size trait 5, 14 and 11 chromosomes more significantly.

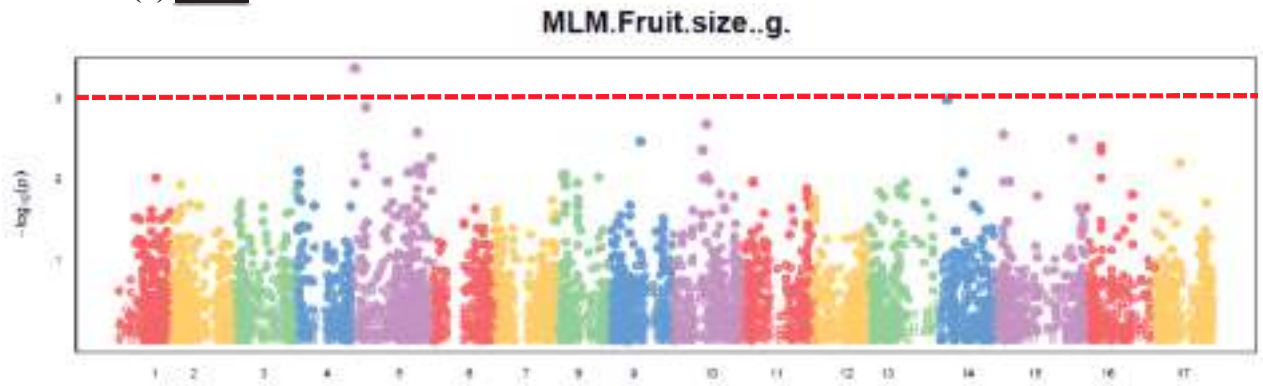
Table 4.List of significant markers for association analysis of fruit size trait

GLM				
SNP	Chromosome	Position	P.value	maf
S05_2349203	5	2349203	0.000434	0.265487
S14_4625359	14	4625359	0.000892	0.017699
S14_4625468	14	4625468	0.000892	0.017699
MLM				
S05_2349203	5	2349203	0.000439	0.265487
Farm CPU				
S00_16011255	0	16011255	0.000206	0.132743
S15_51676517	15	51676517	0.000502	0.495575
S15_31751882	15	31751882	0.000574	0.380531
S11_2665	11	2665	0.000684	0.39823
S11_39019813	11	39019813	0.000866	0.137168
S07_4780405	7	4780405	0.000973	0.199115

(a) Farm CPU



(b) MLM



(a) GLM

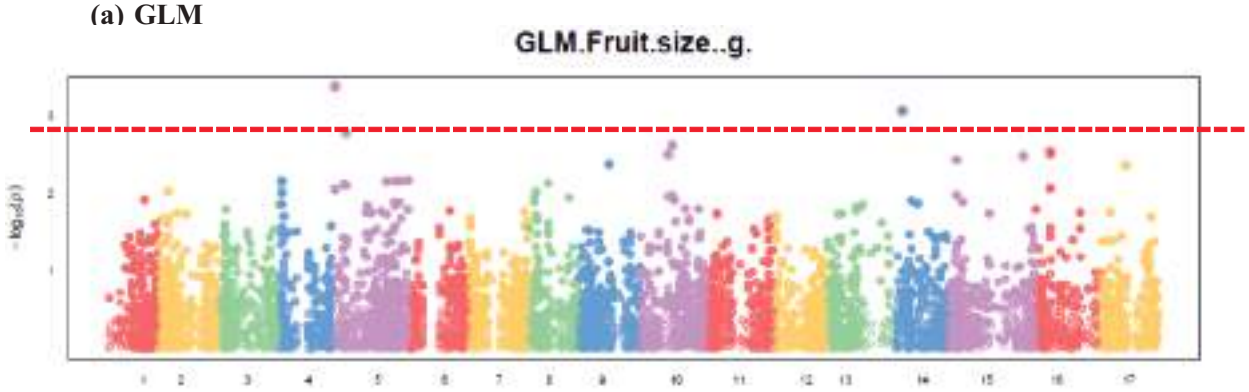
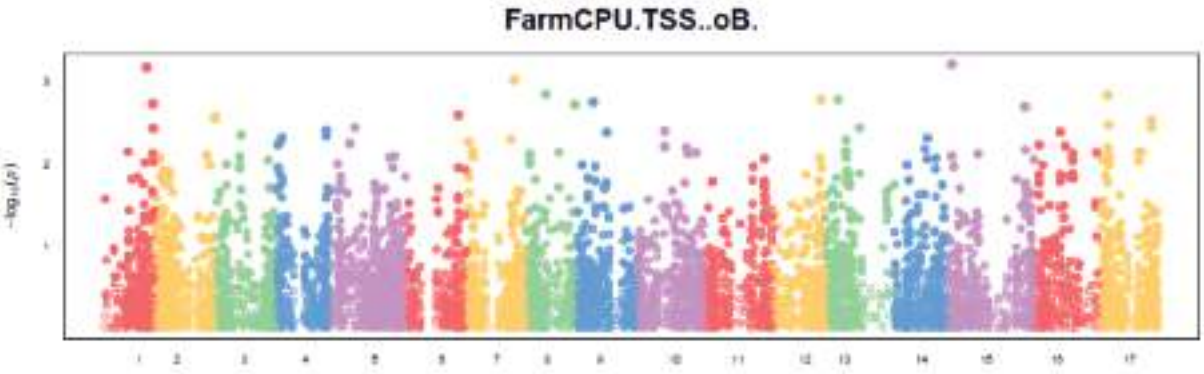


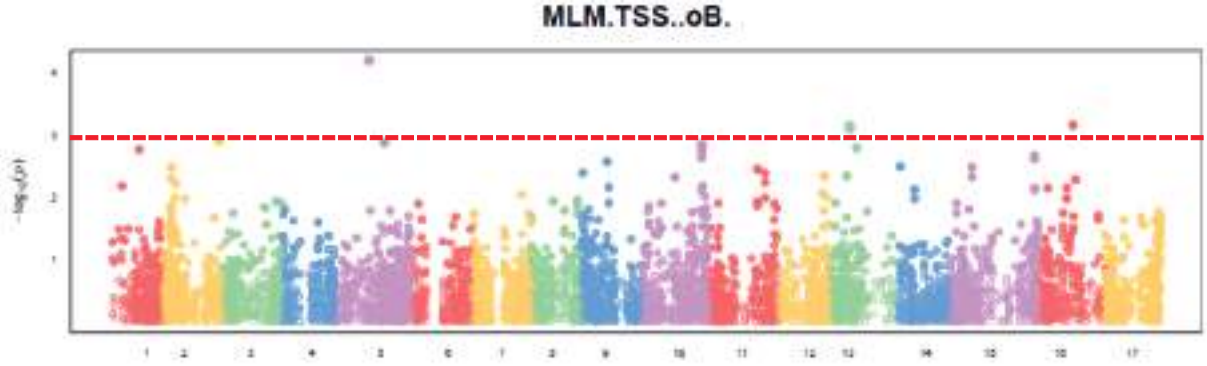
Figure 1.Genome wide distribution of SNPs for fruit size

While considering studies for TSS, 12 significant SNPs at Log10(P) = 3 for for GLM, MLM and FarmCPU models. These 12 significant SNPs have been depicted in Figure 2 (a, b and c) and with more details in Table 5 below.

(a) FarmCPU



(a) MLM



(b) GLM

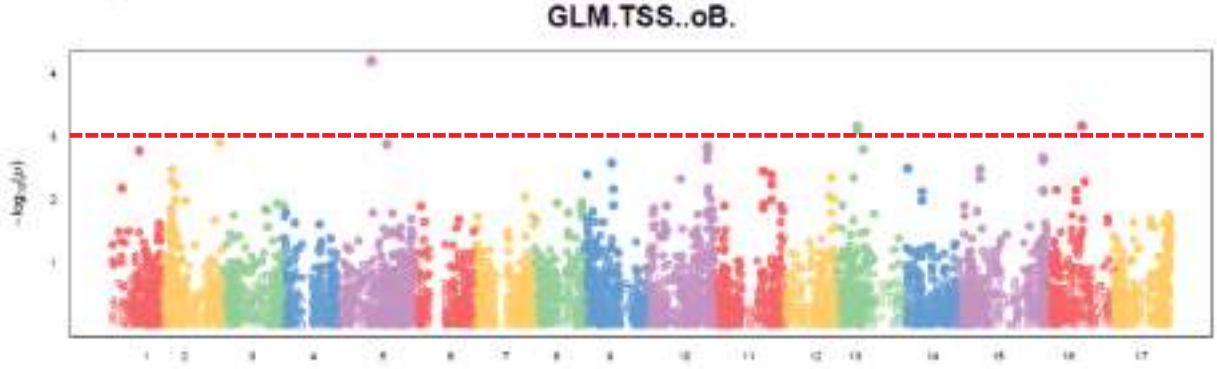


Figure 2. Genome wide distribution of SNPs for TSS trait

Table 5. List of significant markers for association analysis of TSS trait

GLM				
SNP	Chromosome	Position	P.value	maf
S05_21297013	5	21297013	6.24E-05	0.433628
S16_21843746	16	21843746	0.000678	0.106195
S13_12715363	13	12715363	0.000686	0.5
S13_12715471	13	12715471	0.000786	0.495575
MLM				
S05_21297013	5	21297013	6.24E-05	0.433628
S16_21843746	16	21843746	0.00067822	0.106195
S13_12715363	13	12715363	0.00068625	0.5
S13_12715471	13	12715471	0.00078596	0.495575
FarmCPU				
S15_3258120	15	3258120	0.000626	0.345133
S01_27833798	1	27833798	0.000684	0.061947
S07_29875262	7	29875262	0.000967	0.159292
S08_12800829	8	12800829	0.001448	0.115044

In another study,58 apple genotypes were evaluated for nine fruit traits viz., Weight, Length, Breadth, Firmness, L, a, b, Tint and TSS content and molecularly characterised using 53 SSR markers for diversity analysis.Population structure analysis using 'Evanno method' revealed 2 sub-populations within the diversity panel (Fig. 3). Association analysis using three different models revealed total three significant marker-trait associations; out of which, only one SSR marker GD6 was consistently found to be significantly associated with fruit length trait (Table 6). The SSR marker data developed in this study shall assist in saturation of the genotype-by-sequencing (GBS) data based GWAS study which is underway shall help identification of more significant marker-trait associations, marker-assisted breeding and genotype construction.

Table 6.Significant marker-trait associations for fruit traitsusing three different GWAS models.

Model	Trait	Marker (SSR)	P-value
GLM	Length	GD6	4.81e-05
	b	CN921650	0.00043
MLM	Length	GD6	8.40e-05
MLMM	Length	GD6	1.14e-06
	L	CN921650	0.000487
	b	CN921650	0.000321

Pear

During the year 2023,seven asian pear varieties were evaluated for different quality related attributes and cultivar BadshahNakh exhibited the highest recorded values for fruit weight (158.68g), fruit length (77.01mm) and fruit diameter (64.79mm) while the cultivar Punjab Soft displayed the minimum values for these attributes, with fruit weight at 73.39g, fruit length as 56.68mm and fruit diameter as 51.12mm. In terms of pedicle length, maximum pedicle length (48.81mm) was recorded in Punjab Soft and minimum (20.69 mm) in Punjab Beauty. Among colour characteristics (L*, a*, b* and tint), L* values ranged from 48.39 in Badshah Nakh to 56.50 in Punjab Nectar. The a* value ranged from -8.84 in Badshah Nakhto -2.39 in Chinese Sand Pear. Values for b* scale ranged from 27.18 in Chinese Sand Pear to 32.49 in Punjab Soft. Values for Tint ranged from (-8.53) in Chinese Sand Pear to (10.85) in Badshah Nakh. Fruit firmness among

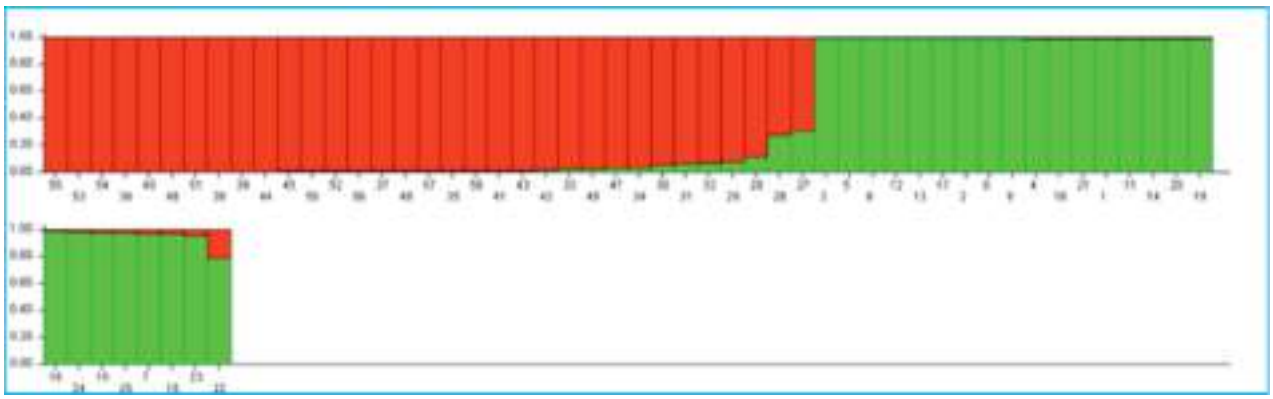


Fig. 3.Population structure of 58 apple cultivars using 53 SSR markers.

the pear cultivars ranged from 60.53lbs in Punjab Soft to 66.50lbsin Badshah Nakh. The highest total soluble solids (TSS) of 14.53° B was recorded in Kashmiri Nakh whereas the lowest TSS of 10.70° B was observed inPunjab Beauty. The highest acidity (0.71%) was found in Badshah Nakh while the lowest (0.29%) was recorded in Kashmiri Nakh. Highest juice percent (64.65%) was recorded in Punjab Soft and lowest (50.53%) was recorded in Chinese Sand Pear.As for ascorbic acid content, Punjab Nectar showed highest (15%), followed by Punjab Gold, Kashmiri Nakh, Badshah Nakh and Chinese Sand Pear (14%). The minimum ascorbic acid content was found in Punjab Soft and Punjab beauty (13mg/100g).Among10 European pear cultivars maximum fruit weight. (181.92 g) was recorded in Max Red Bartlett and fruit length (100.58mm) in cultivar Vicker of Winfield and maximum fruit diameter (70.81mm) in cultivar Gent Drouard and minimum fruit weight (86.82g) , fruit length (51.85mm) and fruit diameter (55.26mm) was recorded in cultivar Doyenne Burrah. Maximum pedicle length (39.95mm) was recorded in cultivar fertility and minimum (23.21mm) in Gent Drouard. Among colour characteristics (L*, a*, b* and tint) , L* values range from (33.44) in Starkrimson to (59.25) in Le Conte, a* value ranged from (-7.44) in Santya Braskaya to (14.73) in Starkrimson. Values for b* ranged from (4.18) in Starkrimson to (33.42) in Sanataya Braskaya. Values for tint ranged from (-60.83) in Starkrimson to (2.25) in William Bartlett. Fruit firmness among the pear cultivars ranged from 39.37RI in Doyenne Burrah to 70.77lbsin Star krimson. The highest total soluble solids (TSS) of 14.8° B was recorded in Starkrimson whereas the lowest TSS of 11.23° B was observed in Doyenne Burrah. The highest acidity (0.42%) was found in Doyenne Burrah while the lowest (0.25%) was recorded in Gent Drouard. Highest juice percent (70.11%) was recorded in Doyenne Burrahand lowest (40.36%) was recorded in Gent Drouard.

Apricot

In apricot, 70 genotypes including two new selections made during 2023 were evaluated for various fruit and yield traits and various parameters varied from genotype to genotype. CITH A 1 produced fruits weighting about 92.94g , CITH A-2 (74.55g), CITH A 3 (67.97 g), CITH A 36 (71.73g) &Harcot (71.05 g) . Two new selections were made during the year which have fruit weight of 108.67 g and 47.5 g. Both of these apricots produced fruits having sweet kernels. Among these 70 genotypes, 24 produced fruits with bitter kernel and 46 with sweet kernel. Most of genotypes have single kernel but 18 genotypes produced double kernels.The TSS was higher in Genotypes PAS followed by CITH A 33 and CITH A 11.

Peach

In peach, seven new cultivars (Venture, Victoria, Blazing Star, Loring, Glenglo, Glowing Star and F Fury) were evaluated for various fruit and yield

Punjab Gold

Punjab Nectar

Punjab Beauty

Fruits of some Asian pear cultivars

Fertility

SantyaBraskaya

Fruits of some European pear cultivars

traits which were planted during 2021-22. The fruit weight in these cultivars varied from 54.01g in Blazing Star to 127.3g in Venture. The TSS was highest in Victoria while minimum in Blazing Star. Fruit firmness was recorded highest in Victoria while minimum stone weight was recorded in Blazing Star (4.59g) and maximum in Venture (7.89g).The fruit number per plant was highest in F Fury and minimum in Venture. Hence, maximum yield per plant was recorded in F Fury (5.84kg) followed by Venture (5.65 kg), Victoria (4.91 kg), Glenglo (4.73 kg), Blazing Star (4.02 kg) and minimum in Loring (3.48 kg). Among all cultivars, Glenglo (first week of July), F Fury and Blazing Star(2nd week of July) were early in maturity, Loring, Venture &Glowing Star were mid in maturity (3rd week of July) while Victoria was late in maturity (3rd week of August). Shelf life was also found more in Victoria and minimum in Glenglo.

Besides this, 21 peach and 4 nectarine cultivars were alsoevaluated for various fruit and stone traits. The heaviest fruits were produced by Kanto 5 (116.58g) followed by Nimla (111.37g), Cresthaven (106.55 g), Red Globe (102.37 g) and Glohaven (101.81 g). Among nectarines heaviest fruits were produced by Silver King (94.24 g) followed by Fantasia (91.83 g). TSS was found highest in Florida Sun andfirmness in Belle of Georgia. Paradelux and Nimla were found to be higher yielders.

Plum

In plum, 32 cultivars and 3 cultivars of plumcot were evaluated for various traits. Among plumcots, FlorTsiraj produced heaviest fruits of 25.03g followed by Mirocais (18.22g) and DPRU-0708 (15.60g). The yield was also higher in FlorTsiraj followed by DPRU0708 and Mirocais. Among 32 plum cultivars , heaviest fruits were producedby Au Rosa, Mariposa and Red plum. The high yielding cultivars were Red plum, Monarch, Au Rosa, Santa Rosa, Terrol, Auruburum, Green Gage, Stanley, Black Beauty, Burbank and Red Beaut. Among all cultivars, Abundance & Red Plum matures in ending June while Stanley, Mariposa and Angelino mature during August and other cultivars mature during July. Based on maturity combination of cultivars can be planted for extending availability period of fresh plums in the market.

Olive

In olive, out of 18 cultivars, 14 cultivars fruited and were evaluated for various fruit and yield traits. The heaviest fruits were produced by cultivar Cipressino (5.18g). The other cultivars which produced fruits having size more than 3 g were Zaituana (4.16 g), Leccino (3.06g), Belice (3.04 g) while fruits having lowest weight was produced by cultivar Koroneik (0.738g). Based on average yield, Coratina was found highest yielder (12.9 kg/ plant) followed by Pendolino (8.82 kg/plant), Etnea (6.30 kg/ plant), Cerigonola (5.1 kg/ plant), Zaituna (5.3kg/ plant) and Frontoio (5.0 kg/ plant). Highest pulp percentage (82.70 %) and pulp : stone ratio (4.82: 1) were recorded in cultivar Cipressino. Other fruit and stone parameters also varied from cultivar to cultivar.

Almond

In almond 12 cultivars and 15 selections were evaluated for various nut and kernel traits. Among cultivars highest nut weight (3.61g) and kernel weight (1.87g) were recorded in Primorskij while kernel recovery was more in Non Pareil (58.76 %). Highest average yield was recorded in Darek followed by Merced and IXL. Among selections, nut weight was found to be highest in CITH A 16 while kernel weight was more in CITH A 19.Kernel percentage was more in CITH A 21.

Walnut

In walnut, 187 genotypes/ varieties were evaluated for floral traits and were categorized on the basis of degree of heterodichogamy. Among all, fifteen genotypes (8.02%) have dichogamy between 0to 10 percent, 36 genotypes (19.25%) were in group having dichogamy between 11 to 40 per cent, 42 genotypes (22.42%) were in dichogamy group of 41 to 70 percent and 94 genotypes (50.26%) were in group having dichogamy between 71 to 100 percent. In general categorization, 128 genotypes (68.44%) were protandrous, 55 (29.41%) were protogynous and 4 (2.13%) were homogamous. As far as nut and kernel traits is concerned,260 genotypes including varieties were evaluated. The nut weight varied from 4.77g to 26.76g, kernel weight from 2.64 g to 12.76g and kernel percentage from 29.67 to 72.73 per cent. Fifteen genotypes/ varieties produced nuts having weight more than 18g while 25 genotypes produced nuts having kernel weight more than 8 g.The kernel recovery was more than 50 percent in 69 genotypes. Besides released varieties, the other genotypes which seems to be promising for commercial production based on desirable traits are CITH-W-12, CITH-W-31, CITH-W-36,CITH-W-62, CITH-W-80, CITH-W-100, CITH-W-118, CITH-W-121, ABB-2,ABB-3, RSH-9,KGM-1& 38/2. For higher yield (no. of nuts /plant), CITH W-121 and MBL 2/1 were found promising.

Pistachio

In Pistachio, there are total six selections out of which four were female and two were male. The Selections which produced sound nuts were CITH Pistachio 1, CITH Pistachio 2, CITH Pistachio 4& CITH Pistachio 6. The heaviest nut and kernels (0.77g& 0.347 g) were produced by CITH Pistachio 1 while highest kernel percentage was maximum (54.18%) in CITH Pistachio 6.

Hazelnut

In hazelnut, 9 cultivars were evaluated for various nut and kernel traits and heaviest nuts and kernels were produced by cv Ennis (3.85g & 1.67g) while maximum kernel recovery and minimum shell thickness was obtained from nuts produced by cv. Butler (51.53 % & 1.33mm).

ICAR-CITH, RS Mukteshwar

During 2023, collection of germplasm was carried out in the form of plants/ scion wood/ runners in various crops like apple, pear, peach, plum, apricot, walnut, strawberry and chestnut and about 65 genotypes were collected and planted/ propagated in the nursery. Besides this, different genotypes under various horticultural crops were maintained at ICAR-CITH, RS Mukteshwar.

Nuts & kernel of Butler and Ennis

Evaluation of temperate fruit germplasms

Evaluation work wascarried out in fruit crops such as apple, peach, plum, and kiwi fruit for various physio-chemical traits under mid hill conditions of Uttarakhand. In apple, 22 apple cultivars belonging to Delicious group, spur type and colour strains were evaluated for various qualitative & quantitative traits during 2023. The maximum fruit weight (167.79 g), fruit diameter (74.67 mm), fruit length (64.16 mm) were recorded in CITH Lodh Apple-1 The maximum fruit T.S.S. (12.00 °B) was recorded in Oregon Spur and Glosteras compared to other apple cultivars.Apart from this, total eleven new cultivars were also evaluated in which the highest fruit weight was recorded in Adams apple (190.95 g) followed by Scarlet Spur-II (175.31 g) and Mema Gala (169.76 g).

In peach, total five cultivars namely Red June, FLA-16-33, Flordasun, Flordaking, and Reliance were evaluated during 2023. The maximum fruit weight (159.08 g), fruit diameter (62.95 mm), fruit length (63.16 mm) were recorded in Reliance and the maximum TSS (10.93 °B) and total sugar (5.06%) were recorded in Red June as compared to other cultivars respectively. In plum, total six cultivars were evaluated and based on the physico-chemical characteristics of fruits, the highest fruit weight (61.27 g) were recorded in Santa Rosaand TSS (11.07 °B) were reported in RamgarhMonarh as compared to other plum cultivars respectively. In apricot, total seven cultivars evaluated for physico-chemical characteristic and highest fruit weight and TSS were found in ChaubatiaMadhu as compared to other cultivars, respectively.

In Walnut, Total ten cultivars were evaluated, the maximum plant height was recorded in CITH W-10 (247.98 cm) followed by CITH W-9 (210.17 cm), CITH W-8 (203.45 cm), CITH W-7 (178.45 cm) and CITH W-4 (175.13 cm) respectively. The maximum number of shoot/plant was recorded in CITH W-7 (13.67) followed by CITH W-10 (11.67) and CITH W-6 (11.33), respectively. The highest nut weight was recorded in CITH W-10 (23.8 g) followed by CITH W-9 (23.5 g) and CITH W-1 (22.5 g), however, the highest number of nut per plant were recorded in CITH W-4 (12.33) followed by CITH W-5 (7.67) and CITH W-6 (7.50) respectively. In kiwifruit total five cultivars were evaluated and based onphysico-chemical characteristics of fruits Hayward, Abbot and Bruno were found superior as compared to other cultivars. The highest fruit weight (75.82 g) wasfound in Hayward, however, highest TSS were found in Abbot (15.10 °B) and Bruno (14.5 °B), respectively as compared to other cultivars.

ICAR-CITH, RS Dirang

A survey was carried out for the collection of wild kiwi germplasm and wild raspberries at Mandala Top, Lubrang village around Dirang, West Kameng district in the month of June 2023. Different genotypes of raspberries and both male and female wild kiwifruit plants were identified. Cuttings, both softwood and hardwood, were obtained from various raspberry and wild kiwifruit plant varieties. These cuttings were then brought to CITH RS Dirang for further multiplication.

Different types of wild raspberries found during survey

Variation in flower structure and colour in different berries

Variation in fruit in different berries

Besides this, an Asian pear genotype which was growing at ICAR-CITH RS Dirang, West Kameng was evaluated for various fruit traits. The pear fruit (Asian) were harvested on 3rd August, 2023. The genotype produced fruits having weight116.45g, fruit length (70.11mm), fruit diameter (58.22mm) and TSS (12.440 B) has been recorded.

Vegetable crop

ICAR-CITH, Srinagar

At ICAR-CITH Srinagar, the germplasm of vegetable crops (kale, pea, root and exotic vegetables) collected under this project were maintained and evaluated under field conditions. The results of evaluation are briefly presented below:

Kale

The genotypes expressed variability for these traits indicating potential differences in plant morphology and yield-related traits. The highest yielding check was HanzHak (394.05 q/ha), which was also the highest yielder among all genotypes(Table7). However, CITH-KC-53 (382.85) performed at par with it and the next highest yielders were Pusa Sag-1 (333.80) and CITH-KC-40 (340.55).

Table 7. Evaluation of kale germplasm for morphological traits during 2023

Genotypes	Plant height (cm)	Canopy diameter (cm)	Leaf blade length (cm)	Leaf blade width (cm)	Total yield (q/ha)
CITH-KC-SEL-1	47.92	54.62	19.17	13.92	121.95
CITH-KC-SEL-3	46.17	48.50	21.33	17.00	148.05
CITH-KC-1/17	44.83	47.53	22.17	16.75	113.65
CITH-KC-1/21	47.83	51.55	20.33	15.67	251.55
CITH-KC-2	57.17	44.67	24.17	18.50	211.15
CITH-KC-3	50.17	47.33	22.83	19.00	136.55
CITH-KC-3/21	55.17	53.58	21.50	14.67	240.20
CITH-KC-4/21	51.17	55.50	23.00	16.61	206.25
CITH-KC-SEL-5	49.50	51.00	19.27	13.77	154.35
CITH-KC-6/21	46.50	58.17	20.17	14.17	123.80
CITH-KC-7	49.83	44.33	18.75	11.67	142.70
CITH-KC-8(Kh Red)	53.67	40.92	19.75	14.75	116.05
CITH-KC-9	49.50	49.25	20.83	14.17	107.65
CITH-KC-11	46.58	42.25	20.00	14.08	104.00
CITH-KC-14	53.67	52.27	19.83	15.20	234.85
CITH-KC-16	39.75	54.45	18.58	13.00	193.45
CITH-KC-17	55.67	59.00	22.00	18.50	259.60
CITH-KC-18	43.67	55.08	26.17	16.98	185.80
CITH-KC-20	50.00	56.67	21.83	15.50	115.40
CITH-KC-21	44.33	40.65	19.00	14.67	269.05
CITH-KC-24	46.00	56.67	25.00	18.83	137.50
CITH-KC-24 KK	42.17	44.75	20.50	12.83	171.15
CITH-KC-26	52.83	55.72	20.60	17.67	125.55
CITH-KC-26(RED)	48.58	42.72	22.92	18.67	201.15
CITH-KC-38	50.33	56.90	22.67	19.67	191.40
CITH-KC-40	55.00	56.42	24.17	16.83	340.55
CITH-KC-40-SEL-1/15	60.33	61.50	22.67	16.83	168.60
CITH-KC-42	52.50	57.08	20.33	16.00	204.90
CITH-KC-44	37.17	40.53	16.17	13.42	107.40
CITH-KC-48	46.33	52.10	18.17	17.50	177.65
CITH-KC-53	51.67	59.92	24.00	16.67	382.85
NW SAG-1	40.67	43.00	20.00	14.33	114.80
NW-SAG-4	51.50	50.00	21.33	12.17	168.90
NW-SAG-15	46.17	50.83	23.83	17.00	219.55
NW-SAG-20(RED)	56.33	55.08	19.83	18.00	148.40
NW-SAG-21	53.67	51.23	20.83	17.17	142.25
NW-SAG-23	50.67	46.83	22.50	14.33	128.65
NW-SAG-24	37.83	53.42	19.17	13.50	133.85
NW-SAG-27	46.83	48.92	18.67	14.33	229.00
NW-SAG-29	49.50	48.08	20.25	14.00	144.55
NW-SAG-30	44.00	51.83	21.50	16.00	234.20
NW-SAG-33	40.83	41.92	19.58	13.50	121.35
NW-SAG-36(RED)	43.17	40.53	18.25	15.25	129.20

NW-SAG-38	**45.67**	**51.08**	**21.50**	**16.00**	**148.20**
NW-SAG-39	48.17	48.50	19.83	15.33	159.35
NW-SAG-40	52.00	49.00	18.33	15.00	211.05
NW-SAG-41	48.00	46.50	20.67	16.17	302.75
NW-SAG-42	49.50	56.00	21.83	15.67	167.00
NW-SAG-44	48.25	51.42	21.17	17.00	161.90
PUSA SAG-1	35.83	52.83	21.06	15.33	333.80
PUSA SAG-2	27.83	49.83	18.33	11.67	160.15
PUSA SAG-3	35.50	49.32	16.58	12.58	93.35
PUSA-SAG-4	37.17	46.20	20.92	11.83	169.25
HW-1	39.50	49.42	20.50	14.67	116.10
HW-5	30.25	54.32	20.92	12.33	209.35
Siberian Kale	39.88	58.98	21.83	15.00	229.75
Japanese Green	46.17	55.08	23.08	13.42	149.45
Khanyari (C)	62.50	36.50	13.83	11.67	202.30
Khanyari Dwarf (C)	47.17	49.58	18.17	16.50	204.00
GM Dari (C)	45.33	45.25	19.75	15.42	128.45
Kawdari (C)	60.58	22.50	13.00	12.08	119.35
HanzHak (C)	47.33	49.50	15.50	11.67	394.05
CD (p=0.05)	*1.08*	*0.89*	*0.61*	*0.56*	*50.44*
CV (%)	*1.06*	*0.84*	*1.51*	*1.93*	*11.01*

Radish and Turnip

In radish, the highest yielding check was Sopori (307.15 q/ha). However, most of genotypes of the germplasm performed better than it (Table87). In turnip, 26 genotypes including two checks Nigeen-1 and PusaChandrima were evaluated for root yield and related traits(Table9). Root yield of the germplasm ranged from 201.27 to 525.47 q/ha with 15 genotypes performing better than better check Nigeen-1 (282.38).

Table 8.Root and yield traits of radish germplasm during 2023

S. No.	Genotypes	Root yield (q/ha)	Root length (cm)	Root diameter (cm)	S. No.	Genotypes	Root yield (q/ha)	Root length (cm)	Root diameter (cm)
1	CITH-R-5	276.35	9.87	7.56	7	Sopori (LC)	307.15	9.74	6.54
2	CITH-R-6	372.35	8.36	7.95	8	Scarlet Globe (C)	116.27	3.98	4.05
3	CITH-R-7	236.45	8.91	7.48	9	PusaHimani (C)	226.25	13.54	4.24
4	CITH-R-8	278.60	9.64	7.36		**CD (p<0.05)**	*76.23*	*8.54*	*2.63*
5	JWL (C)	225.67	23.62	4.23		***CV (%)***	*11.26*	*19.78*	*15.35*
6	PalamHriday (C)	237.60	9.63	8.12					

Table 9.Yieldand root traits of turnipgermplasm during 2023

S. No.	Genotypes	Root yield (q/ha)	Root length (cm)	Root diameter (cm)	S. No.	Genotypes	Root yield (q/ha)	Root length (cm)	Root diameter (cm)
1	PTWG-Ball	264.27	8.54	8.22	15	Turnip globe type	501.27	8.59	8.23
2	PTWG-Flat	316.41	7.12	8.89	16	Purple long	416.88	9.01	7.35
3	PSB	201.27	9.78	8.25	17	PS×PTWG Ball type	498.21	9.14	8.36
4	Purple-white Zebra	454.84	6.54	7.85	18	Purple white Sel-1	432.27	8.39	8.95
5	Pink Globe	332.67	7.23	7.54	19	White flat	326.83	7.25	9.37
6	Pink flat	476.27	5.91	6.85	20	White globe	426.83	8.36	8.51
7	PS-IARI	456.51	7.11	7.72	21	Golden ball w4	312.16	6.39	6.94
8	Sel-2	525.47	7.85	8.11	22	Pink White Zebra	320.83	7.84	6.74
9	Sel-1	516.33	9.85	8.59	23	Purple round	456.27	7.11	7.48
10	Purple Top Green Globe	488.57	7.23	7.55	24	Pink flat zebra	401.41	8.34	8.69
11	PT×PC	325.33	9.26	8.23	25	PusaChandrima (C)	245.88	7.45	7.68
12	Purple flat	309.27	7.53	8.54	26	Nigeen-1 (C)	282.38	9.77	8.32
13	Sel-4	446.67	6.54	7.36	*CD (p=0.05)*	*88.62*	*2.21*	*1.74*	
14	Green Top	468.51	8.72	7.56	*CV (%)*	*12.36*	*8.65*	*13.69*	

Leafy and exotic vegetables

Among leafy, exotic and Brassica crops, Chinese cabbage line CITH-CC-1 expressed 378.56 q/ha of net head yield. The head height was recorded as 21.22 cm, head width 15.16 cm, net head weight of 1.125 kg and TSS was 4.69 %. Broccoli line CITH-Broccoli-1 gave net head yield of 175.69 q/ha with a head height of 11.35 cm, head width of 12.13 cm, net head weight of 0.328 kg and TSS of 10.46 %. In Swiss chard, CITH-SC-Green and CITH-SC-Red yielded 278.69 and 256.37 quintal leaves per hectare.

ICAR-CITH, RS Mukteshwar

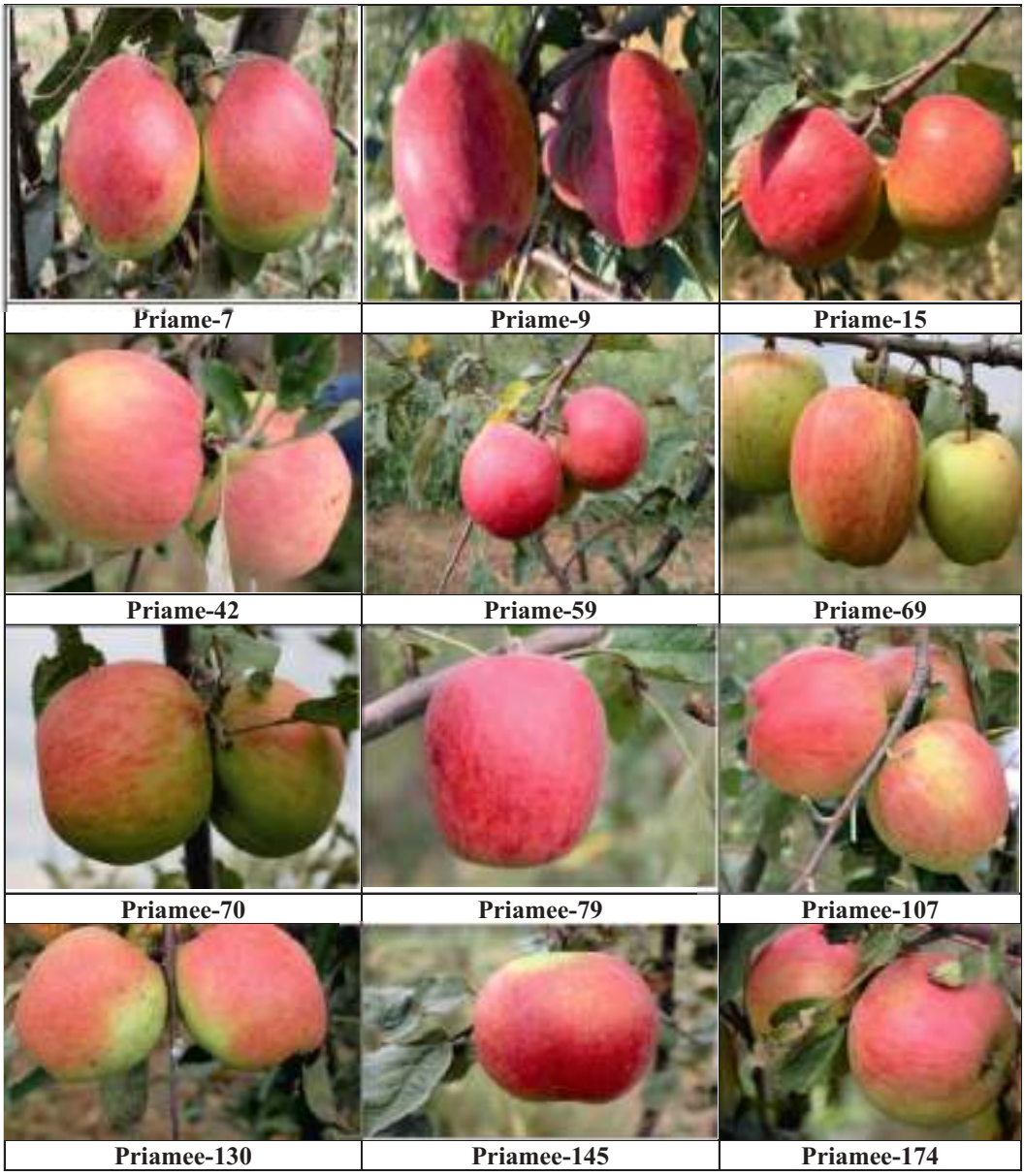
Seeds of high potential and locally cultivated vegetable were collected from nearby village of Uttarakhand in 2022-23 which will be evaluated in research farm of CITH RS in 2024. Two different types of Meethakarela seed was collected from farmer's field. One cultivar has spiny fruit other has smooth texture. Whereas four different coloured French bean seed were collected from TallaDeeni village. Seeds where big brown colour with black spots, creamy white with black spots, small white and dark reddish brown coloured respectively.

Collected seeds of bean having variation in colour and size

Development of superior cultivars/hybrids in temperate fruits through conventional and non-conventional methods

Evaluation of scab resistant CITH-Ambri-1 x Prima population for morphological and biochemical characteristics

Changing weather patterns have led to an increase in fruit diseases especially apple scab which in turn has triggered the need for development of scab resistant apple varieties. One such variety, a cross between scab resistant Prima and Ambri has been developed by CITH-Srinagar. It possesses the trait of scab resistance and the quality with respect to fruit size, TSS, acidity and other physicochemical traits is being ascertained by evaluating these genotypes under open field conditions. During 2023, 32 fruit bearing genotypes were evaluated for fruit quality traits like TSS, acidity, pH, firmness, ascorbic acid, color parameters and for antioxidant potential through DPPH, total phenols, flavonoids and flavanols assays. In the preliminary studies, some genotypes have shown good fruit weight (>100g), TSS (>140B), firmness (>75RI), colour and ascorbic acid (24.5mg/100g) in addition to good antioxidant potential (Table10&Table 11).



Fruits of some Prima x Ambri population under evaluation

Table10. Physiochemical characteristics of CITH-Ambri-1 x Prima population

Genotype	Fruit Weight(g)	Fruit length(mm)	Fruit Breadth (mm)	Firmness (RI)	TSS (^{0}B)	Acidity (%)	pH	Colour			
								l	a	b	tint
Priame-7	87.33^{hij}	58.56^{ghi}	51.1^{m}	80.25^{a}	15.3^{b}	0.35^{ijk}	4.28^{a}	51.48^{fg}	13.87^{ij}	21.77^{p}	-58.51^{def}
Priame -9	124.33^{ef}	60.21^{efg}	61.76^{ghi}	71.53^{hij}	15.93^{b}	0.21^{no}	3.02^{hj}	48.61^{ghi}	21.11^{e}	15.88^{q}	-77.15^{ghi}
Priame -15	156.67^{b}	58.44^{ghi}	64.25^{fg}	75.62^{cde}	13.5^{b}	0.61^{ef}	2.91^{k}	61.31^{bcd}	14.65^{ij}	37.62^{de}	-62.23^{efg}
Priame-16	152^{bc}	64.24^{cde}	71.89^{bc}	70.32^{jkl}	12.3^{b}	0.63^{e}	2.63^{n}	60.27^{cd}	24.52^{d}	32.19^{ijk}	-85.76^{hij}
Priame-30	81.33^{ijk}	55.95^{hij}	53.2^{lm}	73.05^{efgh}	13.4^{b}	0.31^{jkl}	3.90^{c}	60.54^{cd}	16.62^{h}	35.33^{efg}	-20.96^{abc}
Priame-31	73^{m}	48.73^{no}	50.08^{m}	74.57^{def}	14.1^{b}	0.32^{jkl}	3.80^{cd}	59.50^{cde}	-4.58^{o}	32.49^{hij}	-3.86^{ab}
Priame-39	78.66^{lm}	45.73^{o}	57.31^{jk}	76.45^{abc}	11.8^{b}	0.28^{lm}	3.54^{e}	66.12^{b}	4.76^{l}	44.25^{ab}	-32.17^{abc}
Priame-42	140.33^{bcd}	61.23^{def}	69.95^{cde}	73.11^{efgh}	15.567^{b}	0.3^{klm}	3.79^{d}	56.99^{de}	6.5^{l}	28.14^{lm}	-33.30^{abc}
Priame-45	96^{ghi}	55.9^{hijkl}	58.62^{ij}	76^{bcdef}	13.76^{b}	0.66^{de}	2.46^{o}	50.25^{fgh}	20.34^{efg}	26.09^{mn}	-81.17^{ghi}
Priame-53	136^{cde}	64.89^{bcd}	64.40^{fg}	77.53^{abc}	14.43^{b}	0.61^{ef}	3.41^{fg}	50.81^{fgh}	9.75^{k}	22.91^{op}	-41.40^{bcde}
Priame-58	98^{ghi}	54.29^{ijk}	54.96^{kl}	79.92^{ab}	12.6^{b}	0.42^{h}	3.09^{hij}	42.05^{j}	24.43^{d}	14.78^{q}	-93.07^{ij}
Priame-59	87.66^{hij}	52.25^{lmn}	57.04^{jk}	67.65^{klm}	11.86^{b}	0.513^{g}	2.5^{o}	41.00^{j}	43.82^{a}	23.08^{op}	-177.16^{k}
Priame-69	132.66^{de}	68.42^{ab}	67.21^{ef}	64.56^{m}	14^{b}	0.82^{a}	2.89^{kl}	50.57^{fgh}	20.32^{efg}	21.74^{p}	-77.39^{ghij}
Priame-70	103.66^{gh}	58.10^{ghij}	58.40^{ij}	72.42^{fgh}	14.83^{b}	0.29^{klm}	3.31^{g}	45.62^{hij}	35.44^{b}	24.68^{no}	-135.12^{k}
Priame-79	80$^{j\ lm}$	50.30^{mn}	53.08^{lm}	77.90^{abc}	12.53^{b}	0.39^{hi}	3.13^{h}	44.83^{ij}	35.68^{b}	24.03^{nop}	-139.76^{k}
Priame-102	95.66^{ghi}	54.14^{jkl}	57.03^{jk}	70.38^{jkl}	13.3^{b}	0.69^{cd}	3.13^{hi}	59.00^{cde}	5.31^{l}	34.99^{efg}	-33.15^{abc}
Priame-104	98.33^{ghi}	56.69^{hij}	59.87^{hij}	72.85^{efg}	14.46^{b}	0.63^{e}	4.1^{b}	71.96^{a}	2.16^{m}	37.07^{def}	-10.02^{abc}
Priame 107	184.33^{a}	71.40^{a}	79.96^{a}	78.21^{abc}	14.53^{b}	0.72^{bc}	3.34^{fg}	48.65^{ghi}	18.59^{g}	25.43^{no}	-78.17^{ghij}
Priame 112	139.33^{bcd}	66.88^{bc}	68.35^{de}	71.66^{ghi}	14.3^{b}	0.82^{a}	2.83^{klm}	51^{fg}	13.61^{ij}	24.8^{no}	-58.95^{def}
Priame 114	98^{ghi}	54.8^{ijk}	62.56^{gh}	78.94^{abc}	12.83^{b}	0.63^{e}	2.47^{o}	61.48^{bcd}	-4.33^{o}	46.24^{a}	-7.43^{abc}
Priame 121	153.33^{bc}	59.96^{fgh}	70.78^{cd}	72.5^{efg}	48.4^{a}	0.57^{f}	2.89^{kl}	64.25^{bc}	1.62^{m}	38.49^{d}	-23.15^{abc}
Priame 123	84.66^{ijk}	54.30^{ijk}	59.38^{hij}	78.78^{abc}	13.36^{b}	0.16^{o}	3.43^{ef}	54.9^{ef}	15.24^{hi}	33.55^{ghi}	-66.68^{fgh}
Priame 130	88^{hij}	59.82^{fgh}	54.50^{kl}	72.83^{efg}	16.06^{b}	0.62^{ef}	2.5^{o}	60.76^{cd}	13.32^{ij}	38.06^{d}	-59.48^{def}
Priame 135	105^{gh}	60.02^{fgh}	56.95^{jk}	74.97^{cde}	14.23^{b}	0.76^{b}	2.79^{lm}	60.74^{cd}	22.92^{d}	31.13^{jk}	-80.58^{ghi}
Priame 136	95^{ghi}	49.03^{no}	62.45^{gh}	76.55^{abc}	9.23^{b}	0.76^{b}	2.8^{lm}	60.81^{cd}	-8.68^{p}	42.12^{bc}	5.51^{a}
Priame 137	110^{fg}	52.43^{klm}	64.02^{fg}	71.03^{hij}	14.8^{b}	0.83^{a}	2.78^{lm}	61.09^{bcd}	5.43^{l}	37.09^{def}	-34.10^{abc}
Priame 138	145.66^{bcd}	59.87^{fgh}	72.14^{bc}	74.5^{def}	11.6^{b}	0.64^{e}	2.55^{no}	64.40^{bc}	20.93^{ef}	34.60^{fgh}	-77.12^{ghi}
Priame 142	177^{a}	71.09^{a}	74.21^{b}	72.54^{efg}	12.5^{b}	0.26^{mn}	2.86^{klm}	57.4^{de}	19.04^{fg}	29.71^{kl}	-26.82^{abc}
Priame 145	157^{b}	64.30^{cde}	71.48^{bcd}	69.44^{jkl}	13.5^{b}	0.19^{o}	3.84^{cd}	58.20^{de}	10.02^{k}	33.09^{ghi}	-47.66^{cde}
Priame 148	148^{bcd}	63.74^{cde}	70.89^{bcd}	70.75^{ijk}	12.73^{b}	0.36^{ij}	3.44^{ef}	60.29^{cd}	-0.15^{n}	41.46^{c}	-20.10^{abc}
Priame 165	105.33^{gh}	57.77^{ghi}	62.43^{gh}	70.76^{ijk}	14.46^{b}	0.50^{g}	2.77^{m}	50.63^{fgh}	13.04^{j}	23.15^{op}	-55.53^{def}
Priame 174	124.33^{ef}	61.44^{def}	64.51^{fg}	67.43^{lm}	14.16^{b}	0.26^{mn}	4.22^{a}	51.03^{fg}	26.41^{c}	26.65^{mn}	-100.09^{j}

Table11.Antioxidative and free radical scavenging potential of CITH-Ambri-1 x Prima population

Genotype	Ascorbic acid (mg/100g Fw)	%DPPH Scavenging	Flavanoids (mgQE/gFw)	Flavanols (mgQE/gFw)	Phenols (mgGAE/gFw)
Priame-7	21.43^{ab}	90.38^{abc}	0.31^{efg}	0.11^{fgh}	5.03^{c}
Priame-9	16.0^{cd}	91.72^{a}	0.16^{jk}	0.043^{ij}	2.62^{jkl}
Priame-15	17.36^{c}	91.44^{a}	0.08^{l}	0.01^{j}	1.05^{p}
Priame-16	16.00^{cd}	88.69^{cde}	0.19^{hij}	0.47^{b}	2.79^{ijk}
Priame-30	16.00^{cd}	85.92^{fgh}	0.21^{hij}	0.14^{fgh}	7.04^{a}
Priame-31	18.33^{bc}	85.81^{fgh}	0.28^{fg}	0.095^{fgh}	2.53^{jkl}
Priame-39	18.4^{bc}	85.46^{ghi}	0.80^{a}	0.44^{b}	5.94^{b}
Priame-42	16.0^{cd}	87.61^{ef}	0.27^{fg}	0.11^{fgh}	2.69^{ijk}
Priame-45	8.0^{e}	86.5^{fg}	0.44^{cd}	0.18^{ef}	5.06^{c}
Priame-53	25.33^{a}	90.56^{abc}	0.19^{hij}	0.085^{fgh}	4.507^{d}
Priame-58	18.4^{bc}	86.60^{fg}	0.30^{efg}	0.13^{fgh}	3.1^{ghi}
Priame-59	16.33^{cd}	90.02^{abc}	0.28^{fg}	0.30^{cd}	2.94^{hij}
Priame-69	12.16^{de}	86.48^{fg}	0.19^{ij}	0.18^{efg}	1.72^{o}
Priame-70	16.00^{cd}	86.64^{fg}	0.43^{cd}	0.38^{bc}	2.76^{ijk}
Priame-79	24.36^{a}	79.91^{j}	0.46^{cd}	0.65^{a}	4.44^{d}
Priame-102	10.86^{e}	91.14^{ab}	0.33^{ef}	0.36^{bc}	3.58^{ef}
Priame-104	15.66^{cd}	86.52^{fg}	0.12^{kl}	0.02^{ij}	2.27$^{l\,n}$
Priame 107	16.00^{cd}	91.14^{ab}	0.15^{jk}	0.03^{ij}	2.44^{klm}
Priame 112	16.00^{cd}	90.04^{abc}	0.12^{kl}	0.02^{ij}	1.67^{o}
Priame 114	16.00^{cd}	89.38^{bcd}	0.191^{ij}	0.09^{fgh}	2.92^{hij}
Priame 121	16.66^{c}	90.20^{abc}	0.10^{kl}	0.01^{j}	1.64^{o}
Priame 123	16.33^{cd}	86.57^{fg}	0.48^{c}	0.27^{cde}	3.73^{e}
Priame 130	16.33^{cd}	88.51^{de}	0.15^{jk}	0.06^{ghi}	2.86^{hij}
Priame 135	23.66^{a}	86.36^{fg}	0.67^{b}	0.65^{a}	4.96^{c}
Priame 136	24.33^{a}	79.68^{j}	0.22^{hi}	0.08^{fgh}	2.6^{ijk}
Priame 137	16.4^{cd}	72.78^{k}	0.31^{ef}	0.14^{fgh}	3.21^{fgh}
Priame 138	15.33^{cd}	80.96^{j}	0.22^{hi}	0.09^{fgh}	2.53^{jkl}
Priame 142	16.36^{cd}	83.90^{i}	0.08^{l}	0.01^{j}	3.62^{e}
Priame 145	16.73^{c}	86.72^{fg}	0.41^{d}	0.19^{def}	4.41^{d}
Priame 148	8.46^{e}	84.40^{hi}	0.34^{e}	0.17^{efgh}	3.4^{efg}
Priame 165	16.70^{c}	90.05^{abc}	0.18^{ij}	0.04^{hij}	2.29^{lmn}
Priame 174	22.33^{a}	85.05^{ghi}	0.25^{gh}	0.12^{fgh}	3.34^{efg}

Fruit quality analysis of apple hybrids

During 2023, seven apple hybrids were evaluated for stability of morphological and biochemical traits. Among these seven hybrids, three are known for scab resistance namely Pride (Red Delicious x Prima) Priame (CITH-Ambri-1 x Prima), Pritor (Top Red x Prima), two for quality namely Ambrit (CITH-Ambri-1 x Top Red), Ammol (CITH-Ambri-1 x Mollies Delicious) and one hybrid namely Golden Snow has pollinizer activity in addition to fruit quality. Pride, Priame and Pritor besides possessing the trait for scab resistance also show higher fruit weight than their parents (Table12).Ambrit and Golden Snow have higher ascorbic acid (20.8 and 21.2 mg/100gFw) than their respective parents, Ambri (15.9 mg/100gFw), Top Red (15.6 mg/100gFw), Golden Delicious (20.5mg/100gFw) and Snowdrift (15.36mg/100gFw). Hybrid Priame possess high

total phenolic content (2.64mgGAE/gFw) than its parents-Prima (2.143mgGAE/gFw) and Ambri (1.21 mgGAE/gFw) as shown in Table 13. Scab resistance in hybrids namely Priame, Pride and Pritor was confirmed by presence of scab resistant genes namely UI400, AL07, AM19 and Rvi6 (Vf) through semi quantitative RT PCR (Fig4).

CITH apple hybrids under evaluation

		
Pride	**Golden Snow**	**Pritor**
		
Priame	**Ammol**	**Ambrit**

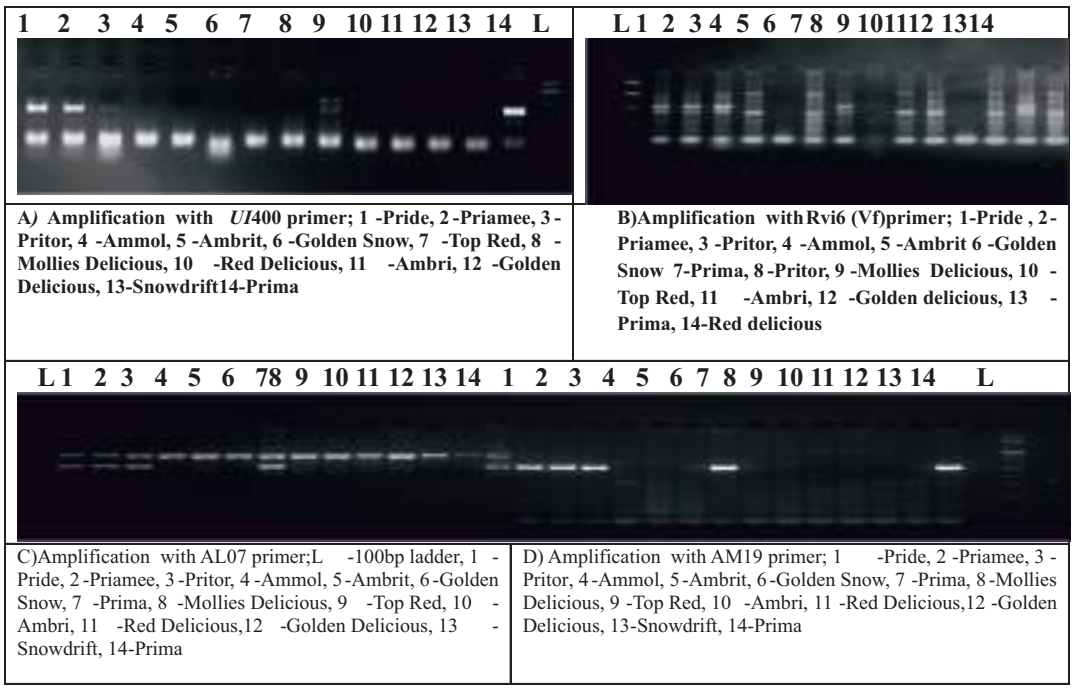
CITH apple hybrids under evaluation

Table 12. Physicochemical traits of apple hybrids

Genotype	Fruit weight (g)	Fruit length (mm)	Fruit breadth (mm)	TSS (°B)	Firmness (RI)	pH	Colour			
							l	a	b	tint
Pride	149.66^{b}	67.95^{bcde}	70.64^{b}	12.58^{fg}	74.4^{a}	3.3^{c}	44.66^{a}	20.67^{a}	16.22^{b}	-84.06^{j}
Priame	196.66^{a}	70.24^{abc}	87.36^{a}	12.13^{g}	65.2^{b}	3.6^{bc}	52.71^{a}	7.37^{bcd}	26.65^{ab}	-40.42^{h}
Pritor	114.0^{bcd}	70.90^{ab}	86.29^{a}	13.4^{e}	61.9^{b}	4.2^{a}	58.40^{a}	4.34^{cde}	31.07^{ab}	-30.35^{fg}
Ammol	177.33^{a}	79.92^{a}	57.08^{cd}	13.06^{ef}	64.6^{b}	4.2^{a}	55.30^{a}	17.19^{ab}	32.70^{ab}	-64.48^{i}
Ambrit	94.33^{d}	55.01^{cde}	59.73^{bcd}	15.56^{c}	73.2^{a}	3.9^{ab}	57.78^{a}	5.167^{cde}	23.82^{ab}	-24.06^{e}
Golden Snow	179.0^{a}	67.80^{abcd}	84.80^{a}	12.4^{g}	62.4^{b}	2.8^{d}	59.74^{a}	-8.53^{f}	31.54^{ab}	9.56^{a}
Prima	101.66^{cd}	53.63^{de}	63.13^{bcd}	12.56^{fg}	73.8^{a}	3.3^{c}	55.15^{a}	7.077^{bcd}	29.23^{ab}	-32.24^{g}
Red Delicious	143.66^{b}	64.02^{bcde}	67.82^{bc}	16.13^{c}	72.7^{a}	3.7^{bc}	56.73^{a}	4.85^{cde}	28.48^{ab}	-28.19^{f}
Ambri	88.66^{d}	53.49^{de}	59.33^{bcd}	17.5^{b}	77.4^{a}	3.9^{ab}	65.92^{a}	-4.86^{def}	38.52^{a}	-5.30^{c}
Mollies Delicious	134.66^{bc}	63.19^{bcde}	63.39^{bcd}	18.66^{a}	65.4^{b}	4.1^{a}	56.58^{a}	18.04^{ab}	24.44^{ab}	-63.66^{i}
Golden Delicious	131.33^{bc}	50.16^{e}	57.36^{cd}	14.2^{d}	72.4^{a}	4.1^{a}	60.89^{a}	-6.12^{ef}	30.85^{ab}	1.70^{b}
Snowdrift	127.66^{bc}	53.25^{de}	59.55^{bcd}	14.56^{d}	72.8^{a}	2.7^{d}	63.14^{a}	1.21^{cdef}	31.45^{ab}	-13.8^{d}
Top Red	78.33^{d}	53.82^{de}	53.97^{d}	14.56^{d}	73.9^{a}	3.7^{bc}	48.76^{a}	8.567^{bc}	20.673^{ab}	-40.38^{h}

Table 13.Antioxidative and free radical scavenging potential of apple hybrids

Genotype	Acidity (%)	Ascorbic acid (mg/100g Fw)	% Scavenging activity	Flavanoids (mgQE/gFw)	Flavanols (mgQE/gFw)	Phenols (mgGAE/gFw)
Pride	0.61^{b}	16.23^{ab}	90.37^{ab}	0.125^{b}	0.084^{bc}	4.619^{de}
Priame	0.4^{c}	13.16^{b}	83.65^{ab}	0.049^{cde}	0.001^{e}	2.644^{h}
Pritor	0.32^{d}	14.6^{ab}	82.12^{ab}	0.121^{b}	0.063^{bcde}	4.403^{e}
Ammol	0.4^{c}	13.16^{b}	85.44^{ab}	0.137^{b}	0.065^{bcd}	1.986^{i}
Ambrit	0.19^{f}	20.8^{a}	85.84^{ab}	0.096^{bcd}	0.057^{bcde}	5.118^{b}
Golden Snow	0.89^{a}	21.2^{a}	91.40^{ab}	0.035^{e}	0.012^{de}	3.542^{f}
Prima	0.38^{c}	14.16^{ab}	89.95^{ab}	0.355^{a}	0.245^{a}	2.143^{i}
Red Delicious	0.19^{f}	16.06^{ab}	90.01^{ab}	0.151^{b}	0.106^{b}	4.791^{cd}
Ambri (CITH-Ambri-1)	0.25^{e}	15.9^{ab}	76.38^{b}	0.103^{bc}	0.091^{b}	1.21^{j}
Mollies Delicious	0.31^{d}	15.36^{ab}	80.18^{ab}	0.097^{bcd}	0.046^{bcd}	7.806^{a}
Golden Delicious	0.31^{d}	20.5^{ab}	92.78^{a}	0.041^{de}	0.026^{cde}	5.092^{bc}
Snowdrift	0.6^{b}	15.36^{ab}	91.93^{a}	0.062^{cde}	0.021^{de}	3.001^{g}
Top Red	0.4^{c}	15.6^{ab}	90.35^{ab}	0.001^{e}	0.002^{e}	2.901^{gh}



A) Amplification with *UI*400 primer; 1 -Pride, 2 -Priamee, 3 -Pritor, 4 -Ammol, 5 -Ambrit, 6 -Golden Snow, 7 -Top Red, 8 -Mollies Delicious, 10 -Red Delicious, 11 -Ambri, 12 -Golden Delicious, 13-Snowdrift14-Prima

B)Amplification with Rvi6 (Vf)primer; 1-Pride , 2-Priamee, 3 -Pritor, 4 -Ammol, 5 -Ambrit 6 -Golden Snow 7-Prima, 8 -Pritor, 9 -Mollies Delicious, 10 -Top Red, 11 -Ambri, 12 -Golden delicious, 13 -Prima, 14-Red delicious

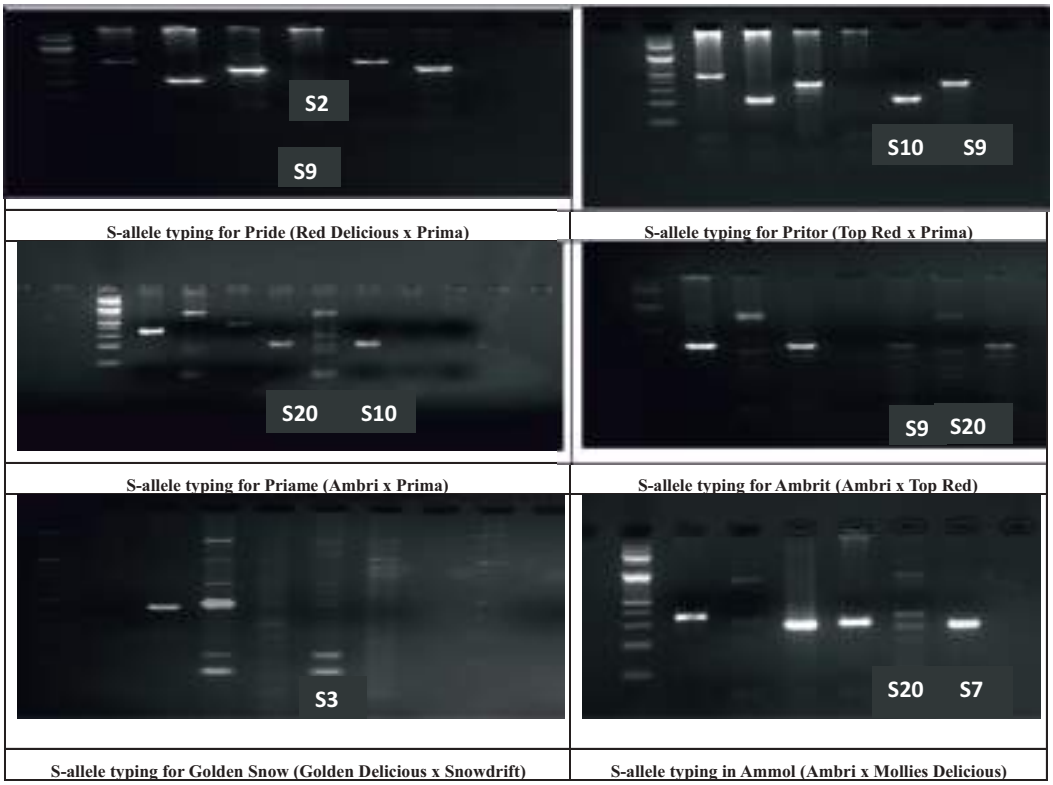
C)Amplification with AL07 primer;L -100bp ladder, 1 -Pride, 2 -Priamee, 3 -Pritor, 4 -Ammol, 5 -Ambrit, 6 -Golden Snow, 7 -Prima, 8 -Mollies Delicious, 9 -Top Red, 10 -Ambri, 11 -Red Delicious,12 -Golden Delicious, 13 -Snowdrift, 14-Prima

D) Amplification with AM19 primer; 1 -Pride, 2 -Priamee, 3 -Pritor, 4 -Ammol, 5 -Ambrit, 6 -Golden Snow, 7 -Prima, 8 -Mollies Delicious, 9 -Top Red, 10 -Ambri, 11 -Red Delicious,12 -Golden Delicious, 13-Snowdrift, 14-Prima

Fig 4.Vf gene screening in hybrids and their respective parents

S-Allele typing in apple hybrids

For confirmation of hybrids namely Pride, Pritor, Priame, Golden Snow, Ammol & Ambrit and determination of pollinizer ability, S allele typing of hybrids was carried out along with their parents viz; Prima, Ambri (CITH-Ambri-1), Top Red, Red Delicious, Golden Delicious, Snowdrift and Mollies Delicious. The allele-specific primers reported by Broothaerts (2003) were used to detect S_2, S_3, S_7, S_9, S_{10}, and S_{28}. The identity of hybrids were confirmed by the presence of combination of s-allele in them as was found in their respective parents (Table 14& Fig 5)



S-allele typing for Pride (Red Delicious x Prima)

S-allele typing for Pritor (Top Red x Prima)

S-allele typing for Priame (Ambri x Prima)

S-allele typing for Ambrit (Ambri x Top Red)

S-allele typing for Golden Snow (Golden Delicious x Snowdrift)

S-allele typing in Ammol (Ambri x Mollies Delicious)

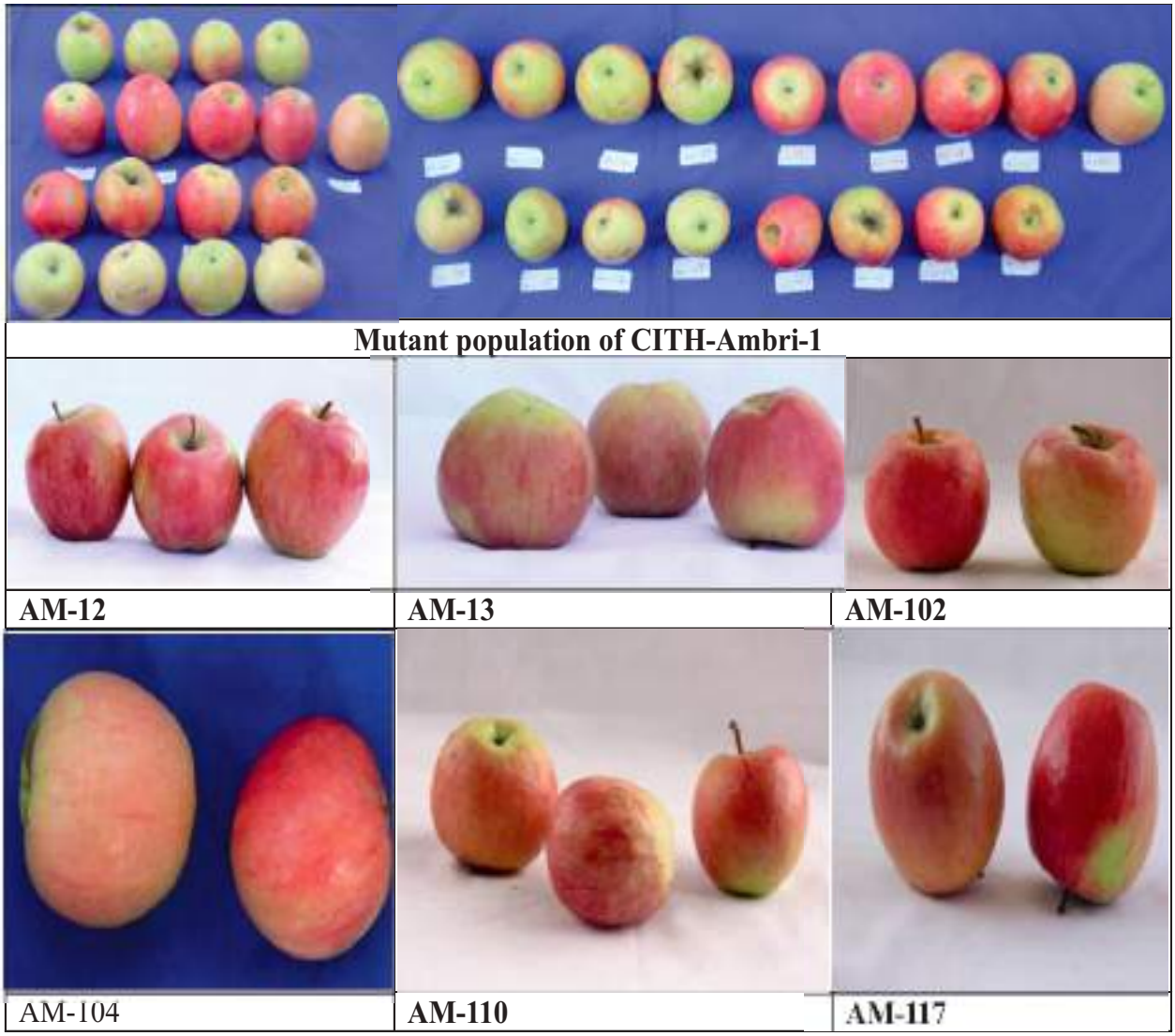
Fig. 5S-Allele typing in apple hybrids

Table 14. S-Allele typing in Apple Hybrids

Parent1		Parent2		Hybrid	
Red Delicious	S9S28	Prima	S2S10	Pride	S2S9
Top Red	S9 S28	Prima	S2 S10	Pritor	S9 S10
Ambri	S9 S20	Top Red	S9 S28	Ambrit	S9 S20
Ambri	S9 S20	Prima	S2 S10	Priame	S10 S20
Ambri	S9 S20	Mollies Delicious	S3 S7	Ammol	S20 S7
Golden Delicious	S2 S3	Snowdrift	S25S45	Golden snow	S3 *

Mutation studies for quality improvement in apple cultivar Ambri (CITH-Ambri-1)

Mutant population was generated by gamma irradiation (30 & 40 Gy) and was evaluated for different physiochemical traits. A total of 93 mutant genotypes bear fruits during 2023 and around 70 mutants were found to be superior to the parent (CITH-Ambri-1) with respect to color and other quality traits (Table15). Maximum color (a=39.12) trait was found in mutant AM-179 which was much higher than the parent CITH-Ambri-1(7.14).



		
AM-132	**AM-140**	**AM-166**
		
AM-175	**AM-214**	**AM-235**
		
AM-338	**AM-347**	**AM-342**
		
AM-347	**AM-372**	**AM-389**

Some promising CITH-Ambri-1 mutants

Table 15.physico chemical traits of apple mutants induced by gamma ray treatments

Genotype	Fruit weight (g)	Fruit length (mm)	Fruit diameter (mm)	TSS(°B)	Firmness (RI)	Colour			tint
						L	a	b	
CITH-Ambri-1	134.66^{bcd}	53.49^{mno}	59.33^{cde}	17.5^{b}	60.50^{pqr}	69.44^{nop}	7.14^{mno}	45.11^{b}	-6.01^{bcde}
AM-10	71.66^{def}	48.70^{vwx}	52.7^{uvw}	13.10^{xyz}	59.26^{stu}	80.91^{fgh}	9.61^{ijk}	-0.38^{qrs}	-17.78^{cde}
AM-12	101.66^{mno}	61.20^{cde}	60.14^{cde}	13.50^{tuvw}	68.73^{abc}	59.65^{qrs}	18.20^{cde}	27.78^{def}	-68.11^{pqr}
AM-13	140.66^{bcd}	68.37^{abc}	70.28^{ab}	13.46^{uvw}	66.55^{bcd}	61.34^{pqr}	18.33^{cde}	33.86^{cde}	-6.17^{cde}
AM-15	68.00^{fgh}	50.29^{tuv}	53.21^{tuv}	11.033^{hi}	61.46^{mno}	84.78^{bcd}	-3.13^{vwx}	86.65^{a}	2.74^{cde}
AM-22	69.66^{efg}	54.55^{lmn}	54.42^{opq}	12.23^{def}	65.08^{def}	91.72^{abc}	9.71^{ijk}	-5.92^{tuv}	-11.1^{cde}
AM-26	98.33^{opq}	40.97^{y}	47.09^{bcd}	14.2^{opq}	70.22^{abc}	82.56^{efg}	4.26^{pqr}	3.03^{pqrs}	-8.59^{cde}
AM-27	96.66^{opq}	55.28^{klm}	55.98^{klm}	12.13^{ef}	65.40^{cde}	87.34^{abc}	-4.337^{yza}	4.55^{pqr}	6.02^{bcd}
AM-28	74.00^{bcd}	48.23^{vwx}	55.46^{lmn}	14.86^{fgh}	67.16^{bcd}	69.86^{no}	30.33^{abc}	11.11^{op}	-53.73^{jkl}
AM-29	93.66^{qrs}	45.58^{xy}	42.03^{d}	13.66^{rst}	62.66^{jklm}	81.96^{fgh}	11.09^{fgh}	-19.41^{yz}	-20.14^{cde}
AM-33	116.33^{fgh}	61.74^{bcd}	61.38^{bcd}	14.1^{opq}	66.56^{bcd}	49.44^{bc}	32.90^{abc}	20.82^{mn}	-120.9^{bc}
AM-37	118.33^{efg}	59.23^{ghi}	62.62^{bcd}	15.23^{efg}	60.89^{opq}	80.26^{fgh}	3.49^{qrs}	3.2^{pqr}	-6.78^{cde}
AM-46	114.33^{fgh}	60.83^{cde}	56.73^{ijk}	14.93^{fgh}	62.4^{klm}	85.58^{bcd}	21.73^{bcd}	-4.07^{tu}	-34.07^{efg}
AM-64	120.33^{def}	68.64^{abc}	61.68^{bcd}	13.23^{xyz}	74.51^{abc}	61.65^{pqr}	22.03^{bcd}	30.16^{cde}	-75.81^{rst}
AM-70	114.33^{fgh}	65.21^{abc}	62.77^{bcd}	14.4^{jkl}	43.73^{w}	61.71^{pqrs}	12.77^{fgh}	33.54^{cde}	-58.16^{lmn}
AM-71	144.33^{bcd}	67.57^{abc}	64.7^{abc}	14.96^{efg}	71.46^{abc}	57.4^{qrs}	18.45^{cde}	28.29^{def}	-70.30^{qrs}
AM-73	107.66^{ijk}	58.85^{hij}	65.15^{abc}	12.33^{cde}	62.16^{lmn}	87.22^{abc}	9.98^{ijk}	-8.24^{vwx}	-15.00^{cde}
AM-74	178.33^{a}	64.20^{abc}	64.25^{abc}	14.56^{ijk}	64.06^{efg}	61.12^{qrs}	23.15^{bcd}	24.92^{fgh}	-83.67^{vwx}
AM-96	122.66^{cde}	70.69^{a}	62.57^{bcd}	14.23^{nop}	78.29^{a}	60.71^{qrs}	17.27^{def}	32.13^{cde}	63.16^{ab}
AM-98	147.66^{bcd}	66.65^{abc}	64.75^{abc}	14.03^{pqr}	73.65^{abc}	52.76^{xyz}	26.99^{abc}	24.80^{fgh}	101.69^{a}
AM-100	106.33^{jkl}	62.76^{abc}	60.80^{bcd}	15.43^{def}	71.84^{abc}	62.58^{opq}	18.34^{cde}	30.78^{cde}	-59.48^{mno}
AM-102	108.00^{ijk}	61.12^{cde}	58.07^{fgh}	12.33^{cde}	76.20^{ab}	60.67^{qrst}	20.65^{bcd}	32.59^{cde}	-78.89^{tuv}
AM-104	99.33^{nop}	61.14^{cde}	56.06^{klm}	13.66^{rst}	72.49^{abc}	55.77^{stu}	20.91^{bcd}	31.23^{cde}	-83.62^{vwx}
AM-110	94.00^{qrs}	61.27^{cde}	54.26^{pqr}	12.83^{zab}	73.00^{abc}	57.81^{qrs}	26.78^{abc}	29.22^{cde}	100.28^{a}
AM-115	94.66^{qrs}	60.37^{cde}	68.79^{abc}	12.23^{def}	72.19^{abc}	53.53^{vwx}	35.89^{ab}	23.547^{ghi}	-35.99^{efg}
AM-117	155.33^{ab}	59.94^{def}	60.63^{cde}	15.03^{efg}	67.43^{abc}	52.66^{xyz}	33.77^{abc}	22.94^{hij}	-33.6^{efg}
AM-118	117.66^{efg}	68.65^{abc}	65.33^{abc}	13.23^{xyz}	52.56^{vw}	65.33^{opq}	10.56^{ghi}	40.367^{bc}	-49.16^{ijk}
AM-130	106^{klm}	59.62^{efg}	60.55^{cde}	69.80^{a}	69.8^{abc}	75.40^{mn}	19.3^{cde}	-8.94^{wx}	34.05^{bc}
AM-137	97.66^{opq}	52.91^{nop}	49.40^{zab}	13.66^{rst}	64.46^{def}	79.02^{hij}	9.1^{jklm}	-4.917^{tuv}	-3.29^{cde}
AM-138	86.33^{uvw}	49.09^{uvw}	57.38^{ghi}	12.63^{abc}	62.54^{klm}	92.21^{ab}	-9.377^{za}	8.15^{pqr}	14.11^{bcd}
AM-140	93^{qrst}	61.14^{cde}	56.19^{klm}	13.66^{rst}	64.39^{def}	61.16^{qrs}	19.92^{bcd}	28.03^{def}	-68.75^{pqr}
AM-148	79.33^{abc}	51.72^{rst}	50.06^{yza}	14.43^{jkl}	66.84^{bcd}	84.84^{bcd}	14.51^{efgh}	-4.983^{tuv}	-23.86^{cde}
AM-157	73.33^{cde}	49.16^{uvw}	51.5^{wxy}	14.13^{opq}	59.35^{stu}	85.57^{bcd}	21.23^{bcd}	-4.33^{tuv}	-31.20^{def}
AM-159	140.66^{bcd}	60.45^{cde}	60.34^{cde}	14.70^{hij}	71.88^{abc}	56.54^{rst}	24.33^{abc}	28.92^{cde}	-87.15^{xyz}
AM-162	116^{fghi}	61.79^{bcd}	55.44^{mno}	15.50^{def}	73.23^{abc}	62.00^{opqr}	10.72^{ghi}	34.21^{bcde}	-51.94^{ijkl}
AM-166	86^{uvw}	55.28^{klm}	53.69^{rstu}	11.867^{fg}	59.36^{stuv}	79.80^{ghi}	16.01^{efgh}	-4.46^{tuvwx}	-31.18^{def}
AM-167	83.667^{xyz}	50.89^{stuvwx}	58.39^{efg}	12.03^{efg}	69.90^{abcd}	78.00^{jklm}	21.21^{bcde}	-26.55^{z}	-33.18^{efgh}
AM-168	109.33^{ijk}	57.39^{ijk}	54.38^{opq}	12.033^{efg}	60.45^{qrs}	83.57^{def}	11.55^{fgh}	-2.22^{rst}	19.53^{bcd}
AM-170	85.33^{wxy}	47.16^{wxy}	52.87^{uvw}	14.13^{opq}	64.86^{def}	85.27^{bcd}	13.417^{fgh}	-9.013^{wx}	-20.86^{cde}
AM-173	103.33^{mno}	60.1^{def}	59.54^{cde}	13.43^{vwx}	75.13^{abc}	86.77^{abc}	14.603^{efg}	-7.483^{uvw}	-20.97^{cde}

AM-175	**101.00^{mno}**	**61.88^{bcd}**	**60.87^{bcd}**	**16.40^{c}**	**74.13^{abc}**	**59.51^{qrst}**	**23.73^{abc}**	**25.133^{fgh}**	**-31.16^{def}**
AM-177	109.33^{ijk}	52.14^{pqr}	59.76^{cde}	12.16^{ef}	73.16^{abc}	82.73^{efg}	18.1^{cde}	-8.237^{vwx}	-28.53^{def}
AM-179	62.66^{gh}	47.80^{wxy}	50.47^{xyz}	14.4^{jkl}	62.34^{klm}	78.36^{ijk}	39.12^{a}	-8.83^{wx}	-42.40^{fgh}
AM-187	89.00^{tuv}	53.63^{mno}	56.48^{jkl}	13.3^{xyz}	63.09^{ijk}	75.94^{lmn}	20.21^{bcd}	0.22^{pqr}	-35.85^{efg}
AM-188	58.00^{h}	48.09^{vwx}	59.31^{cde}	11.53^{gh}	63.58^{ghi}	91.81^{abc}	-0.66^{uvw}	-6.22^{tuv}	3.73^{cde}
AM-190	110.00^{ijk}	59.73^{efg}	60.47^{cde}	13.6^{stu}	64^{fgh}	86.18^{abc}	1.64^{stu}	-1.05^{qrs}	-2.05^{cde}
AM-195	86.00^{uvw}	54.45^{lmn}	48.87^{abc}	15.00^{efg}	64.94^{def}	81.61^{fgh}	18.49^{cde}	-10.44^{xy}	7.04^{bcd}
AM-213	105.66^{klm}	55.15^{klm}	58.31^{efg}	14.53^{ijk}	62.61^{jkl}	85.01^{bcd}	2.46^{rst}	2.56^{pqr}	-5.17^{cde}
AM-214	119.66^{efg}	64.57^{abc}	63.20^{abc}	15.03^{efg}	66.5^{bcd}	58.65^{qrs}	16.74^{efg}	32.397^{cde}	-60.78^{nop}
AM-215	96.00^{pqr}	52.59^{opq}	53.78^{qrs}	13.43^{vwx}	71.4^{abc}	85.60^{bcd}	-9.75^{za}	9.43^{pq}	14.44^{bcd}
AM-224	114.00^{ghi}	59.52^{fgh}	56.90^{ghi}	13^{yza}	62.49^{klm}	88.31^{abc}	-3.03^{vwx}	-0.38^{qrs}	5.34^{bcd}
AM-226	106.33^{jkl}	61.80^{bcd}	59.31^{cde}	12.96^{yza}	66.6^{bcd}	61.58^{pqr}	22.84^{bcd}	29.52^{cde}	-80.45^{tuv}
AM-230	114.33^{fgh}	60.61^{cde}	63.45^{abc}	15.433^{def}	64.5^{def}	60.24^{qrs}	9.56^{ijk}	30.60^{cde}	-44.34^{ghi}
AM-232	136.33^{bcd}	64.63^{abc}	65.05^{abc}	12.36^{cde}	74.63^{abc}	53.88^{uvw}	20.31^{bcd}	22.45^{ijk}	-75.12^{rst}
AM-235	97.00^{opq}	60.79^{cde}	60.16^{cde}	14.1^{opq}	68.01^{abc}	46.13^{c}	26.28^{abc}	21.67^{lmn}	-107.33^{abc}
AM-259	97.66^{opq}	52.59^{opq}	46.64^{cd}	15.6^{de}	62.83^{jkl}	92.81^{ab}	-3.41^{wxy}	4.47^{pqr}	12.67^{bcd}
AM-263	101.66^{mno}	60.67^{cde}	54.85^{nop}	13.26^{xyz}	58.17^{tuv}	80.88^{fgh}	18.60^{cde}	-7.61^{uvw}	-24.91^{cde}
AM-264	104.33^{lmn}	61.47^{cde}	64.67^{abc}	15.43^{def}	71.54^{abcd}	53.61^{vwxy}	22.11^{bcde}	25.42^{fgh}	-28.41^{def}
AM-319	89.66^{stu}	48.91^{vwxy}	54.73^{nop}	12.33^{cdef}	61.2^{nopq}	90.91^{abcd}	-4.05^{xyza}	2.6^{pqrstuv}	7.44^{bcd}
AM-372	112.33^{hij}	69.96^{ab}	60.32^{cde}	14.3^{mno}	72.68^{abc}	56.89^{rst}	23.63^{abc}	29.29^{cde}	-87.94^{yza}
AM-273	93.66^{qrs}	58.63^{hij}	55.70^{klm}	13.96^{qrs}	76.83^{ab}	51.23^{abc}	24.80^{abc}	20.09^{no}	-89.48^{zab}
AM-282	112.00^{hij}	62.83^{abc}	62.26^{bcd}	14.76^{ghi}	71.6^{abc}	62.54^{opq}	20.33^{bcd}	37.29^{bcd}	-72.64^{rst}
AM-283	97.33^{opq}	59.63^{efg}	60.15^{cde}	14.56^{ijk}	70.5^{abc}	59.84^{qrs}	24.25^{abc}	30.09^{cde}	-86.42^{xyz}
AM-284	110.33^{ijk}	61.78^{bcd}	60.13^{cde}	15.23^{efg}	62.94^{jkl}	62.87^{opq}	12.02^{fgh}	33.52^{cde}	-51.47^{ijk}
AM-286	87.00^{uvw}	56.39^{jkl}	57.62^{fgh}	14.4^{jkl}	65.00^{def}	77.66^{klm}	14.38^{efg}	2.35^{pqr}	-22.79^{cde}
AM-293	129.33^{bcd}	67.84^{abc}	67.21^{abc}	14.36^{klm}	73.10^{abc}	62.53^{opq}	8.37^{klm}	33.48^{cde}	-41.43^{efg}
AM-294	144.33^{bcde}	66.80^{abcd}	67.87^{abcd}	14.03^{pqrs}	73.00^{abcd}	52.94^{wxy}	22.04^{bcde}	21.807^{klmn}	-81.34^{uvw}
AM-296	133.66^{bcd}	46.95^{wxy}	53.39^{stu}	14.66^{hij}	63.3^{hij}	83.81^{cde}	15.64^{efg}	-3.42^{stu}	-26.83^{def}
AM-298	130.33^{bcd}	66.45^{abc}	66.27^{abc}	12.96^{yza}	72.2^{abc}	61.93^{opq}	13.31^{fgh}	33.19^{cde}	-55.02^{klm}
AM-299	123.33^{cde}	67.31^{abc}	63.02^{abc}	13.2^{xyz}	65.56^{cde}	64.27^{opq}	4.76^{opq}	32.40^{cde}	-26.70^{def}
AM-312	81.66^{zab}	53.06^{nop}	56.74^{hij}	12.5^{bcd}	70.56^{abc}	61.74^{opq}	11.86^{fgh}	29.75^{cde}	-49.01^{ijk}
AM-316	98.00^{opq}	60.50^{cde}	58.10^{fgh}	11.26^{h}	70.26^{abc}	62.71^{opq}	9.32^{ijk}	35.17^{bcd}	-43.70^{ghi}
AM-318	91.00^{rst}	55.19^{klm}	54.12^{qrst}	10.4^{i}	60.43^{qrs}	86.51^{abc}	6.02^{nop}	-5.8^{tuv}	-8.123^{cde}
AM-338	108.66^{ijk}	61.463^{cde}	61.41^{bcd}	15.16^{efg}	69.43^{abc}	61.68^{pqr}	17.57^{def}	31.62^{cde}	-20.05^{cde}
AM-339	90.00^{rst}	56.22^{jkl}	59.863^{cde}	14.13^{opq}	72.1^{abc}	63.13^{opq}	17.74^{cde}	30.61^{cde}	-60.83^{nop}
AM-341	70.33^{efg}	47.11^{wxy}	51.86^{vwx}	12.5^{bcd}	56.43^{uv}	90.69^{abc}	-9.37^{za}	3.78^{pqr}	14.54^{bcd}
AM-342	86.33^{uvw}	56.43^{jkl}	57.35^{ghi}	14.33^{lmn}	72.28^{abc}	61.47^{pqr}	12.69^{fgh}	34.53^{bcd}	0.673^{cde}
AM-344	144.00^{bcd}	64.113^{abc}	63.88^{abc}	13.33^{wxy}	60.28^{rst}	94.08^{a}	-16.477^{a}	7.55^{pqr}	-6.21^{cde}
AM-346`	150.66^{bc}	67.98^{abc}	66.45^{abc}	14.4^{jkl}	65^{def}	51.267^{abc}	33.38^{abc}	22.13^{jkl}	-123.69^{c}
AM-347	115.66^{fgh}	64.32^{abc}	63.13^{abc}	15.00^{efg}	74.7^{abc}	61.74^{opq}	24.11^{abc}	25.73^{fgh}	-89.34^{yza}
AM-364	85.66^{vwx}	57.85^{ijk}	57.97^{fgh}	13.1^{xyz}	64.16^{efg}	80.49^{fgh}	-3.80^{wxy}	4.49^{pqr}	5.76^{bcd}
AM-370	88.66^{tuv}	49.32^{uvw}	50.23^{xyz}	13.03^{xyz}	64.9^{def}	83.55^{def}	13.387^{fgh}	-7.22^{uvw}	-21.84^{cde}
AM-373	101.33^{mno}	70.57^{a}	72.54^{a}	14.26^{nop}	72.4^{abc}	63.06^{opq}	11.62^{fgh}	35.10^{bcd}	-58.833^{mno}
AM-374	137.00^{bcd}	66.34^{abc}	61.89^{bcd}	13.46^{uvw}	70.8^{abc}	63.15^{opq}	10.24^{hij}	39.12^{bcd}	-47.85^{hij}
AM-382	86.66^{uvw}	51.83^{qrs}	57.20^{ghi}	14.33^{lmn}	61.46^{mno}	85.73^{bcd}	0.75^{tuv}	3.60^{pqr}	0.06^{cde}

AM-387	**123.33^{cde}**	**63.13^{abc}**	**63.99^{abc}**	**15.00^{efg}**	**72.56^{abc}**	**61.85^{opq}**	**20.90^{bcd}**	**38.31^{bcd}**	**-76.28^{stu}**
AM-389	127.00^{bcd}	67.38^{abc}	66.44^{abc}	14.1^{opq}	73.26^{abc}	51.71^{zab}	14.4^{efg}	22.83^{hij}	-126.50^{c}
AM-391	95.667^{pqr}	54.61^{lmn}	60.3^{cde}	12.33^{cde}	75.33^{abc}	56.46^{rst}	7.77^{lmn}	35.83^{bcd}	28.75^{bcd}
AM-396	83.33^{yza}	56.31^{jkl}	59.01^{def}	14.66^{hij}	76.93^{ab}	54.39^{tuv}	22.48^{bcd}	30.64^{cde}	-87.86^{yza}
AM-398	96.00^{pqr}	60.80^{cde}	57.25^{ghi}	14.1^{opq}	74.23^{abc}	52.49^{yza}	23.88^{abc}	22.42^{ijk}	-85.70^{wxy}
AM-400	122.00^{cde}	65.13^{abc}	62.89^{bcd}	15.40^{efg}	66.26^{bcd}	60.76^{qrs}	13.43^{fgh}	33.47^{cde}	-54.78^{klm}
AM-404	150.33^{bcd}	67.42^{abc}	68.25^{abc}	14.26^{nop}	73.267^{ab}	61.227^{qrs}	11.78^{fgh}	27.25^{efg}	17.86^{bcd}
AM-406	125.66^{bcd}	63.18^{abc}	65.92^{abc}	16.03^{cd}	65.36^{cde}	60.72^{qrs}	25.46^{abc}	32.19^{cde}	-63.48^{opq}
AM-417	110.66^{hij}	62.83^{abc}	68.79^{abc}	15.26^{efg}	71.1^{abc}	63.13^{opq}	10.03^{hij}	35.9^{bcd}	-44.79^{ghi}

Pear

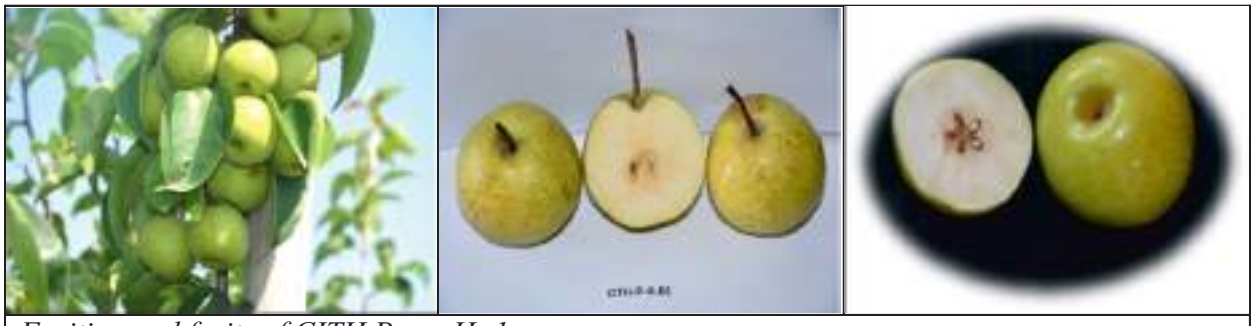
In pear, number of crosses was performed earlier years and the population showing superior morphological traits was top worked in the pear breeding block. During the year 2023, five new genotypes viz.CITH-Pear1,CITH-Pear2, CITH-Pear 3 and CITH- Pear 4 and CITH- Pear 5, came to bearing and the fruits of these were evaluated for some fruit and organoleptic traits in comparison to parents. The hybrid population which showed promise initially are presented below:

CITH Pear1

It is a cross between Kosui × Sand Pear. The fruit weight was recorded between 122.00g to 193.16g whilefruit length, fruit diameter, and fruit shape index were 60.22 mm, 66.30 mmand 1.05, respectively. The pedicle length indicated an average value of 35.15 mm. The color attributes of the hybrid measured were L*(52.60), a*(-5.54), b*(27.34), and Tint (-0.95), while the fruit firmness was 59.30 RI. Fruits have TSS of 13.45° Brix, juice percent of 60.33% and acidity of 0.47per cent. Further, the average values for ascorbic acid, reducing sugar, total sugar, and non-reducing sugar in hybrid were 15.00 mg/100g, 2.81%, 6.57%, and 3.76%, respectively. The fruit was ready to harvest during first week of September and so far no major disease has been observed in field conditions.

CITHPear2

It is cross between Kosui × Sand Pear. The fruit weight ranged between CITH-Pear-H-2 to195.85g, with an average of 154.57g. The average fruit length, fruit diameter, and fruit shape index were 59.99 mm, 67.06 mm and 1.05, respectively. The pedicle length showed an average value of 35.82 mm. The color attributes of the fruits were as L*(51.79), a*(6.29), b*(26.30) and tint (-34.42 while the average fruit firmness was 63.07 RI. Fruits have TSS of 14.33 ° B, juice percent of 54.53% and acidity of 0.62 percent. Further, the average values for ascorbic acid, reducing sugar, total sugar, and non-reducing sugar in the fruits of this hybrid were 13.00 mg/100g, 7.24%, 9.93% and 2.69% respectively. The fruit was ready to harvest during first week of August and so far no major disease has been observed in field conditions.



Fruiting and fruits of CITH Pear- H -1

Fruiting and fruits of CITH Pear- H -2

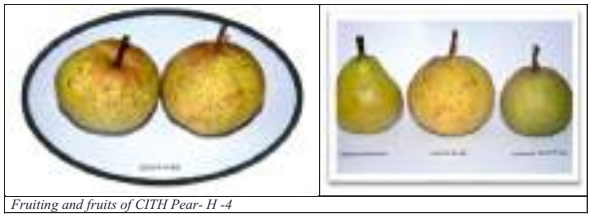
CITH Pear 3

It is a cross betweenKosui × Sand Pear. The fruit weight ranged from 214.00g to 350.00g, with an average fruit weight of 279.36g. This produced fruits having length, diameter and fruit shape index as 72.83mm, 81.18mm and 1.03, respectively. Pedicle length was recorded as 32.06mm. Among color attributes the value for L*(57.04), a*(-4.60), b*(37.37), and Tint (-10.40) and fruit firmness as 68.23 RI.Fruits have TSS of 12.90 °B, juice percentageas 52.74% and acidity as 0.45per centTheascorbic acid, reducing sugar, total sugar, and non-reducing sugar in variety were 13.00 mg/100g, 5.94%, 8.43%, and 2.49%, respectively. The fruit was ready to harvest during first week of September and so far no major disease has been observed in field conditions

Fruiting and fruits of CITH Pear- H -3

CITH-Pear4

It is cross between William Bartlett × Sand Pear. The fruit weight ranged from 273.84g to 290.15g, with an average fruit weight of 279.36g.The genotypes produced fruits havinglength, diameter, and fruit shape index as 71.09mm, 84.67mmand 1.03, respectively. The pedicle length was 32.33mm. The value for different color characteristics were as L*(51.24), a*(-2.12), b*(26.47) and tint (-9.09) and firmness of 66.90 RI. Fruits have an average TSS of 13.80° B, juice percentage of 54.37% and acidity as 1.03 per cent. The average content of ascorbic acid, reducing sugar, total sugar and non-reducing sugar in hybrid was recorded as 13.10 mg/100g, 5.11%, 7.07% and 1.96%, respectively.



Fruiting and fruits of CITH Pear- H -4

CITH-Pear5

It is ainterspecific cross between GentDrouard x Sand Pear. The fruit weights ranged from 117.05g to 137.01g, with the average fruit weight of 127.60g. It produced fruits having length, Fruit diameter, and fruit shape index as82.88mm, 59.51mm and 1.09, respectively. The pedicle length of fruits was37.02mm. Among different colour attributes the value recorded for L*(55.34), a*(-5.23), b*(30.69), tint (-6.24) and fruit firmness of 58.63RI. The fruits have average TSS of 15.16° B, juice percentage of 55.61% and acidity of 0.47 per cent. Theascorbic acid content, reducing sugar, total sugar, and non-reducing sugar were 13.00 mg/100g, 6.61%, 8.62% and 2.01%, respectively.

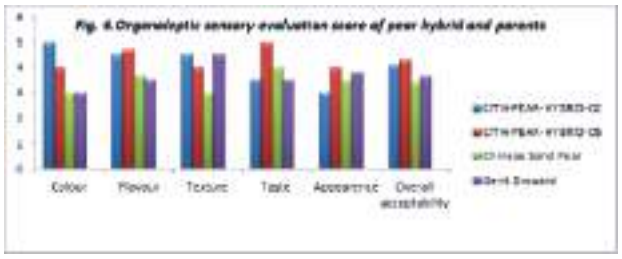
Fruiting and fruits of CITH Pear- H -5

Organoleptic sensory evaluation of pear hybrid (CITH-P-H-02 and CITH-P-H-05)

The organoleptic sensory evaluation of pear parents and hybrid was conducted in Fruit Science Lab on 19th of September 2023. A panel of six members was invited to conduct the sensory evaluation on Five point Hedonic Scale(Fig.6). The average score of all the parameters indicate the CITH-PEAR-HYBRID-05, showed best performance followed by CITH-PEAR-HYBRID-02 than the parents. The overall acceptability of CITH-PEAR-HYBRID-05 was

4.34 and CITH-PEAR-HYBRID-02 was 4.10 which were far better than parent Sand Pear (3.44) and Gent Drouard (3.66).

Organoleptic sensory evaluation of pear hybrid



Rootstock breeding in Apple

During the year 2023, the previous year's crossing population was evaluated for multiplication by air layering method in pots to reduce the evaluation processes. Based on the rate and ease of multiplication the hybrid populations were categorized into four different categories depending upon the rooting abilities viz.. very weak, weak, medium, and strong as per DUS guidelines. Amongst the evaluated population hybrid rootstocks CITH-A-BP-01, CITH-A-BP-07, CITH-A-BP-08, etc were grouped under the very weak category based on of roots biomass. Roots of hybrid rootstocks CITH-A-BP-03, CITH-A-BP-022, CITH-A-BP-32etc were categorized as a weak category, CITH-A-BP-04, CITH-A-BP-10, CITH-A-BP-11etcwere categorized under the medium category, while hybrid rootstocks population CITH-A-BP-02, CITH-A-BP-05, CITH-A-BP-06etcwere grouped under strong category. Different hybrid rootstock populations based on rooting ability under different categorieswere presented in Table 16.

Different rooting categories of hybrid rootstocks as per DUS guidelines

Table 1 6. Categorization of various population of rootstocks obtained from crossing for rooting thrpugh air layering

S.No.	Characteristic: Rooting in Air layering	Example Rootstocks
1	**Very Weak**	CITH-A-RS-BP-01,CITH-A-RS-BP-07,CITH-A-RS-BP-08,CITH-A-RS-BP-09,CITH-A-RS-BP-13,CITH-A-RS-BP-14,CITH-A-RS-BP-28,CITH-A-RS-BP-30,CITH-A-RS-BP-34,CITH-A-RS-BP-25, CITH-A-RS-BP-38, CITH-A-RS-BP-39,CITH-A-RS-BP-41,CITH-A-RS-BP-57,CITH-A-RS-BP-58,CITH-A-RS-BP-66, CITH-A-RS-BP-67,CITH-A-RS-BP-84,CITH-A-RS-BP-90, CITH-A-RS-BP-92, CITH-A-RS-BB-07,CITH-A-RS-BB-08,CITH-A-RS-BB-16,CITH-A-RS-BB-17,CITH-A-RS-BB-19 & CITH-A-RS-BB-24
2	**Weak**	CITH-A-RS-BP-03,CITH-A-RS-BP-22,CITH-A-RS-BP-32,CITH-A-RS-BP-37,CITH-A-RS-BP-36,CITH-A-RS-BP-40,CITH-A-RS-BP-42,CITH-A-RS-BP-43CITH-A-RS-BP-46,CITH-A-RS-BP-48, CITH-A-RS-BP-49,CITH-A-RS-BP-52,CITH-A-RS-BP-53,CITH-A-RS-BP-60,CITH-A-RS-BP-65,CITH-A-RS-BP-73,CITH-A-RS-BP- 77,CITH-A-RS-BP- 78,CITH-A-RS-BP-85, CITH-A-RS-BP-86, CITH-A-RS-BB-01, CITH-A-RS-BB-03,CITH-A-RS-BB-09,CITH-A-RS-BB-10,CITH-A-RS-BB-18 CITH-A-RS-BB-22,CITH-A-RS-BB-23 &CITH-A-RS-BB-25
3	**Medium**	CITH-A-RS-BP-04,CITH-A-RS-BP-11,CITH-A-RS-BP-10,CITH-A-RS-BP-18,CITH-A-RS-BP-26,CITH-A-RS-BP-31,CITH-A-RS-BP-33,CITH-A-RS-BP-47,CITH-A-RS-BP-54,CITH-A-RS-BP-59, CITH-A-RS-BP-64,CITH-A-RS-BP-68,CITH-A-RS-BP-71,CITH-A-RS-BP-74,CITH-A-RS-BP-79,CITH-A-RS-BP-80,CITH-A-RS-BP-81,CITH-A-RS-BP-82, CITH-A-RS-BB-04,CITH-A-RS-BB-12,CITH-A-RS-BB-15,CITH-A-RS-BB-20,CITH-A-RS-BB-28,CITH-A-RS-BB-29,CITH-A-RS-BM6-02,CITH-A-RS-BM6-03
4	**Strong**	CITH-A-RS-BP-02,CITH-A-RS-BP-05,CITH-A-RS-BP-06,CITH-A-RS-BP-12,CITH-A-RS-BP-15,CITH-A-RS-BP-16,CITH-A-RS-BP-17,CITH-A-RS-BP-19,CITH-A-RS-BP-20,CITH-A-RS-BP-21,CITH-A-RS-BP-23,CITH-A-RS-BP-24,CITH-A-RS-BP-25,CITH-A-RS-BP-27, CITH-A-RS-BP-29,CITH-A-RS-BP-44,CITH-A-RS-BP-45,CITH-A-RS-BP-50,CITH-A-RS-BP-51,CITH-A-RS-BP-55,CITH-A-RS-BP-56,CITH-A-RS-BP-61,CITH-A-RS-BP-62,CITH-A-RS-BP-63,CITH-A-RS-BP- 70 CITH-A-RS-BP- 72,CITH-A-RS-BP- 75, CITH-A-RS-BP- 83, CITH-A-RS-BB-02,CITH-A-RS-BB-05,CITH-A-RS-BB-06,CITH-A-RS-BB-12,CITH-A-RS-BB-21& CITH-A-RS-BB-27

CITH-A-RS-BP is a cross between M. Baccata& M9-Pajam, CITH-A-RS -BB between M. Baccata& B9 and CITH-A-RS-BM 6 between M. Baccata& MM-106.

Resistance/tolerance in hybrid population against white root rot diseases (Dematophoranecatrix).

A trial was conducted under polyhouse conditions during, 2023 to evaluate the level of resistance/tolerance in apple rootstocks (*Malusbaccata* × M9) against white root rot disease (*Dematophoranecatrix*). A total of 29 apple rootstocks were screened in pot culture and were challenge inoculated by introducing fungus inoculums multiplied on maize grain in the rhizosphere and soil moisture was maintained at regular intervals. Apple rootstocks exhibited differential reactions to disease developmental parameters viz., rate of wilting, defoliation, leaf chlorosis, and mortality of the plant. Chlorosis on the leaves in some rootstocks and wilting in others were observed as the first symptom of disease expression which took one week after the inoculation in susceptible rootstocks whereas the incubation period was extended in tolerant ones. Most of the population of different susceptible rootstocks collapsed within 30 days after inoculation. However, six rootstocks viz., BP-1, BP-51, BP-52, BP-55, BP-56 and BP-61 exhibited some level of tolerance against the disease even after 30 days of inoculation(Table 17).

Table.17. Screening of Apple rootstock against white root rot (*Dematophoranecatrix)*

Rootstocks	Date of Inoculation 03/07/2023				Date of Inoculation 10/07/2023				Date of Inoculation 17/07/2023				Date of Inoculation 24/7/23			
	Chlorosis	Wilting	Defoliation	Death	Chlorosis	Wilting	Defoliation	Death	Chlorosis	Wilting	Defoliation	Death	Chlorosis	Wilting	Defoliation	Death
BP-17	-	-	-	-	+	+	-	-	++	++	+	-	+++	+++	++	+
BP-90	+	+	-	-	+	++	-	-	++	++	-	-	+++	+++	-	+
BP-16	-	-	-	-	-	+	-	-	+	+	-	-	++	++	+	-
Bp-92	-	-	-	-	+	+	-	-	++	++	-	-	++	++	-	-
Bp-91	-	-	-	-	-	-	-	-	+	+	-	-	++	+	-	-
Bp-39	-	+	-	-	+	++	-	-	+++	+++	+	+	+++	+++	+	+
BP-40	-	-	-	-	+	+	-	-	++	++	-	-	+++	+++	+	+
BP-38	+	+	-	-	+	++	-	-	+++	+++	-	+	+++	+++	+	+
BP-49	-	-	-	-	-	-	+	-	-	++	+	-	++	++	++	-
BP-51	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-
BP-48	++	+	-	-	+++	++	+	-	+++	+++	++	+	+++	+++	++	+
BP-77	-	-	-	-	-	-	-	-	+	+	+	-	++	++	+	-
BP-74	+	+	-	-	++	++	-	-	+++	++	+	-	+++	+++	+	+
BP-75	-	-	-	-	-	-	-	-	+	+	-	-	++	++	+	-
BP-78	-	-	-	-	-	+	-	-	+	+	-	-	++	++	-	-
BP-73	+	+	-	-	++	++	-	-	+++	+++	+	+	+++	+++	+	+
BP-11	+	+	-	-	+++	++	-	-	+++	+++	+	+	+++	+++	+	+
BP-09	++	+	-	-	+++	+++	+	+	+++	+++	++	+	+++	+++	++	+
BP-12	-	-	-	-	-	+	-	-	++	++	-	-	+++	+++	+	+
BP-10	-	-	-	-	-	-	-	-	+	+	+	-	+++	+++	+	+
BP-27	-	+	-	-	+	++	-	-	+++	+++	-	+	+++	+++	+	+
BP-25	-	+	-	-	+	++	+	-	++	++	+	-	+++	+++	+	+
BP-33	-	+	-	-	-	++	-	-	+	++	-	-	++	++	+	-
BP-30	+	+	-	-	+++	++	-	-	+++	+++	-	+	+++	+++	+	+
BP-26	++	+	-	-	+++	++	-	-	+++	+++	-	+	+++	+++	+	+
BP-21	-	-	-	-	-	+	-	-	+	+	-	-	++	++	+	-
BP-20	-	-	-	-	-	+	-	-	++	++	-	-	+++	+++	+	+
BP-24	+	-	-	-	++	+	-	-	+++	++	+	-	+++	+++	++	+
BP-22	-	-	-	-	-	+	-	-	+	++	-	-	++	++	+	-
BP-70	-	-	-	-	+	+	-	-	++	++	-	-	+++	+++	-	+
BP-71	-	-	-	-	-	-	-	-	+	+	+	-	++	+	-	-
BP-60	+	-	-	-	+	+	-	-	++	++	-	-	+++	+++	+	+
BP-69	+	-	-	-	++	+	-	-	+++	++	-	-	+++	+++	-	+
BP-56	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-

BP-68	++	++	-	-	+++	+++	+	+	+++	+++	++	+	+++	+++	++	+
BP-52	-	-	-	-	-	-	-	-	-	-	+	-	+	-	++	-
BP-55	-	-	-	-	-	-	-	-	+	-	-	-	+	+	-	-
BP-54	-	-	-	-	+	+	-	-	++	+	-	-	+++	+++	+	+
BP-53	++	++	-	-	+++	+++	-	+	+++	+++	+	+	+++	+++	+	+
BP-62	-	-	-	-	-	+	-	-	+	+	-	-	++	++	+	-
BP-59	-	-	-	-	-	+	-	-	+	+	-	-	++	++	-	-
BP-58	-	-	-	-	-	-	-	-	+	+	-	-	+++	++	+	-
BP-61	-	-	-	-	-	-	-	-	-	+	-	-	+	+	-	-
BP-57	++	+	-	-	+++	++	+	-	+++	+++	+	+	+++	+++	++	+
BP-07	-	-	-	-	-	-	-	-	+	+	-	-	+++	+++	-	-
BP-02	-	-	-	-	-	-	-	-	++	+	-	-	+++	+++	-	+
BP-06	-	-	-	-	-	+	-	-	++	++	-	-	+++	+++	-	+
BP-01	-	-	-	-	-	-	-	-	+	-	-	-	++	+	-	-
BP-08	-	-	-	-	-	-	-	-	+	+	-	-	+++	++	-	+(80%)

**+ = slight, ++ = moderate, +++ = high, - = absent*

Characterization and diversity analysis of flowering related gene/ genes in almond

The transcriptome of two almond cultivars Waris and Ferralise were sequenced using the next generation sequencing technology. The data was submitted to NCBI under the Bio-Project accession No. PRJNA898899 (https://www.ncbi.nlm.nih.gov/bioproject/?term=PRJNA898899). GProfiler based gene ontology analysis of the differentially expressed genes revealed key terms, some of which include "intracellular anatomical structure", "organelle organization" and "organo-nitrogen compound biosynthetic process". It is interesting to note that DAVID annotation platform identified Auxin signalling pathway and Cell wall biogenesis/degradation as key terms among the up-regulated genes. DAVID also identified some KEGG pathway genes associated with Pyrimidine metabolism in up-regulated genes like Prudul26B005033, Prudul26B019171, Prudul26B019863, Prudul26B023061, Prudul26B006864 and others. Among the down-regulated genes, key genes associated with phosphatidylinositol signalling system included Prudul26B026001, Prudul26B026197, Prudul26B008531, Prudul26B021755, Prudul26B002429, Prudul26B016492, Prudul26B007113, and others. Primers of following genes were synthesised and expression analysis through Real Time PCR analysis is under process(Table.18).

Table 18. Identified unregulated genes for relative expression studies using Q-PCR in almond

Gene	Sequence (5' to 3')
CLCF	ATATTTCGGCCCAGCACAAC
CLCR	GGGTTGAGTGAACGAAGCCA
RRF	CAGTGCTGTAACCTTCCGAT
RRR	CTGATTGTCCACCCCACCAC
UCF	CCGGCAACCACATCTCCTTT
UCR	GCTTCCAACCCTGCCATAGA
DRPF	GAAGTCTTTTCGGCAGTGGC
DRPR	TCCGAAATCCTGGGTGAAGC
LST1F	ATGCTCCCTTGACAGATGCC
LST1R	AAGGCCAGTGCTCCATTACC
LST2F	GCAGAGAGATGGGCAGAGTG
LST2R	CTCTTCAGCCCAGGCAAACT
FBPF	CCTCCCTTGAATGCCCATGT
FBPR	CCAACTCAAACCAGCAACGG
EIFF	ACACCTAACGTTCAAGCACTGA
EIFR	GCCTTCTCCAAATTTTGCCTGA
ACSF	ACTTGGTGTCGGTTCACATTG
ACSR	TCTTTGTTCACGAAAGCGCA
EULF	ACGTCTCATCTCAGGTGTGC
EULR	CTTCAGTCTTGCCCCCGATT
DGKF	CACTTTGCTGCATTGCCTGT
DGKR	CTCAGCAGCCCTCTTCAACA
GSTF	CAAAAGTTCGACCCAGCAGC
GSTR	GCCCGGCTCAGTAGCATAAA
ACTIN F	GGCTCTATTCCAACCATCCA
ACTIN R	TAGAAGCAGTGCCACCACAC
Tubulin F	ATGTTCAGGCGCAAGGCTT
Tubulin R	TCTGCAACCGGGTCATTCAT
CsTUB F	TGATTTCCAACTCGACCAGTGTC
CsTUB R	ATACTCATCACCCTCGTCACCATC

From the comparative RNA-sequencing between early blooming (Nonpareil, Shalimar and Waris) and late blooming (Tardy Nonpareil, Ferragnese and Ferralise) cultivars. Upon examination of 52305 coding sequences (CDS), 3311 sequences were identified with SSR with 2-6 nucleotide motifs. Total 184 EST-SSR designed successfully and assessed for their amplification using almond genome sequence data (electronic PCR). Total 70 EST-SSRs primers have been amplified successfully on 13 almond cultivars and polymorphic EST-SSRs have been identified (Fig.7). Remaining EST-SSRs are being under evaluation for their PCR amplification and polymorphism for diversity analysis.

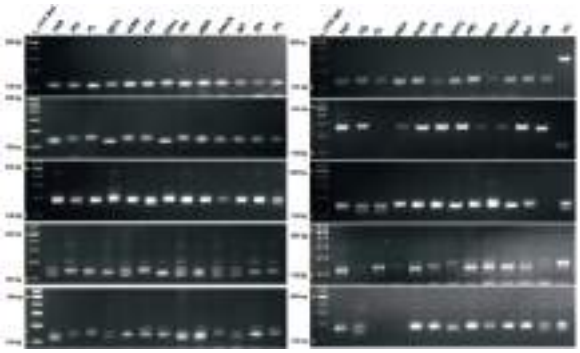


Fig. 7.Successful PCR amplification and polymorphism of EST-SSRs on almond cultivars. (Abbrev: TNP= Tardy Nonpareil; FG= Ferragnese; FL= Ferralise; MAK= Makhdoom; WAR= Waris; CPS= California Paper Shell; SHAL= Shalimar; PRI= Primorskiy; MER= Merced; PRAN= Pranyaj; NP=Nonpareil; DR= Drake; IXL)

Breeding for development of superior varieties/hybrids in Solanaceous crops

In chilli, capsicum and brinjal 100, 60 and 40 genotypes were grown for seed production, respectively, however, evaluation for yield and related traits was done only in promising genotypes selected for further evaluation in IET at national level under AICRP-VC. The data obtained is presented in the following Table 19.

Table 19. Fruit and yield traits of some important genotypes in Capsicum

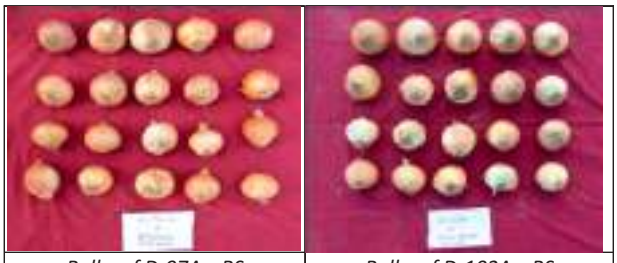
Crop	Genotypes	Yield (q/ha)	Fruit length (cm)	Fruit width (cm)
Capsicum	Gold-Sel-01	524.51	7.25	6.48
	CITH-SP-3-1	645.55	6.23	6.41
	CITH-N-4-1-1	701.27	7.54	6.13
	CITH-SP-4	611.35	4.41	4.26
	CITH-CW-4-1/15	643.83	7.36	7.01
	CITH-NS-284-1-1-15	515.77	7.12	6.97
	Nishat-1-Sel-05	412.56	7.52	7.32
	Nishat-1 (C)	330.67	7.25	6.95
	CD (p<0.05)	***21.56***	***1.56***	***0.94***

Development of CMS lines in onion (Allium cepa L)

The F3M2 progeny obtained from crossing intermediate day (source: PAU, Ludhiana) and long day onion accessions were evaluated for the following traits in 2023.The predominant bulb color was yellow (Table20). The selected bulbs of each progeny were massed again to obtain F4M3 progeny in 2024.

Table 20. Developmental and bulb characteristics of F3M2 progeny of various crosses

Cross	Bolting at harvesting (%)	Neck fall after 6 months (%)	Bulb colors	Average TSS (%)
D97A x BS	0	80	yellow/red/white	10.88
D102A x BS	5.60	28	yellow/red	11.42
D103A x BS	0.04	0	red/yellow	-
D266A x BS	6.67	0	red/yellow	-
D73A x BS	0	0	yellow/white	-



Bulbs of D-97A x BS (F3M2)

Bulbs of D-102A x BS (F3M2)

II. Crop Production

The productivity of quality produce in temperate horticultural crops in India is still low as compared to advanced countries and the factors responsible to the low productivity are quality planting material supply coupled with non adoption of advanced production technologies in training, pruning, nutrient & water management, pollination, post harvesting handling, diseases and pest management which ultimately decides the benefit to farmer. ICAR- CITH, Srinagar and its Regional Stations are continuously propagating planting material of elite varieties of temperate fruits, nuts, vegetables and ornamentals to supply quality planting material to farmers, line department and research organizations. The demand for institute planting material along with production technology is increasing year after year. During 2023-24, institute has supplied about 18035 plants of different temperate fruit crops besides the supply of 13958 scionwood; 1340plants & 2707 seedlings of flowers; about 30.36 kg vegetable seeds & 1535 vegetable seedlings besides 12 kg onion seedlings to different stakeholders, vegetable growers & research organization etc. During the year 2023-24, besides above planting material supplied about 1500 grafted plants of walnut were provided to Uttarakhand Forest Resource Management Project for establishment of mother orchards as well as for planting in farmers field under project promotion of walnut in Uttarakhand funded under Japan International Cooperation Agency (JICA). The revenue generated during the financial year from farm was 60.15 lakhs and overall revenue was 91.67 lakh. To increase the production of quality produce, institute is continuously generating technologies through various experimentations for the benefit of the farmers The outcomes of various experiments on production aspect for generating farmer friendly technologies presented below:

Assessment of soil carbon dynamics and carbon sequestration potential of selected temperate fruit crops of Arunachal Pradesh

In this experiment, 108 composite soil samples were collected depth wise from Apple, Walnut and Kiwifruit orchards of Arunachal Pradesh comprising of three elevations were subjected to soil quality assessment along with different carbon fractions. The average pH ranged from 5.82 ± 0.39 to 5.99 ± 0.46 in apple orchards, 6.05 ± 0.81 to 6.20 ± 0.44 in walnut orchards, and 5.86 ± 0.41 to 6.14 ± 0.54 in kiwifruit orchards. The pH of surface soils were slightly acidic in nature and was increasing with depth indicating it's shifts towards nuetrality. Irrespctive of depth, the organic carbon content was very high in all orchards. In apple orchards the organic carbon content decreased with increasing depth (2.54 ± 0.18 to 2.50 ± 0.20), while in walnut (2.27 ± 0.28 to 2.4 ±0.21) and kiwifruit (2.1± 0.07 to 2.31±0.14) orchards it was increasing with depth. The primary and secondary nutrients like available nitrogen, phosphorous, potassium, calcium, magnesium and sulphur content were maximum in surface soils of all orchards and were decreased with increasing depth of soils (Fig 8).

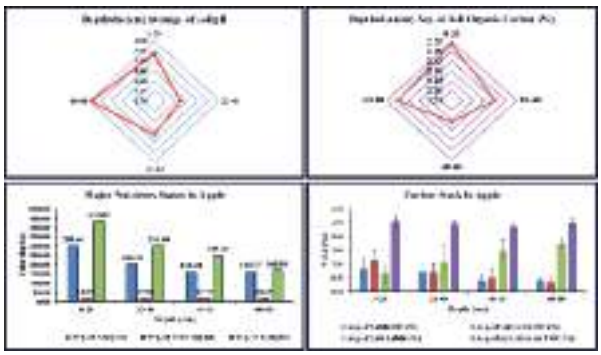


Fig 8.Soil pH, Organic Carbon, Major Nutrient Status and C stock in Apple orchards

In apple orchards the mean available nitrogen content was dropped from 299.66 ± 107 kg/ha in surface soils (0-25 cm) to 163.07 ± 51.55 in

subsurface soil (75-100 cm). Similarly, the available phosphorous (18.07 ± 2.27 to 18.65 ± 5.69 kg/ha), exchangeable potassium (431.87 ± 117.61 to 168.80 ± 83.20 kg/ha), calcium and magnesium (7.47 ± 3.32 to 3.11 ± 1.71 mEq/100g)) and available sulphur (85.85 ±14.54 to75.67 ± 13.00 kg/ha) content. In surface soils, the values of total potential acidity, pH dependent acidity, soil microbial biomass carbon (SMBC), labile organic carbon (LOC) and very labile organic carbon (VLOC) content were at their highest (6 ± 2.29 (meq/100g), 5.74 ± 2.22 (meq/100g), 760.39±315.48, 0.84±0.38 (%), and 1.15±0.37 (%), respectively. The lowest values were found in subsurface soil samples, suggesting that these parameters decrease with depth. On the other hand, exchangeable acidity and H+ & Al3+ do not change with soil depth. Additionally, in surface soils, the low labile organic carbon (LLOC) and soil buffer for lime requirement were low, but they rose as soil depth increased. Surface soils also exhibited the highest levels of dehydrogenase and urease enzymatic activity (0.35 ± 0.07 µg/g/hr and 14.96 ± 5.69 mg urea/g/hr, respectively), which subsequently declined as soil depth increased (Fig 9).

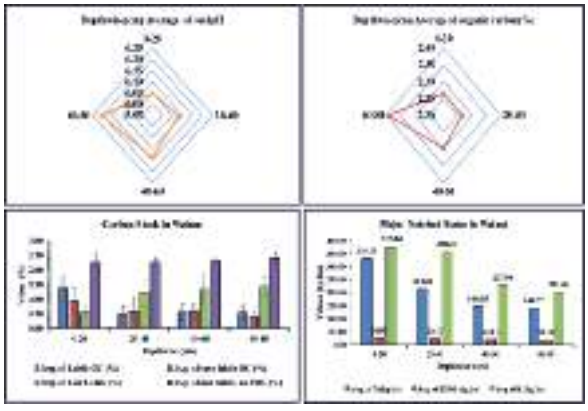


Fig 9. Soil pH, Organic Carbon, Major Nutrient Status and C stock in Walnut orchards

In orchards of walnuts, the highest levels of available nitrogen, phosphorous, exchangeable potassium, calcium and magnesium, and sulfur were found in surface soils, with respective values of 330.33 ± 142.90 kg/ha, 24.03 ± 3.07 kg/ha, 377.84 ± 47.20 kg/ha, 7.44 ± 1.24 mEq/100g, and 99.51 ± 18.94 kg/ha. These levels declined as soil depth increased. Further, total potential acidity (4.94 ± 2.28 meq/100g), pH dependent acidity (4.74 ± 2.18 meq/100g), SMBC (504.88±408.25), LOC (1.37 ± 0.44 %) and VLOC (0.94±0.45%) content were at their highest in surface soils and the lowest was recorded in sub-surface soils of 75 to 100 cm depth. Similar results with respect to dehydrogenase and urease enzymatic activity (0.35 ± 0.14 µg/g/hr and 13.79 ± 0.95 mg urea/g/hr) respectively was recorded in surface soils. However, exchangeable H+ & Al3+ ion activity and exchangeable acidity do not change with soil depth. On the other hand, low labile OC, non-labile OC and soil buffer for lime requirement were increased with depth of soils and found highest in sub- surface soils (1.44 ± 0.30 %, 2.40 ± 0.28 % and 6.84 ± 0.48 respectively).

The main and secondary nutrients in kiwifruit orchards followed the same pattern as in apple and walnut orchards, with surface soils showing the maximum availability and subsurface soils showing the lowest (Fig 10). Similarly, total potential acidity (6.43 ± 2.42 meq/100g), exchangeable Al3+ (0.16 ± 0.10), pH dependent acidity (6.24 ± 2.33 meq/100g), SMBC (711.97±364.81), LOC (1.14 ± 0.3 %), VLOC (0.91±0.31%), dehydrogenase activity (0.34 ± 0.14 µg/g/hr) and urease activity (20.96 ± 0.76 mg urea/g/hr) was highest in surface which subsequently declined with depth of soils. Further, exchangeable H+ activity, low labile OC, non-labile OC and soil buffer for lime requirement were found increasing with depth and highest in the sub surface soils (0.08± 0.05 meq/100g, 1.51 ± 0.47 %, 2.31 ± 0.14 % and 6.85 ± 0.41 respectively)

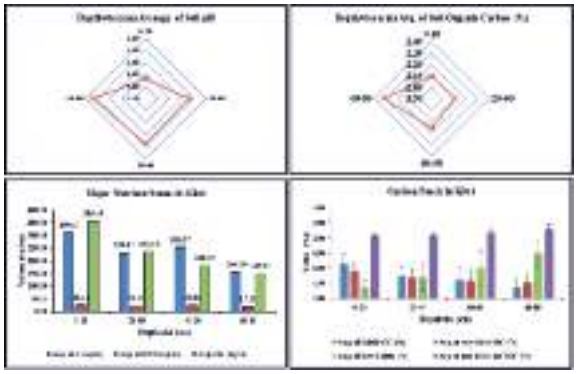


Fig 10. Soil pH, Organic Carbon, Major Nutrient Status and C stock in Kiwifruit orchards

Impact of combined application of phosphorus and silicon on apple rootstock performance under various soil moisture regimes

Three different rootstocks viz., M-9, MM-106, and MM-111 were evaluated for their root proliferation under varying soil moistures regimes (W1, W2 and W3) in relation to the combined effect of silica and varying levels phosphorous application. Under lower phosphorus levels (P1-15:10:15 NPK g/ pot + 15g silicon) the soil moisture regime of 40 % field Capacity (W2) with rootstock MM-111 recorded highest growth parameters. However, with increased phosphorous levels (@P2 and P3 levels) the soil moisture regime of 60 % field capacity (W3) with rootstock MM-106 recorded the better growth parameters. Further the results need to be confined with soil quality parameters and use efficiency indices which are under process.

Development and Evaluation of Integrated Nutrient Management module for high-quality temperate vegetables production

A field experiment with organic, inorganic, integrative and natural component treatments was conducted at ICAR CITH farm to study the effect on performance of kale, onion and garlic as well as to assess the soil quality. A simple Randomized Block design comprising of ten treatments and three replications was employed. In Kale crop, the treatment T6 - 50% Inorganic + 50% organic (Trichoderma enriched Vermi-compost) recorded significantly higher yield (38790.08 kg/ha) which was at par with the treatments T8 – 75 % Inorganic + 25 % organic (T. enriched Vermi-compost) and T9 – Jeevamrutha @ 500 litre/ha. Further, the better growth parameters and soil fertility were also recorded under T6 treatment. In onion and garlic, the treatment consisting of 50% Inorganic + 50% organic (trichoderma enriched Vermi-compost) recorded significantly higher growth parameters and higher yields Viz., 55.23 t/ha and 32.3 t/ha respectively.

Glimpses of experimental field on Integrated Nutrient Management module for high-quality temperate vegetables production

Effect of combined application of phosphorus and silicon on apple rootstock performance under various soil moisture regimes

Comparative assessment of organic vs natural vs farmers practice in apricots of Kashmir Valley

A study was undertaken to assess the comparative effect of organic, natural, and conventional farming on the quality traits of apricot (Prunus armeniaca L.). The soil quality and biochemical properties of two commercially cultivated apricot cultivars viz., CITH Apricot-1 and CITH Apricot-2 were studied. In cultivar CITH Apricot-1, significantly higher TSS was exhibited under organic (11.93 0B ± 0.47) and natural (12.91 0B ± 0.47) farming conditions; whereas, 'Apricot-2' showed the maximum pulp moisture content (29.07% ± 0.90) under conventional practices. Furthermore, CITH Apricot-1 showed significantly higher phenolic content (60.03 mg, GAE/100 g fw ±1.23 and 57.86 mg, GAE/100 g fw ± 1.23) and DPPH activity (7.51 µmol, TE/ g fw ± 0.66 and 7.33 µmol, TE/ g fw ± 0.66) under organic and conventional farming systems respectively

Glimpses of experiment on comparative assessment of organic vs natural vs farmers practice in apricots

Pre harvest fruit drop in apple (Malus X domestics Borkh)

Effect of NAA application on Pre Harvest fruit drop in apple (Malus X domestics Borkh)

An investigation was carried out during the year 2023 to control pre harvest fruit drop by the application of 1-naphthaleneacetic acid (NAA) on three varieties of apple (Golden Delicious, Red Delicious, and Oregon Spur) on MM-106 rootstock. The application of treatments was done two weeks days before harvesting and three concentrations of NAA were used viz. 10ppm, 20ppm, and 30ppm. From the data, it is revealed that the highest extent of fruit drop was noted at control (13.04%) in the case of the Golden Delicious variety (Fig 11). The 30ppm treatment showed a lower fruit drop (3.16%) compared to 20ppm (3.97%) and 10ppm (4.87%). Similarly, for Oregon Spur and Red Delicious, the control showed the highest fruit drop at 9.21% and 10.42% respectively. The 30ppm NAA application resulted in the lowest pre-harvest fruit drop (3.02% in Oregon Spur and 3.57% for Red Delicious). At 20ppm, NAA application, Oregon Spur had a fruit drop of 3.77%, while Red Delicious had 4.09Percent. At 10ppm, Oregon Spur recorded the fruit drop at 4.15% and Red Delicious at 5.90%. Comparing the three varieties, Oregon Spur showed the most significant reduction in fruit drop at 30ppm (3.02%) followed by Golden Delicious (3.16%) and Red Delicious (3.57%).

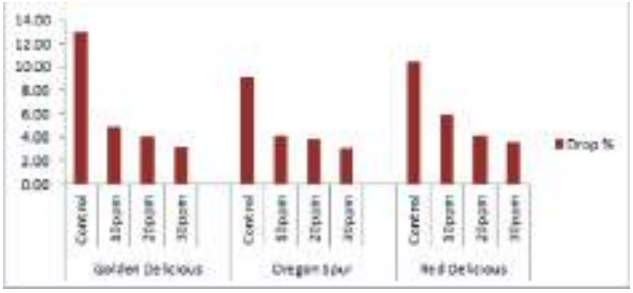


Fig 11.Effect of different concentrations of NAA on pre harvest fruit drop in apple

Development of almond based intercropping system involving saffron

The cultivation is associated with many biotic and abiotic production problems leading to more losses to farmers. So to avoid losses to farmers an attempt has been done to develop an almond based intercropping system involving saffron . In this experiment, different type of varieties having varied growth habit viz. erect, semi erect and spreading were tried along with sole saffron crop and effect of various almond varieties was studied on saffron. The highest saffron yield was recorded under spreading type of almond varieties followed by semierect, sole and erect type. The highest almond yield (t/ha) was recorded in spreading type (1.57 t/h) followed by semi erect (1.42t/ha) and erect (0.856 t/h). The highest almond yield equivalent to saffron was recorded in spreading type (1.261 kg/ha) followed by semi erect type (1.135kg/ha) & erect type (0.685 kg/ha). The highest cumulative yield were recorded under spreading type followed by semi erect, erect type & sole. Non significant effect has been observed for most of plant and flower traits. Thus saffron-almond is the best combination and there is less effect of almond varieties having different growing habit on economic traits of saffron. Thus the almond crop can give additional returns to growers and will be more beneficial to compensate losses during adverse biotic and abiotic stresses. The varieties especially spreading & erect type can give more returns to the growers due to more almond yield which may be due to varietal potential or more number of spurs followed by better pollination. The crocin, picocrocin and safranal contents were also estimated after two months from harvesting. He crocin was 2.50 % in sole, 2.70% in erect, 2.30 in spreading and 2.20% under semi spreading type of varieties. Similarly picocrocin was 1.52,1.40,1.20 and 1.40 percent in saffron grown under different treatments while safranal was 0.017 in sole, 0.037 under erect, 0.017 in spreading and 0.012 % under semi erect type of varieties.

Canopy management and plant architectural engineering in temperate fruits

In canopy architectural engineering experiment in apple; six training systems (vertical axis, cordon, espalier, head & spread, spindle bush and modified central leader system) with two cultivars (Oregon Spur & Red Delicious) on four rootstocks (Seedling, MM 111, MM 106 & M 9) were evaluated for various fruit and yield traits. Among various rootstocks, varieties and training systems, maximum productivity was recorded in Oregon Spur (67.76 t/ha) on MM 106 rootstock closely followed by same variety on M 9 rootstock (66.61 t/ha) and same variety on MM 111 rootstock (66.09 t/ha) while it was 54.51 t/ha on seedling rootstock trained on vertical axis system. As far as training systems is concerned, mean productivity was higher in Oregon Spur as compared to Red Delicious except Cordon system. Similarly, among rootstocks productivity was higher on MM 106 followed by M-9, seedling and MM 111 in Oregon Spur while in Red Delicious it was higher on MM 106 followed by M 9, MM 111 and seedling. The average yield per plant was also higher in Oregon Spur in all systems as compared to Red Delicious.The highest average yield was recorded in Espalier System.

In canopy architectural engineering in pear experiment, 4 varieties (Red Bartlett, Starkrimson, William Bartlett & Kashmiri Nakh), 2 rootstocks (BA 29 C & Q C) and 4 training systems (Vertical Axis, Espalier, Tatura Trellies and Modified Central Leader System) were used for experimentation. Overall highest productivity was recorded in William Bartlett (35.74 t/ha) on BA 29 C rootstock on vertical axis system followed by Red Bartlett (31.39 t/ha). In BA 29 C

rootstock, higher average productivity was recorded in Vertical Axis followed by MCLS, Espalier and Tatura Trellis on BA 29 C rootstock. In case of Q C rootstock, higher productivity was recorded in Wiiliam Bartlett (24.60t/ha) followed by Red Bartlett (16.41 t/ha) & Starkrimson (13.49t/ha) . In QC rootstock, mean productivity was higher in Vertical Axis followed by Espalier, MCLS and Tatura Trellis. In comparison of means of different varieties on BA 29 C rootstock planted in different training systems, productivity was more in Red Bartlett followed by William Bartlett, Starkrimson & Kashmiri Nakh and while on QC rootstock, William Bartlett gave more productivity followed by Red Bartlett, Starkrimson and Kashmiri Nakh .The average fruit weight was higher on BA 29C rootstock as compared to QC rootstock.

Standardization of integrated nutrient management of vegetables as intercrop in apple orchard.

For evaluation of integrated nutrient management of vegetables as intercrop in apple orchard, the technology were demonstrated to among farmer under MGMG and SCSP scheme at Sunkiya, Nainital, Gahena, Nainital, Odlohar-Simsyari, Bageshwar villages during 2023 respectively with the aim to promote crop diversification for sustainable production and to utilize better space as well as natural resources per unit area without eroding soil health for enhancing production per unit area.

Development of different techniques for enhancing the multiplication rate of temperate fruits under protected/open conditions

Air layering in apple rootstocks in greenhouse conditions

When clonal rootstocks of apple are multiplied in the polyhouse, some plants grow > 4 ft in height. After these rootstocks are harvested only 6 to 9 inches (15-25 cm) is needed for grafting/budding operations & rest > 80 % is cut off and just wasted. Keeping in this view, an experiment has been done to initiate rooting along the entire stem at different points based on the height and thickness of the shoot so that this portion of plant can be utilized in a most efficient way. First those plants having a diameter of (5-7 mm) were selected and wounding/incision has been given and rooting hormones IBA (2500 ppm) was applied in the form of lanolin paste to the wounded portion. Small bags filled with rooting medium has been fastened at those points where rooting needs to be initiated. Light weight substrate having high water holding capacity was used (Cocopeat). Staking was done to hold the bags in fixed position. Watering at regular intervals was done to keep the rooting media moist. Rootstocks selected were M9-Pajam, M9-T337, M9-T339, P-22, B-9, M-27, MM-106, CIV P21 and G11. The success percentage varies from 45.9% to 93.02% with maximum percentage in MM-106 and minimum in M9-Pajam. The Maximum plant height (125.6cm), plant diameter (9.42mm) and root length (18.0cm) was recorded in MM-106 and minimum plant height (44 cm) in G-11, plant diameter (3.99mm) in CIVP21 and root length(5.4cm) in P-22. While considering root diameter, the MM-106 showed maximum (2.47mm) root diameter and minimum (0.72 mm) root diameter was recorded in P-22. The number of adventitious roots varied between 2.0 to 4.0 with maximum value in MM-106, M9-Pajam and minimum value in CIVP21 and P-22. Additionally MM-106 had the maximum inter nodal distance at 3.54cm while M9-Pajam had the minimum at 2.4cm.

M9-T337

M9-T339

B-9

M-27

MM-106

P-22

M-9 Pajam

CIVP21

G-11

Rooting in different air layered rootstocks of apple under polyhouse conditions

Air layering in apple rootstocks in open field conditions

During the year 2023, six apple rootstocks MM-106, M9-T339, M9-T337, M-9 Pajam, MM-111 and M-26 were evaluated for rooting and other traits under open conditions. Among 6 rootstocks, the success percentage varies from 43.05% to 86.37% with maximum percentage in MM-106 and minimum in M9-T337.The Maximum plant height (85.0cm) was recorded in M-26 and minimum (53.0cm) in M9-T337. In terms of plant diameter, it ranged from 5.12mm to 6.86mm with maximum value in MM-111 and minimum value in M9-T337. When considering total root length, MM-106 exhibited the maximum length of 9.60cm, contrasting with the minimum length of 5.84cm observed in M-26. In case of root diameter, the MM-106 showed maximum (2.58mm) root diameter and minimum (1.11mm) root diameter was recorded in M-26. The No. of adventitious roots varied between 2.0 to 5.0 with maximum value in MM-106 and minimum value in M-111, M9-T337 and M-26. Additionally, M9-T337, M-111 and MM-106 had the maximum internodal distance at 2.9cm, while M9-T339 had the minimum at 2.6cm.

MM-106

MM-111

M9-T337

M9-T339

M9-Pajam

M-26

Rooting in different air layered rootstocks of apple under open conditions

Air layering in colt (cherry rootstock)and quince (pear rootstock) under polyhouse conditions

For faster multiplication, air layering was tried in pear rootstock (quince) and cherry rootstock (colt). In case of cherry rootstock, maximum plant height (121cm), plant diameter (8.06mm), root length (11.46cm), root diameter (1.96 mm) and intermodal distance (3cm) was recorded. in cherry colt and minimum plant height (49cm) and plant diameter (4.60mm) in Quince. Similarly in case of pear rootstock quince, plant height (49 cm), plant diameter girth (4.60mm), root length (16.92 cm), root diameter (1.40mm) and intermodal distance (2.1 cm) was recorded.

Propagation of apple rootstock through cuttings

In this trial, two apple rootstocks (MM 106 & MM 111) were tried. In rootstock MM-106, the maximum plant height (127cm) was recorded and minimum (120 cm) in MM-111 whereas, the maximum plant diameter (7.87mm) was recorded in MM-111. When assessing root characteristics, MM-106 showed the maximum root length of 33.7cm with maximum root diameter 4.38 mm. The number of adventitious roots varied between 3 to 4 with maximum value in MM-106 and minimum value in MM-111. In addition, MM-106 showed the maximum inter nodal distance (3.1cm), while MM-111 showed the minimum (2.2cm).

Rooting in cherry rootstock colt through air layering

Rooting in pear rootstock quince through air layering

Different stages of apple rootstock propagation through cuttings under polyhouse conditions

Propagation through cuttings in other fruit crops (Grapes, Pomegranate, Olive, Hazelnut& Kiwifruit)

In all the trials cocopeat has been used as a rooting medium. In grapes, the success percentage (85%) was recorded with maximum plant height (214cm) and plant diameter (5.88mm). When assessing root characteristics, it showed maximum root length of 36.24cm with maximum root diameter (4.57mm). The number of adventitious roots observed was 5. In case of pomegranate, the success percentage (65%) was recorded with maximum plant height (102cm) and plant diameter (7.00mm). When assessing root characteristics, it showed maximum root length of 43.60cm with maximum root diameter (2.40mm). The No. of adventitious roots observed was 4. In olive, the success percentage (45 %) was recorded with maximum plant height (46cm) and plant diameter (6.29mm). When assessing root characteristics, it showed maximum root length of 12.80cm with maximum root diameter (1.84mm). The number of adventitious roots observed was 3 with internodal distance of 2.9 cm. In hazelnuts, the very less success percentage (10 %) was recorded with maximum plant height (58cm) and plant diameter (5.20mm). When assessing root characteristics, it showed maximum root length of 43.60cm with maximum root diameter (2.46mm). The number of adventitious roots observed was 6 with internodal distance of 2.7 cm. In kiwifruit, the less success percentage (15.0 %) was recorded with maximum plant height (35.0cm) and plant diameter (6.61mm). When assessing root characteristics, it showed maximum root length of 23.27cm with maximum root diameter (3.53mm). The number of adventitious roots observed was 4.

Rooting in different fruit crops through cuttings

Air layering in quince rootstocks in polyhouse conditions (Pots)

In this experiment, 4 rootstocks (QA, BA 29, BA 29C & QC) were tried for air layering in pot. Maximum plant height (128 cm) was recorded in Quince-BA-29 and minimum (112cm) in Quince-C. In terms of plant diameter, it ranged from 6.44mm (Q C) to 7.26mm (BA 29C).The total root length, Quince-A exhibited the maximum length of 14.6cm and minimum root length of 11.38cm observed in BA-29C. In case of root diameter, the maximum value (2.18mm) was recorded in Quince-C and minimum root diameter (1.64 mm) was observed in BA-29C. The number of adventitious roots varied between 2 (BA 29) to 5 (QA).

Vertical expansion technology of apple rootstock at ICAR-CITH, Regional Station, Dirang, (Arunachal Pradesh)

The technology developed by ICAR-CITH, Srinagar on vertical expansion of rootstock multiplication in apple was tried at Regional Station Dirang. The experimental design comprised two treatments: the application of rootwin to 40 plants for each rootstock and a combination of rootwin and Aloevera to 20 plants of each rootstock. Additionally, a control group of 05 plants for each variety was maintained under standard growing conditions inside naturally ventilated polyhouse conditions. The procedure involved making incisions applying rootwin (a powder form of IBA), and a 1:1 mixture of Aloevera and rootwin to the incised portion. For control group incisions was given without any application of treatment. Subsequently, the incisions were wrapped with polybags and cocopeat was used, as rooting medium and irrigation was provided at regular intervals. The successful rooting by using rootwin was recorded in 24 plants, and in the combination 15 plants and in the control only in two plants. Out of a total of 325 plants, 41 developed rooting successful, resulting in a 12.6% success rate. The experiment involved five apple rootstocks (M9 T339, M9 T337, B9, M9-Pajam and M27). B9 rootstock showed the highest rooting percentage, of 33.8%, while M9-Pajam and M27 showed less favorable results with success rates of 4.6 percent.

Treatment application and fastening of polybags filled with cocopeat at Dirang

Quince-A	*BA-29*	*BA-29C*	*Q C*

B 9	M9 T337	M9 T339	M27	M9- Pajam

Rooting in different rootstocks

III. Crop Protection

The temperate horticultural crops are prone to attack of large number of insect, pests and diseases which ultimately leads to a great loss of quality produce.Institute is continuously doing need based research on plant protection aspect, so that losses of farmers can be saved. The results of various studies carried out during 2023 are presented below:

Survey, collection, characterization and documentation of temperate horticultural crops

Screening of apple germplasm against major diseases using phenotypic and biochemical approaches

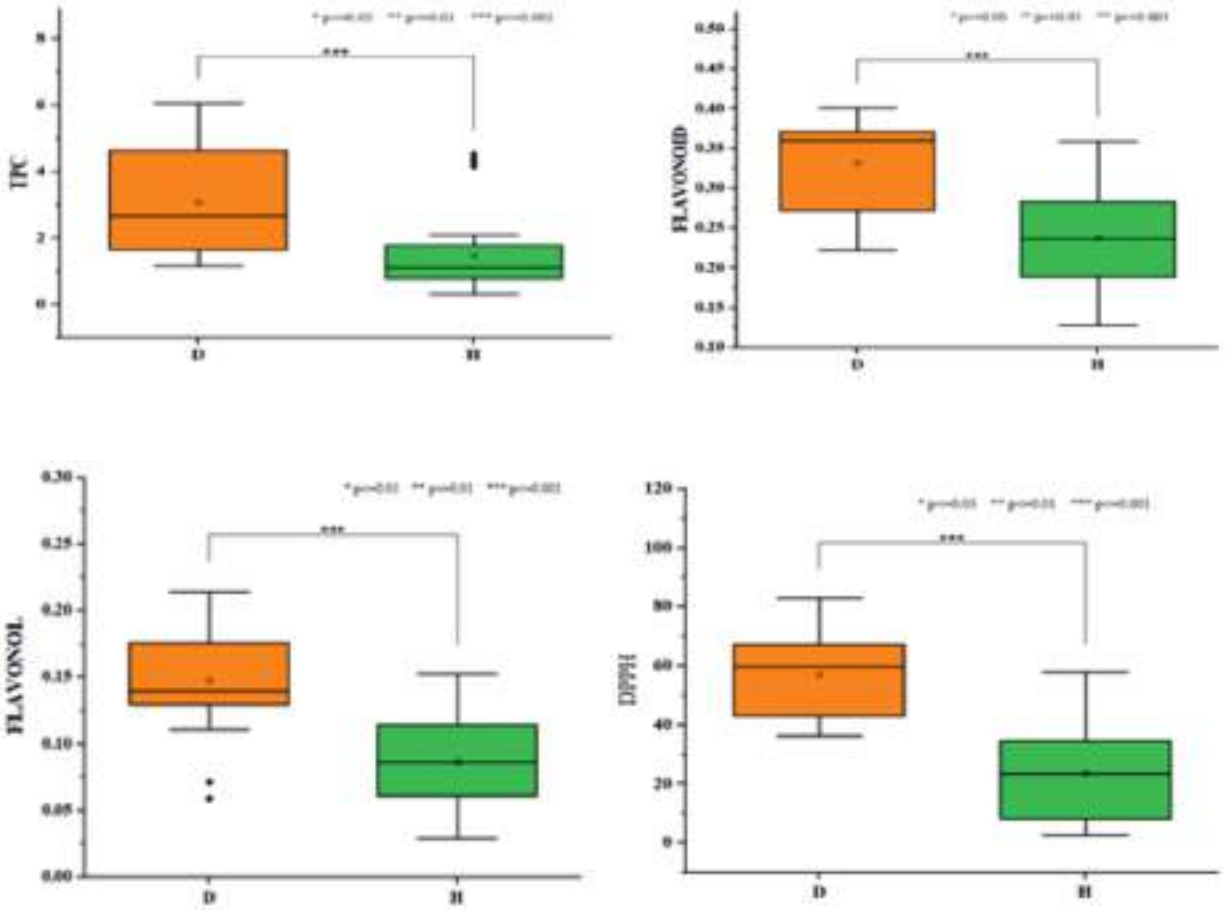
During 2021, 2022 and 2023, total 203 apple cultivars maintained in field gene bank at ICAR-CITH Srinagar, were screened under field conditions for powdery mildew of apple incited by *Podosphaera leucotricha*. In spring when the terminal buds begin to grow, the fungus colonizes the young, green tissue as it emerges. These infected "flag shoots" have a silver-gray appearance and may exhibit defoliation, stunted growth, and die-back. Five categories based on disease intensity 0%, 1-5%, 6-20%, 21-50% and 51-100% for immune, resistant, moderately susceptible, susceptible and highly susceptible respectively were recorded using 0-5 severity scale. Based on three year data, out of 203 genotypes, 50 genotypes were found resistant.

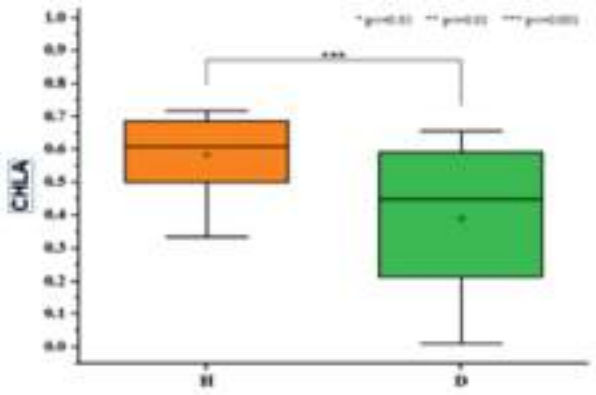
Diagnosis, transmission and management of virus/virus like diseases of temperate fruit crops

Biochemical characterization of compatible plant-viral interaction- a case study with ApMV/ApNMV-Apple host-pathosystem

The experimental was conducted during 2022–2023 and 2023-24 at ICAR-Central Institute of Temperate Horticulture, Srinagar on 20 genotypes of apple. The leaf sample collected from mosaic infected and healthy apple plants during the month of May (First week) were subjected to biochemical assays. The various bioassays taken into consideration under present study were total phenol content (TPC), flavonoids, flavonols, 2,2-diphenylpicrylhydrazyl (DPPH), Chlorophyll, Carbohydrate/total starch, malondialdehyde (MDA), catalase (CAT), superoxide dismutase (SOD), peroxidase, polyphenol oxidase (PPO), phenylalanine ammonia-lyase (PAL). The mature leaf samples were taken from different genotypes of mosaic infected and healthy apple plants. In this study, the significantly ($p<0.05$) higher phenolic contents were recorded from mosaic infected apple genotypes and lesser from their respective healthy plants. The flavonoid and flavonol concentration in mosaic infected plants were significantly ($p<0.05$) higher as compared to healthy plants across the 20 genotypes. The concentration of flavonoids ranged from 0.22-0.40 mg/g.fw in infected plants and 0.12-0.35 mg/g.fw in healthy plants. Also flavonols ranged from (0.05-0.21 mg/g.fw) in infected plants as compared to (0.03-0.14 mg/g.fw) in healthy plants. The DPPH is a stable free radical, which is scavenged by antioxidants through the donation of hydrogen forming the reduced DPPH. The DPPH activity was significantly higher in infected genotypes than their healthy ones. In infected plants, percentage range of DPPH radical scavenging activity was 36.42-83.06% and in healthy plants, the percentage range was 4.17-48.35%. The mosaic-affected plants showed strong biochemical alterations with one of the major symptoms as chlorosis, which is associated with loss of chlorophyll content. The study revealed that significant loss of chlorophyll was observed in mosaic infected cultivars than their

healthy ones. Moreover total starch in infected leaves from all genotypes showed a significant decrease in comparison to the leaves taken from healthy apple trees. Oxidative stress markers MDA, considered as general indicator of lipid peroxidation. The significantly higher level of MDA in all mosaic infected plants and lower levels in healthy plants was observed. Concentration of MDA in mosaic infected was 7.87-13.65 µm/g f.wt and in healthy plants 3.87-10.09µm/g f.wt. Phenylalanine ammonia-lyase (PAL) is the marker enzyme for phenolic biosynthesis in plants. It is known to mediate rapid biosynthesis of phenolic acids. The present study recorded changes in PAL activities in the entire virus infected apple genotypes and their healthy ones. Significantly higher PAL activity (6.87-15.66mg/g f.wt) was seen in entire virus infected genotypes in comparison to healthy ones (5.45 15.42 mg/g f.wt). Focusing on enzymatic responses, catalase, peroxidase, SOD and PPO activity were significantly ($p<0.05$) different and higher in mosaic infected plants than their healthy plants in most of genotypes confirmed by two way ANOVA and Tukey's test. A significant difference for means of antioxidant enzymes under mosaic and mosaic free condition are illustrated by box plots (Fig12). The correlation analysis revealed significant associations among the various biochemical parameters studied. The correlation graph for the antioxidative and biochemical characters using Spearman's correlation coefficient ($p<0.05$) are illustrated in Fig. 13.

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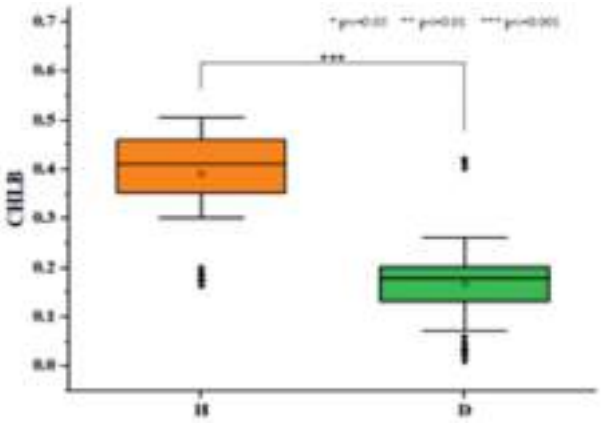
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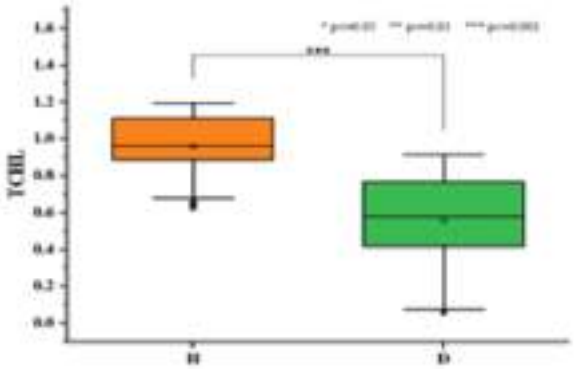
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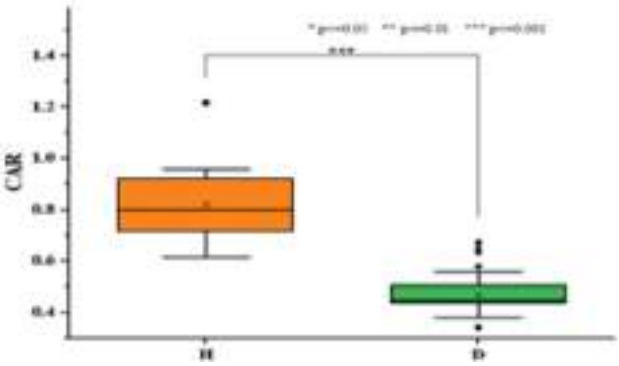
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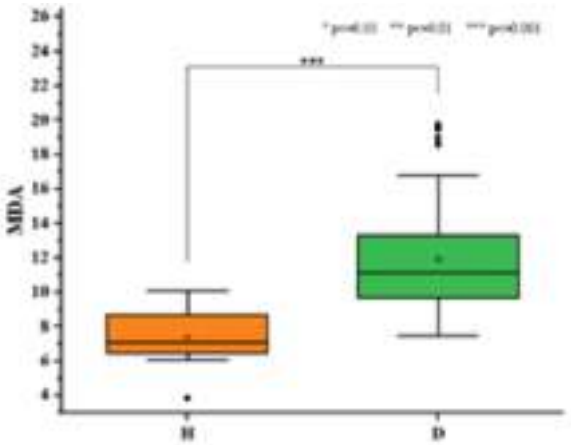
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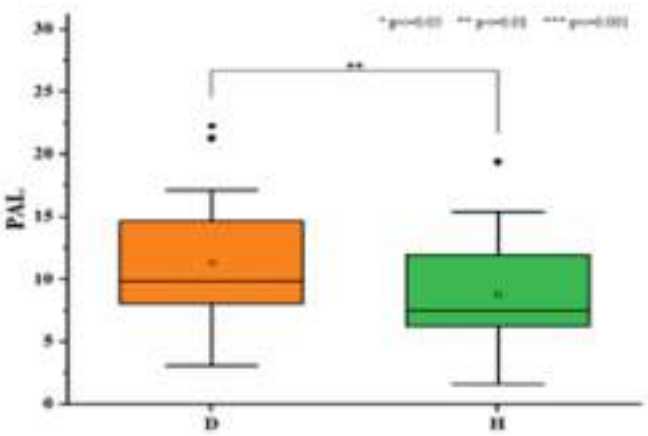
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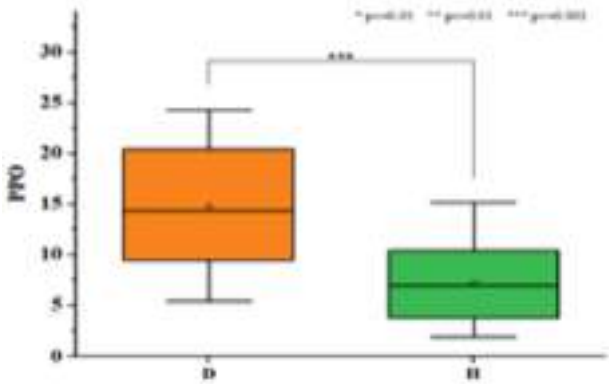
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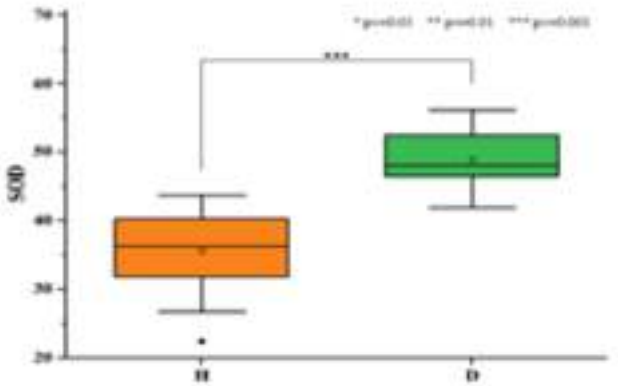
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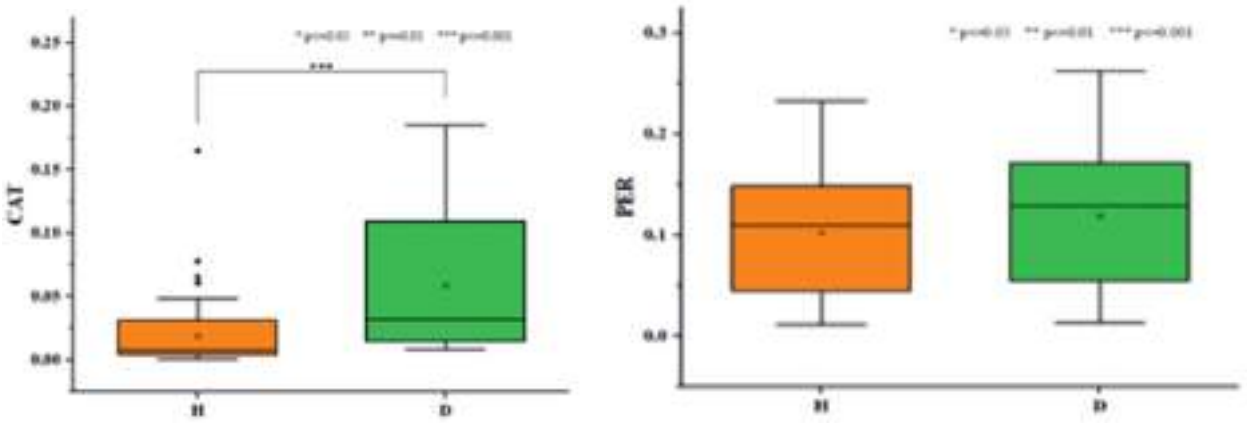


Fig.12. Box plot depicting disparities in the mean values of diverse biochemical assays (TPC), flavonoids, flavonols, 2,2-diphenylpicrylhydrazyl (DPPH), chlorophyll, carbohydrate/total starch, malondialdehyde (MDA), catalase (CAT), superoxide dismutase (SOD), peroxidase activity, polyphenol oxidase (PPO), phenylalanine ammonia-lyase (PAL) comparing mosaic disease and healthy condition by performing honestly significant difference (HSD) Tukeys test (p-value<0.05).

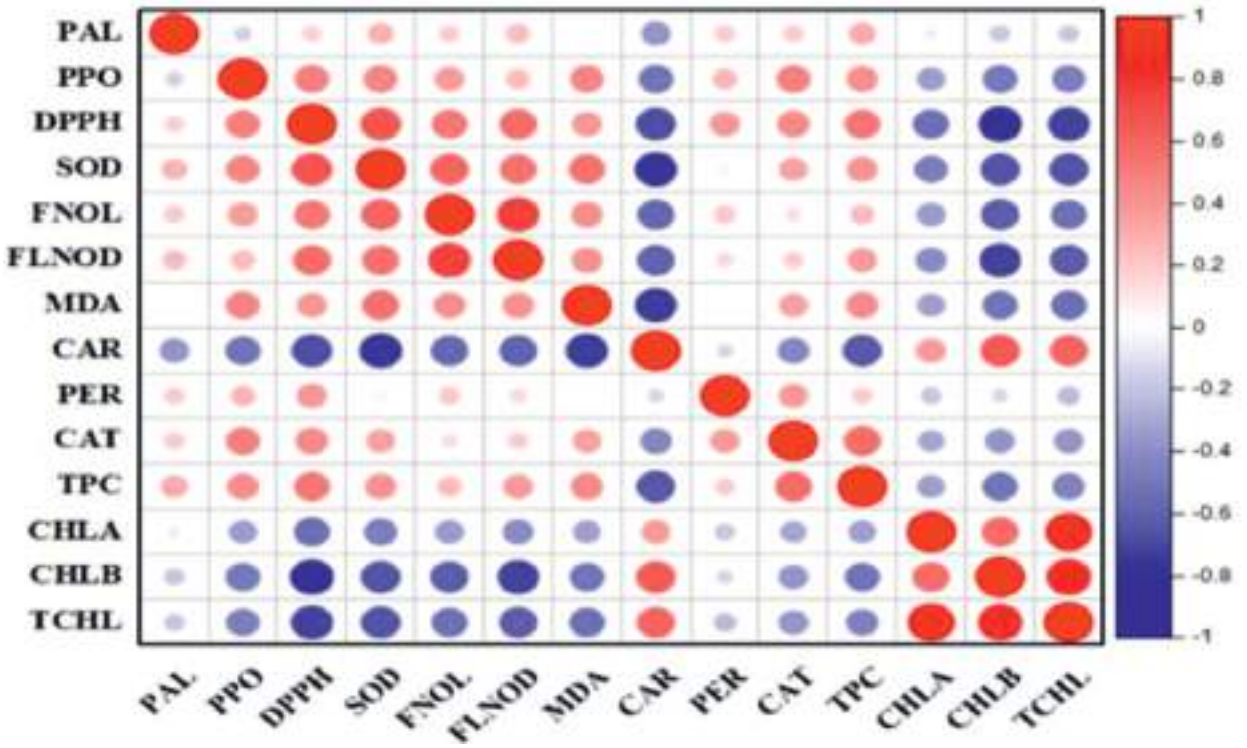


Fig. 13. Correlation network analysis showing the biochemical interactions, the size of each circle is proportional to its degree of correlation with other parameters; larger circles indicate stronger correlations. The colour intensity of circles corresponds to the magnitude of correlation, with deeper shades indicating astronger correlation

To develop the isothermal RT-LAMP based detection assay for apple necrotic mosaic virus

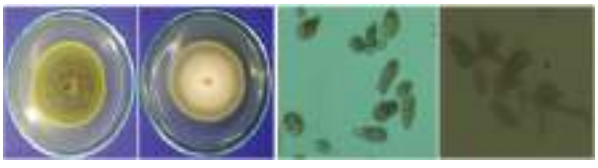
Reverse transcription loop-mediated isothermal amplification (RT-LAMP) assay was developed for detection of apple necrotic mosaic virus *(ApNMV)*. In this study, as a first step towards the rapid detection of *ApNMV,* the virus positive samples were confirmed through RT-PCR and for development of RT-LAMP assay two sets of primers consisting of two outer (F3 and B3), two inner (FIP and BIP) and two loop primers (BL) were designed targeting the coat protein genes of

ApNMV. After incubation of RT-LAMP reaction mixture at an isothermal temperature (60°C/30 min), the amplified products were visually confirmed using SYBR Green I whereas in negative samples no colour was observed.

Elucidating the diversity, species spectrum and management of *Alternaria* spp. infecting apple *(Malus domesticaBorkh.*)

Molecular characterization of Alternaria spp. associated with Alternaria leaf blotch disease of temperate fruit crops

The molecular characterization was done for thirty isolates from all the temperate fruit crops. The isolated pathogens were grown in potato dextrose broth for DNA isolation. The DNA of all thirty cultures was isolated and PCR amplification was done using ITS Primers and the product was sequenced. The BLASTn analysis revealed that our isolates showed sequence similarity with four *Alternaria* species viz., *Alternaria alternata, Alternaria angustivovidea, Alternaria tenuissima and Alternaria compacta* infecting these crops as shown in Table 21. The *Alternaria alternate* was abundant and *Alternaria* species infected all the temperate fruit crops. The *Alternaria alternate* and *Alternaria compacta* were found in Himachal Pradesh associated with ALB of apple. *Alternaria alternata* and *Alternaria tenuissima* were found in J&K associated with ALB of apple.



Cultures of Alternaria species and spores observed under microscope

Table.21. Alternaria species associated with Alternaria leaf blotch of temperate fruit crops in north-western Himalayan region of India

Isolate number	Crop	Alternaria species identified	Percent sequence similarity
1	Almond	*Alternaria alternata*	99.81%
2	Pear	*Alternaria alternata*	96.28%
3	Pear	*Alternaria alternata*	95.97%
4	Walnut	*Alternaria angustiovoidea*	99.45%
5	Walnut	*Alternaria alternata*	94.35%
6	Almond	*Alternaria alternata*	92.95%
7	Almond	*Alternaria alternata*	97.59%
8	Quince	*Alternaria alternata*	99.08%
9	Quince	*Alternaria alternata*	90.03%
10	Apple	*Alternaria compacta*	99.81%
11	Apple	*Alternaria alternata*	95.20%
12	Apple	*Alternaria tenuissima*	98.51%
13	Apple	*Alternaria alternata*	99.63%
14	Apple	*Alternaria tenuissima*	99.45%
15	Apple	*Alternaria tenuissima*	99.81%
16	Apple	*Alternaria alternata*	99.63%
17	Apple	*Alternaria tenuissima*	99.26%
18	Apple	*Alternaria tenuissima*	100%
19	Apple	*Alternaria tenuissima*	99.45%
20	Apple	*Alternaria alternata*	99.82%
21	Apple	*Alternaria alternata*	99.63%
22	Apple	*Alternaria alternata*	99.73%
23	Apple	*Alternaria alternata*	99.45%
24	Apple	*Alternaria alternata*	99.45%
25	Apple	*Alternaria alternata*	95.63%
26	Apple	*Alternaria tenuissima*	99.83%
27	Apple	*Alternaria tenuissima*	99.81%
28	Apple	*Alternaria alternata*	100.00%
29	Apple	*Alternaria alternata*	99.81%
30	Apple	*Alternaria alternata*	98.06%

Evaluation of various spray scheduled for management of Alternaria leaf blotch in apple using various fungicides under field conditions at different intervals of time

The experiment was conducted during 2022-23 and 2023-24 on apple cultivars maintained in field gene bank at ICAR-CITH, Srinagar. The fungicides used in various spray schedules were both systemic and contact in nature which includes Ziram, Fluxapyraxod+Pyraclostrobin, Myclobutanil, Hexaconazole+ Carbandazim and Hexaconazole at different concentrations. The trees were 4 years old and the experiment during 2023 was started on 12th May. Similarly, another two experiments were also conducted with same set of fungicides used in first experiment starting from 19th of May 2023 and 5th June 2023. The detailed list of fungicides and their application details are given in Table 22. Each treatment was applied to two adjacent rows in a randomized complete block design and replicated five times. Reduction percentage on disease incidence was computed based on the results of control plants. Among all the 15 spray schedules evaluated, all the three schedules shown in table managed the ALB disease. However, among the three spray schedules, the schedule started on 5th June was managing the ALB better as compared to other schedules.

Table 22. Evaluation of various spray schedules against *Alternaria* leaf blotch under field conditions

12th May 2022											Remarks
Treaments	Fungicide	Spray date	Fungicide	Spray date	Fungicide	Spray date	Fungicide	Spray date	Fungicide	Spray date	Rank 3
T2	Ziram	12-05-22	Fluxapyraxod+ Pyraclostrobin	19-05-23	Myclobutanil	02-06-22	Hexaconazole+ Carbandazim	16-06-22	Hexaconazole	30-06-22	
19thMay 2022											Rank 2
T2	Ziram	19-05-22	Fluxapyraxod+ Pyraclostrobin	26-05-22	Myclobutanil	09-06-22	Hexaconazole+ Carbandazium	22-06-22	Hexaconazole	07-07-22	
05th June 2022											Rank 1
T3	Fluxapyraxod+ Pyraclostrobin	05-06-22	Myclobutanil	19-06-22	Hexaconazole+ Carbandazim	3-07-22	Hexaconazole	17-07-22	Ziram	31-07-22	

Bio prospecting of Rhizo-cum-endospheric Microbiota of temperate fruit rootstocks for management of soil and foliar diseases

Among fungal pathogens, *Dematophora necatrix* causing white root rot in apple is a destructive pathogen if left untreated and many a times may result in the death of plant. The indiscriminate application of chemical fungicides results in chemical leakage into ground water, microbial imbalance in the soil–root ecosystem etc. So the focus has now been shifted to use of microorganisms as biocontrol agents which include both rhizospheric and endophytic microorganisms. The rhizospheric and endophytic microbial communities of two apple rootstocks (M27 and MM106) were evaluated against *D. necatrix*. The microorganisms were isolated by serial dilution technique. A total of 475 microorganisms were isolated and evaluated using various tests like dual culture, volatile compounds and cell free culture assays. Based on the results of these tests, five bacterial and five fungal isolates were found effective in inhibiting the pathogen under *in vitro* conditions. The graphs in Figures 14&15 depict comparative inhibition of *D. necatrix* using dual culture, volatile and cell free culture assay.

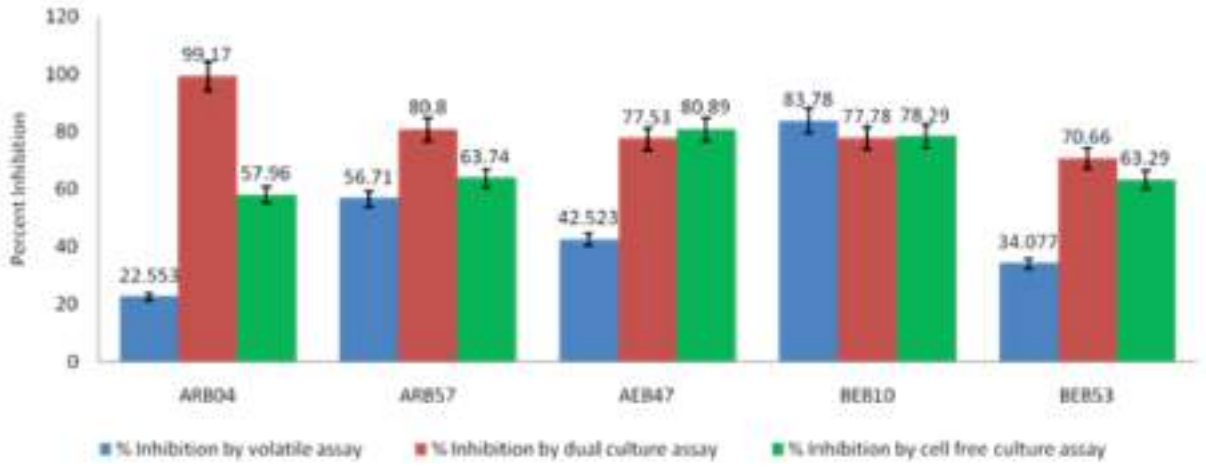


Fig.14. Comparative Inhibition of D.necatrix by various bacteria via dual culture, volatile and cell free culture assay

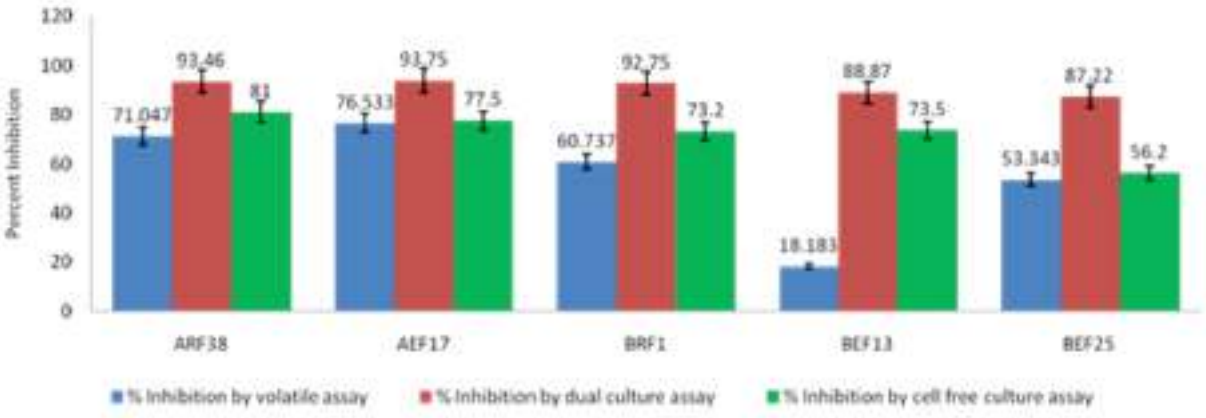


Fig.15. Comparative Inhibition of D.necatrix by various fungi via dual culture, volatile and cell free culture assay

Molecular Identification of Bacterial and fungal potential bioagents

Genomic DNA was isolated from potential five bacterial and five fungal isolates following standard protocol. To confirm the identity of isolates, two universal primers were used. The 16s rRNA, 27F (5′-AGAGTTTGATCMTGG CTC AG-3′) and 1492R (5′-CGGTTACCTTGT TAC GACTT-3′) in case of bacteria and ITS1-F(5 ′ -TCCGTAGGTGAACCTGCGG-3′) ITS4-R(5′-TCCTCCGCTTATTGATATGC-3′) in case of fungus was using PCR. The 16s rRNA gene was amplified from all the five bacterial isolates and an amplicon of 1200 bp was obtained after PCR amplification. Similarly, ITS region was amplified from all the five fungal isolates and an amplicon of 750 bp was obtained. Both the fragments from bacteria and fungi were sequenced and analyzed. All the sequences generated were submitted to NCBI Gene Bank and accession numbers were received. Detailed illustration of these potential bacterial and fungal isolates and their accession numbers, percentage similarity to the closest species, and genetic identity based on BLASTn search, are given in Table 23. For further identification multigene analysis is being utilized.

Table 23. Molecular identification of potential bioagents (fungi and bacteria)

Fungi					
Bioagents designated	**Isolate Name**	**Identified name**	**Percent Inhibition (%)**	**Accession Numbers**	**Percent similarity**
CITH- Fungal Bioagent 1	B1	*Trichoderma lentiforme*	*80.9*	OR077590	99.3
CITH-Fungal Bioagent 2A	AE17	*Trichoderma longibrachiatum*	*82.59*	OR077591	99
CITH-Fungal Bioagent 2B	BEF25	*Trichoderma longibrachiatum*	*70*	OR077593	98
CITH-Fungal Bioagent 3	A35	*Aspergillus fumigatus*	*76.86*	OR077592	98.8
Bacteria					
CITH-Bacterial Bioagent 1A	BE53	*Bacillus subtilis*	56	OR077600	97
CITH-Bacterial Bioagent 1B	ARB4	*Bacillus subtilis*	60	OR077603	96.2
CITH-Bacterial Bioagent 2	AE47	*Pseudomonas putida*	66.98	OR077602	98.3
CITH-Bacterial Bioagent 3	BE10	*Bacillus thuringiensis*	79.95	OR077604	98.5
CITH-Bacterial Bioagent 3	ARB57	*Pseudochrobactrumasaccharolyticum*	67	OR077601	97.5

Development of consortium of bioagents

For developing the consortium of various bioagents compatibility between the bioagents is very important. To check the compatibility of isolates, tests were conducted. Compatibility was checked between bacterial and bacterial isolates, fungus with fungal isolates and bacteria with fungal isolates. Different isolates of bacteria grown separately on nutrient agar plates were streaked perpendicular to each other on a fresh plate containing 20 ml nutrient agar. Similarly, 5-mm disc from 7-day-old cultures of the isolates of fungal cultures grown separately was placed in a fresh plate containing PDA, maintaining equal distance with each other. Both the consortia were incubated at 27 ± 2 °C. Zone of inhibition, if any formed was measured as the incompatibility against the two antagonists. The test was replicated three times. All the bacterial isolates were compatible with each other; similarly, all the fungal isolates were also compatible to each other. However, the test results of compatibility test between bacteria and fungus revealed that all fungal isolates were incompatible with *Bacillus subtilis*.

The compatibility between bacterial-bacterial and fungal-fungal bioagents.

Bionomics, modelling, and management of aphid-pest complex of temperate fruits

Population dynamics of green apple aphid, Aphis pomi De Geer (Hemiptera: Aphididae) in apple orchards

The seasonal population fluctuation of green apple aphid was studied in medium and high-density apple orchards throughout the year. The incidence of green apple started from the third week of March as occasional colonies, mostly on spots that did not receive delayed dormant horticultural mineral oil spray. The incidence continued as wingless viviparous females for two generations and by the 2nd week of April, the production of winged spring migrants started (Fig.15). The aphid population peaked from mid-June to July and subsequently decreased towards the third week of August. Thereafter, the population rebounded and maintained a steady state till the 1st week of October when the aphid populations entered the sexual phase, marked by the production of oviparae and males. Egg laying started from the 2nd week of October. The incidence of green apple aphids was consistently higher on the non-bearing apple trees, indicating a significant effect of fruit load on the vegetative growth rate and subsequently on the incidence of the aphids.

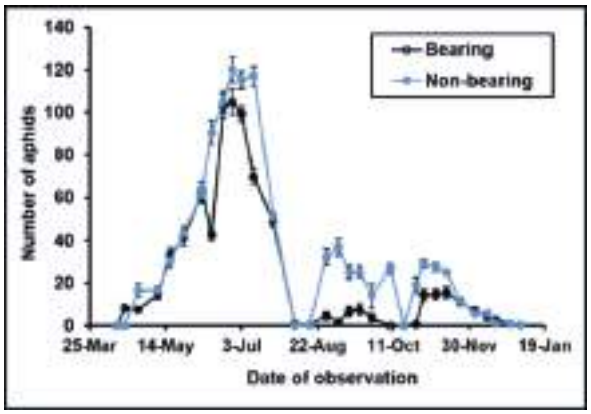


Fig.15. Seasonal population fluctuation (2023) of green apple aphid, Aphis pomi in bearing non-bearing apple orchards

Population dynamics of spiraea aphid, Aphis spiraecola Patch infesting spiraea bushes

Population dynamics of spiraea aphid was monitored in Vanhoutte spirea bushes (*Spiraea* × *vanhouttei*) throughout the year to explore the possibility of cross infestation of apple trees by the spiraea aphid. The spiraea aphid population reached a peak from May to July and gradually

declined afterwards (Fig. 16). The production of winged viviparous morphs was highest from June-July and decreased significantly afterwards (Fig. 2). The spiraea aphids remained in asexual mode though the year, including winter, and did not undergo sexual reproduction on the Vanhoutte spirea bushes.

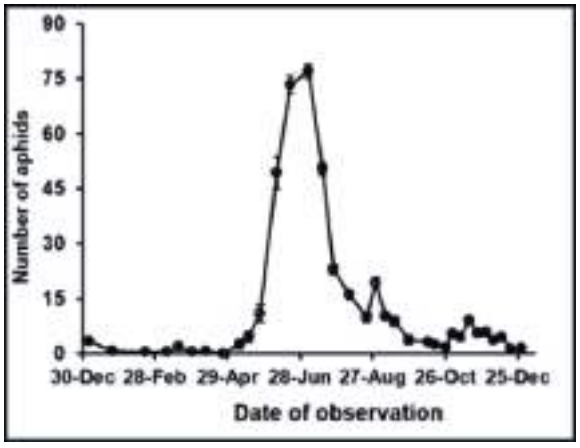


Fig. 16. Seasonal population dynamics of spiraea aphid, Aphis spiraecola on Vanhoutte spirea bushes (2023)

Studies on overwintering survival of green apple aphid eggs in apple orchards

The overwintering survival of green apple aphids was studied on intact shoots on apple trees and on excised shoots stalked on ground to mimic the process of survival on pruned wood from the last week of December to last week of March. Sections with 25-35 eggs were marked on each shoot and were observed weekly for survival as intact eggs. Three shoots each of nine trees were marked and three segments were selected on each shoot. in the stalked pruned shoots, two shoots each from five bundles/ heaps were selected and three segments were selected on each shoot. The eggs are subject to death by predation, effect of wind and rain, and to some extent by cold and freezing injury during winter. By the time when dormancy in over, some of the eggs start hatching. Therefore, on any sampling occasion, the eggs are either in intact form, partly eaten, shriveled completely missing. Egg hatch started by the 1st week of March. Overall, 43.0 ± 2.99% egg survival was observed up to 13th March,2023 after which most of the eggs started hatching (Fig. 17). Significant difference was observed in survivor ship of eggs on intact shoots as compared to those stalked on ground.

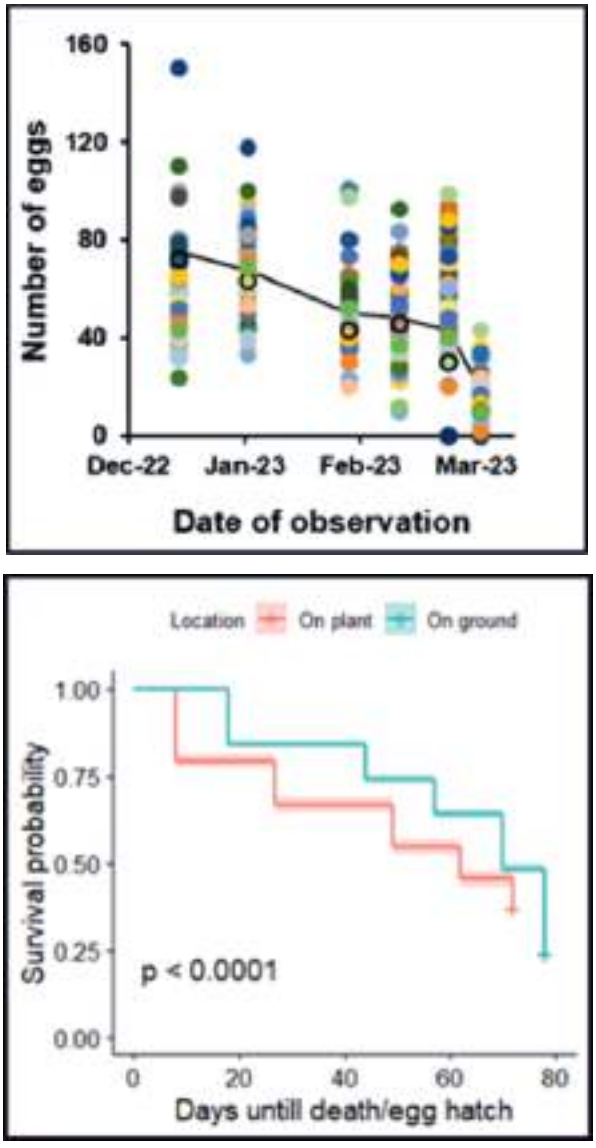


Fig. 17. Overwintering survival of green apple aphid eggs in apple orchards

Study of hatching schedule of eggs of green apple aphid, Aphis pomi on apple shoots

The hatchability of surviving eggs of green apple aphid was studied on intact shoots on apple trees from the first week of March, 2023. Sections with

25-35 eggs were marked on each shoot and were observed daily for hatching in both bearing and non-bearing trees. Overall, 45 samples were observed in each block. The egg hatch started by 7th of March and reached a maximum during the third week of March (Fig. 18). The overall hatchability of the surviving eggs was found as 41.25 ± 9.25%. No significant difference was found in the hatching schedule of GAA eggs between the two blocks.

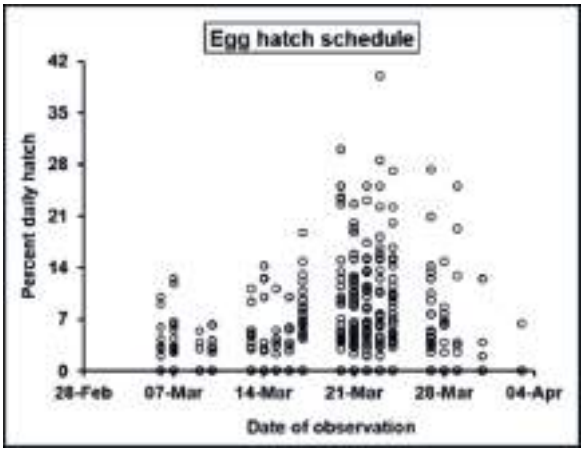


Fig. 18. Egg hatch schedule for green apple aphid, Aphis pomi in apple orchards (2023)

Growers' perception survey on the incidence and management of green apple aphids in apple orchards of Kashmir

The online survey program was continued for the second year to understand the perception of apple orchardists of Kashmir valley about the incidence and management of green apple aphid, *Aphis pomi*. Growers from all 12 districts of the valley (n = 180) participated in the survey. While as 7.2% of the respondents reported that green apple aphid was not a problem in their apple orchards, the remaining 92.8% respondents reported that green apple aphid has been a problem for the last 1 to 3 years in their orchards. Eighty five percent of the respondents observed sooty mould on leaves, 68.9% observed sooty mould on fruits, and 63.3% reported that additional cleaning or washing was required before packaging of such fruits. In 20.6% cases, one additional insecticide spray was needed for the management of green apple aphid, while as in 49.4%, 17.2% and 7.8%, two, three or more than three additional insecticide sprays, respectively were needed for the management of green apple aphids. Therefore, it is apparent that the incidence of green apple aphids in outbreak situation has led to significant increase in the cost of cultivation of apples in Kashmir valley.

Effect of winter pruning and delayed dormancy HMO spray on the incidence of green apple aphids

The effect of winter pruning and subsequent application of horticulture mineral oil was evaluated on the incidence of green apple aphid. The standard pruning operation (thinning and head-back) lead to significant reduction (80.90%) in the number of GAA eggs on apple shoots ($t(80) = 10.88$, $p \leq 0.01$.). Thinning cuts were more efficient at removing the GAA eggs (96.60%) as compared to heading-back (84.12%). Subsequently, the selected apple trees were divided in to two blocks and one of the blocks was sprayed with HMO @ 2% on 15th March,2023. By this time the egg hatch was already in progress. The effect of HMO spray percent egg hatch was significant ($\chi2(1) = 43.72$, $p \leq 0.01$, Kruskal-Wallis test). The percent egg hatch was noted as 9.90 ± 1.91% on HMO treated trees and 46.92 ± 2.28% in untreated trees (Fig. 19). Subsequently, the population build-up of green apple aphid was monitored on trees that did and did not receive winter pruning and subsequently were treated with HMO or kept as untreated. The aphid incidence on trees that received winter pruning remained low till the last week of May. Further, the incidence of GAA in HMO treated trees was lower throughout the season in comparison to control (Fig. 20).

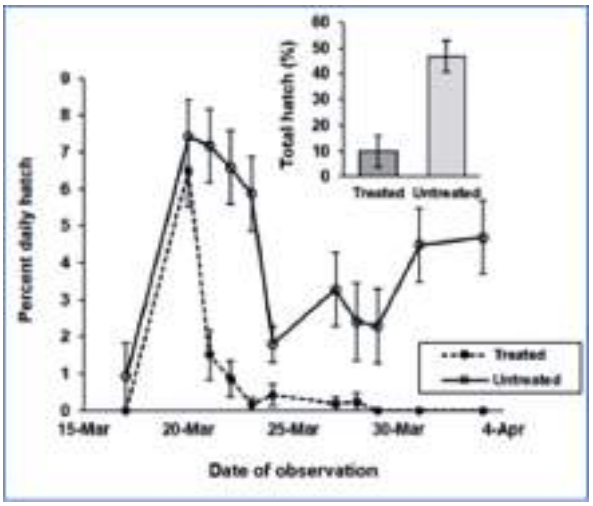


Fig. 19. Effect of HMO on percent hatch and hatching schedule of the eggs of green apple aphid

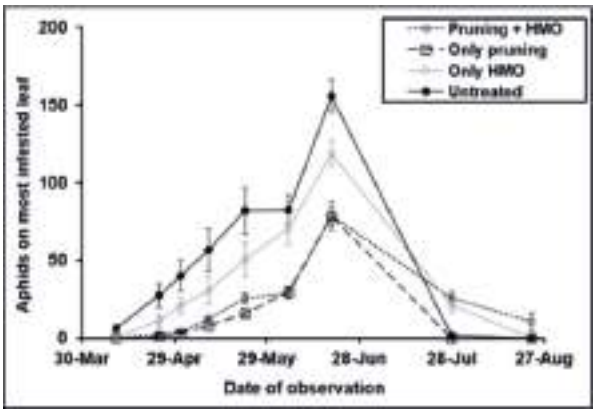


Fig. 20. Effect of winter pruning and HMO on the seasonal incidence of green apple aphid.

Bio-efficacy of insecticides with novel mode of action against of green apple aphids

The efficacy of thiacloprid 240 SC @ 0.04%, bifenthrin 8% SC @ 0.075%, HMO (summer Oil) @ 0.5%, imidacloprid 17.8 SL @ 0.04%, thiamethoxam 25 WG @ 0.02%, chlorpyriphos 50% + cypermethrin 5% EC @ 0.2%, and thiamethoxam 12.6% + lambda cyhalothrin 9.5% ZC @ 0.04% was evaluated against green apple aphids. Chlorpyriphos 20 EC @ 0.25%, dimethoate 30 EC @ 0.1%, and quinalphos 25 EC @ 0.2% along with untreated check were used control treatments. Out of these, thiamethoxam 25 WG @ 0.02% and thiamethoxam 12.6% + lambda cyhalothrin 9.5% ZC @ 0.04% performed best and provided satisfactory population suppression up to 14 days after treatment. The currently recommended insecticides including chlorpyriphos 20 EC @ 0.25%, and dimethoate 30 EC @ 0.1% did not provide satisfactory control of green apple aphids. In a second trial, neem oil 1500 ppm @ 0.25% and imidacloprid 6% + lambda cyhalothrin 4% @ 0.06% were evaluated in comparison to chlorpyriphos 20 EC @ 0.25% and uncontrolled check. Both neem oil 1500 ppm @ 0.25% and imidacloprid 6% + lambda cyhalothrin 4% @ 0.06% were found to provide satisfactory control of GAA incidence.

Biology, ecology and management of fruit flies infesting temperate fruits

Species diversity of fruit flies in temperate fruit orchards

The species diversity of fruit flies was studied with the help of McPhail traps charged with methyl eugenol and protein hydrolysate-based baits and by rearing of fruit larvae from infested fruits of cherry, peach, and apple. In all five species of fruit flies were recovered from the traps and rearing of infested fruits viz., *Bactrocera dorsalis), Bactrocera zonata , Zeugodacus cucurbitae, Zeugodacus scutellaris , Zeugodacus tau.*

Seasonal population dynamics of fruit flies in temperate fruit orchards

The seasonal population fluctuation of fruit flies was monitored with the help of McPhail traps charged with methyl eugenol and 10% propylene glycol as collection fluid. The traps were deployed in multiple fruit orchards from April to December. The trap catch was cleared at weekly interval and preserved in 70% ethanol. The samples were later sorted, identified, sexed and counted. The seasonal incidence of *Bactrocera dorsalis* is depicted in Fig. 21. Highest fruit fly activity was noted from August to November.

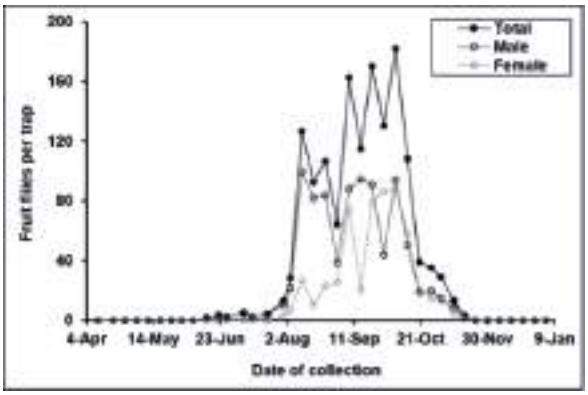


Fig. 21. Seasonal incidence of Bactrocera dorsalis in mixed fruit orchard system

Evaluation of traps and lures for monitoring of fruit fly activity

The trapping efficiency of three lures was evaluated against predominate fruit flies in the temperate fruit orchards. McPhail traps were deployed on the trees and were charged with either bakers' yeast with borax, methyl eugenol analytical reagent or commercially available methyl eugenol lure, in comparison to blank traps filled with 10 % propylene glycol only like all other traps. The commercial formulation of methyl eugenol was found to trap maximum number of *Bactrocera dorsalis* adults (Fig. 21). The sex ratio of the collected individuals was 0.93, 2.65, 2.67 and 0.82 for the four types of traps, respectively. Therefore, the yeast + borax trap was able to trap almost equal number of male and female adults of *Bactrocera dorsalis*.

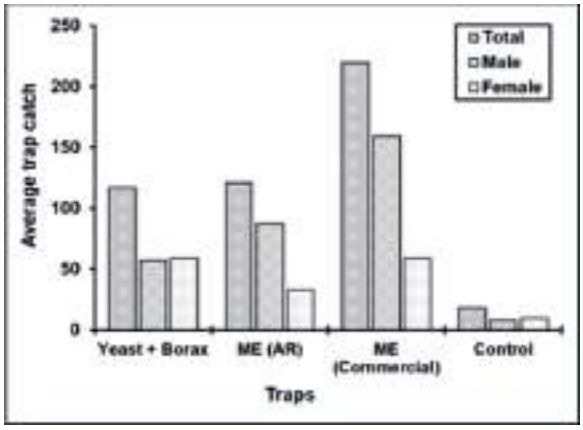


Fig. 21. Fruit fly trappaing effcicincy

IV. Post-Harvest Technology

The post -harvest management of the temperate horticultural crops is also major area which needs a great attention to save huge losses of produce and economy of farmers. Majority of crops have very less shelf life and needs to be send market as soon as possible. The ultimate returns to the farmer largely depend on pre and post- harvest handling. The stone fruits and vegetable crops are more perishable as compared to others. ICAR-CITH is continuously doing need based research to enhance the post- harvest life of produce as well as value addition. The research work carried out during 2023 is briefly presented in different heads.

Development of edible coating enriched with anti-microbial bioactive compounds for various stone fruit

During the year 2023, under this project, extraction and purification of temperate stone fruit-based gummosis was done. The gummosis samples were collected from sweet cherry, peach, nectarine and apricot orchards. The collected gummosis samples were dried in hot air dryer at 60 °C until constant weight was not attained. These dried gummosis samples grounded in mixer-grinder until the particle size of the fine powder passes through the 60 mesh sieve. The extraction and washing of grounded gum samples was done using ethanol and stored in desiccator. It was observed that gummosis samples from sweet cherry trees resulted in production of highest quantity of pure gums, whereas least purified gum quantity was obtained from apricot gummosis. Though the quantity of pure gum from apricot trees was less in quantity but the end product had

highest transparency. Similarly, peach and nectarines extracted and washed gummosis had presence of darker tints and sweet cherry has transparency in-between transparency of other three gummosis samples.

Development and value addition of temperate fruits

Under post-harvest management of temperate fruits, the development and value addition of temperate fruits, possibilities of development of value-added products from sweet cherries, preservation of green almond and preparation of green apple pickle were explored. The process of two value-added products from cherries were standardized i.e. sweet cherry marmalade and sweet cherry preserve. Also, preservation of green almond in brine solution for extending its availability during off-season and pickling of green apple were done.

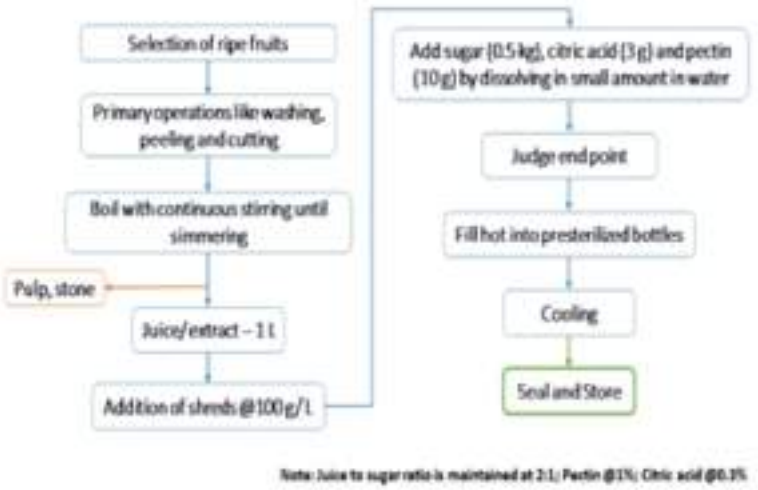
Sweet cherry marmalade

Sweet cherries (Prunus avium L.) are highly perishable fruit with a short harvest season, therefore extensive preservation and processing is essential for extension of shelf-life. As sweet cherry fruits have high TSS therefore, one of the most consumed valued added products prepared from fruits is marmalade and/or Jam. To preserve the sweet cherry for longer period, varities with higher anthocyanin content as well as TSS value were identified for preparation of sweet cherry marmalade and/or jam to limit the addition of external sugar. The prepared value-added product has pleasant deep red colour, shiny appearance and rich in flavour, taste and aroma. Also have excellent spreadability to meet the minimalistic characterization of marmalade and/or jam. The sweet cherry marmalade has shelf-life of up to nine months with retaining its quality and absence of incidences of growth of fungus.

Gummosis samples of Sweet Cherry, peach, Nectarine and Apricot trees respectively.

Extracted and purified gummosis extracted from sweet cherry, peach, nectarine and apricot trees respectively.

Sweet cherry marmalade



Step-by-step procedure for preparation of sweet cherry marmalade

Sweet cherry preserve

Sweet cherries (Prunus avium L.) are a nutritious temperate fruit that is rich in polyphenols and have high antioxidant potential. Sweet cherries are available in harvesting season only and preferably consumed as fresh fruit due to lower shelf-life. The process of preparation of sweet cherry preserve was optimized to extend the availability of sweet cherry in off-season. To prepare preserve, one of the most important criteria is selection of firm texture varities which limit the disintegration of fruit and retains their shape and texture for longer period. Therefore, to meet this criterion, *Mishri* ( )variety was identified, as *Mishri* has firm texture and suitable TSS value. The sound cherries were selected and washed thoroughly under the running water followed by pitting. The pitted cherries were preserved in to sugar solution of certain °Brix and little amount of salt. The sweet cherry preserve has shelf-life of up to four months with retaining its structure, texture, and colour.

Sweet cherry preserve and step-by-step procedure for preparation of sweet cherry preserve

Preservation of green almonds in brine solution

Green almonds *(Prunus dulcis*) are immature soft embryonic nutty tissue covered by the velvety texture and commonly consumed as chutneys and as a source of acidifying agent in the traditional *Kashmiri* culinary preparations. Hence, thoroughly cleaned, washed and sorted green almonds of Non-Pariel and merced varieties were preserved in brine solution. The washed green almonds were dipped in a standard brine-based solution containing salt, vinegar and citric acid in the predetermined amounts and stored in a heat sterilized glass jar.

Green almond preserved in brine solution

Green apple and mixed vegetables pickle

Green apples *(Malus x domestica Borkh*) are packed with the nutritional benefits of pectin, starch, vitamins and minerals. A protocol was developed for the use of pre-harvest dropped green apple for pickle processing. The green apples are cleaned and washed with hot water and cubical cuts was made and immersed in potassium meta bisulphite for reducing the browning reaction. Then the treated apples were utilized for pickle processing. Ingredients like oil, salt, spices and condiments were used for pickle preparation with sodium benzoate as the preservative agent and filled in a heat sterilized glass jars.

Similarly, a protocol for preparation of mix vegetables pickle was prepared for utilising green vegetables for pickling. Various vegetables such as carrot, knol-khol, collard green leaves, cauliflower and additional ingredients like oil, salt, spices and condiments were used for pickle preparation with sodium benzoate as the preservative agent and filled in a heat sterilized glass jars.

Green apple pickle *Mix vegetable pickle*

Evaluation of plum cultivars based on skin and flesh characteristics

The plum fruit is diverse in terms of their appearance, colour, taste, shape and size. Besides this, wide variation in its skin as well as flesh (pulp) is observed in different cultivars. A brief study was taken to evaluate the cultivars based its skin and flesh colour to correlate with its color parameters and total phenolic contents. The colour coordinates of different plum cultivars were presented in terms of hue and chroma values. Hue of the colour coordinates represents the colour of the purity of the colour without any white or black added. It was observed that the colour value of pulp of Methley, Frontier, and Santa Rosa has hue of red colour, Methley with the highest purity and started gradually decreasing with increase in the hue angle (Fig. 22a). As the hue value increases up to 120 degrees, the hue value becomes mix value of both red and green. Similarly, almost all cultivars have hue value of their skin in first quadrant i.e. 120 > hue > 0 and have hue of primarily red colour. Only Methley has the hue value more than 240 degree, that means the skin colour of Methley cultivars has hue of gradient of both red and blue colour (Fig. 22 b).

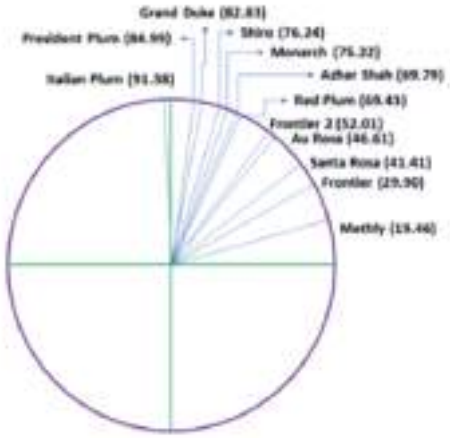


Figure 22a. Hue angles of flesh (pulp) of Plum cultivars

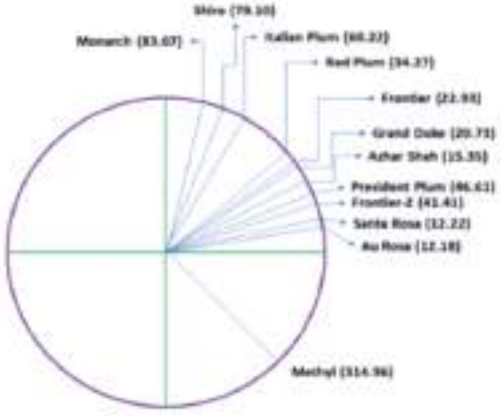


Figure 22b. Hue angles of skin of Plum cultivars

The chroma value of colour coordinates represents the intensity of colour or refers as the purity or vividness of colour. It describes how much a colour differs from a neutral grey of the same lightness. The chroma value of skin of almost all the cultivars was lower than the chroma values of that cultivars flesh's chroma value (Fig. 22c). It indicates that the intensity of the flesh chroma was higher for its particular hue. Whereas, the lower value of chroma indicates that the colour of skin was relatively dull for its particular hue. The least chroma value was observed in case of Methley cultivar's skin colour whereas highest chroma was observed in case of Monarch cultivars.

The evaluation of total phenolic content (TPC) of different plum cultivars indicated that the flesh of the plum was rich in TPC in comparison with TPC content in skin. Highest TPC was reported in the Au Rosa, Methley, Frontier and Azhar Shah cultivar's flesh (Fig. 22d) whereas, the TPC values of skin of different cultivars indicated that the cultivars such as Santa Rosa, Monarch, Grand duke and Frontier have lesser TPC.

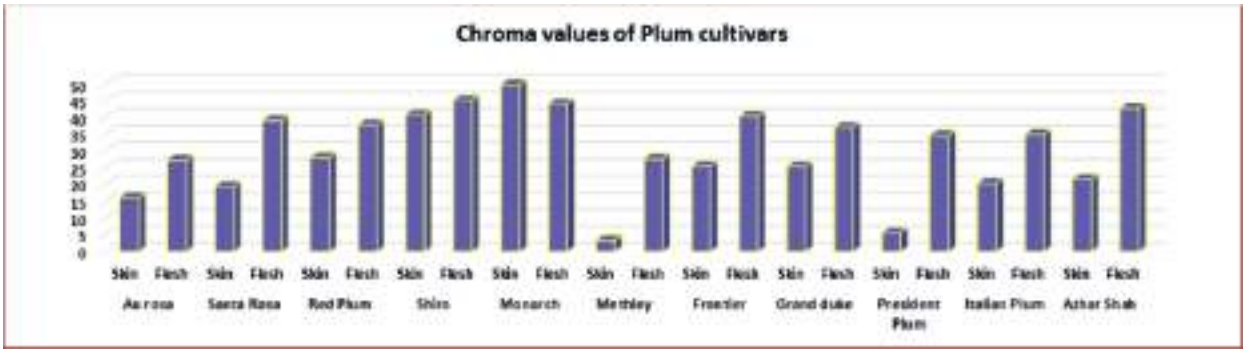


Fig. 22c. Choma values of different plum cultivars.

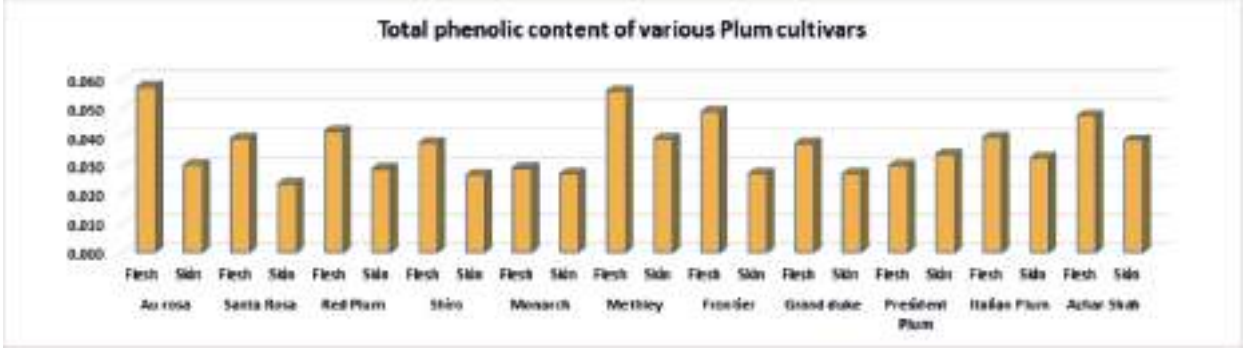


Fig 22d. Total phenolic content of various Plum cultivars grown in Kashmir's local conditions.

Change in qualitative parameters in some apple cultivars

Apple is primary main fruit crop in J&K and to cater the quality quantity as well as economics and customer acceptance requirement,, it becomes essential to cultivate the varieties have higher market value and consumer acceptance. Similarly, traditionally grown apple cultivars offer quality produce, that is as par to the imported apples. Thus, a comparative study was taken to evaluate local as well as imported cultivars grown in Kashmir's local conditions. It was observed that local cultivars such as Ambri, Lal Ambri and CITH Lodh Apple has higher capability to retain its weight, similarly restricted reduction in length and diameters. Whereas, cultivars such as Super Chief, Jeromine, Oregon spur, Starkrimson and Coe Red Fuji shown maximum loss in physiological loss in weight. The ΔE values indicates that lowest colour change was observed in case of Super Chief and Ambri cultivars, whereas Fuji cultivars exhibited maximum colour change.

Table. 24.Percentage change in various qualitative parameters of apple cultivars grown in local conditions.

Cultivar	Ä Weight	Ä Length	Ä Diameter			Ä Firmness	Ä TSS	Ä E
			Max.	Top	Bottom			
Ambri	-8.00	-3.73	-1.94	-8.77	-0.16	2.86	-13.99	4.08
Lal Ambri	-6.34	-3.40	-2.20	-8.04	-3.84	4.17	-0.63	4.4
CITH Lodh Apple-1	-3.65	-1.51	-2.69	-6.29	-1.43	-8.09	-13.92	9.8
Super Chief	-18.82	-7.55	-8.79	-4.55	-7.95	4.44	18.82	4.05
Red Delicious	-6.64	-3.04	-0.81	-8.14	-12.93	-10.97	-13.04	6.40
Jeromine	-19.23	-14.86	-12.41	-13.61	-2.36	-17.70	3.01	7.43
Oregon Spur	-15.41	-6.14	-3.50	-7.40	-5.20	8.75	2.641	6.70
Starkrimson	-15.74	-6.49	-5.67	-4.03	-1.54	-7.75	-11.11	7.96
Fuji	-11.82	-6.91	-3.69	-2.51	-1.28	-3.13	4.7	14.88
Red Fuji	-3.18	-0.61	-3.10	-5.85	-2.06	-6.65	6.9	6.84
Coe Red Fuji	-15.39	-5.88	-3.40	-10.90	-1.57	-15.65	-10.56	10.99

Note: "-ive" sign indicates percentage reduction in value; ΔE is measure of colour difference.

V. Externally Funded /Network projects

Besides the in house projects, institute used to compete for need based externally funded projects from different agencies to cater the need of stakeholders. The salient outcome of various externally projects funded handled by different scientist during 2023 at ICAR-CITH are presented below:

Production of quality planting material of elite walnut cultivars and demonstration of improved agro-technology for walnut orchards in Kashmir and Arunachal Pradesh

For promotion of CITH released walnut varieties in UT of Jammu & Kashmir and state of Arunachal Pradesh, 800 grafted plants of CITH released walnut varieties along with the bud wood were provided for establishment of mother blocks at SKUAST-K, Srinagar, farmer's field in Jammu and Kashmir and Arunachal Pradesh along with research institutes in Arunachal Pradesh & Assam. Trainings on walnut multiplication under polyhouse conditions using cleft grafting & patch budding were given to farmers of different districts in Jammu and Kashmir. Also trainings was imparted to farmers on planting of lateral bearing walnut varieties (Chandler, Fernor, Franquette and Fernette) to different stakeholders including farmers of Jammu and Kashmir in collaboration with SKUAST-K, Srinagar. For promotion of lateral bearing varieties (Chandler, Fernor, Franquette and Fernette) were imported from China in UT of Jammu& Kashmir and state of Arunachal Pradesh. Demonstration on imported varieties of walnut (Chandler, Fernor, Franquette and Fernette) was laid down in farmer's field and different institutions in collaboration with SKUAST-K, Srinagar. Mother blocks of ICAR-CITH, Srinagar released walnut varieties were established at SKUAST-K, Srinagar and farmer's field in Jammu and Kashmir in the year 2023. Also the material (CITH released varieties) was sent to NEH region including Assam for establishment of mother blocks.

Augmentation of plant genetic resources and capacity building of researchers in India and Uzbekistan

Exchange visit within Indian-Uzbekistan collaborative research project entitled, "Augmentation of plant genetic resources and capacity building of researchers in India and Uzbekistan" with the purpose to explore the temperate horticultural germplasm suitable for exchange and also to get exposure of Uzbekistan scientists to India during 2023. Dr Yuldash Saimnazarov, Director, Scientific Research Institute of Horticulture, Viticulture and Winemaking named after academician M. Mirzayev and Dr Shukhrat Akhmedov, Scientist, Tashkent, Uzbekistan visited ICAR-CITH, Srinagar from 15th to 16th November, 2023. Exposure was given to visiting scientists on different activities related to germplasm management, quarantine, planting material propagation, virus indexing and molecular characterization of temperate horticultural crops. Performance of germplasm imported from Uzbekistan under this project was shown and the utilization of imported material for future breeding programmes was discussed.

Multiplication of CITH walnut varieties at ICAR-CITH, Srinagar for demonstration under the project

Visit of Uzbekistan scientists to farm and germplasm block of imported material from Uzbekistan at ICAR-CITH, Srinagar

Overview of germplasm of temperate fruits (imported from Uzbakistan)

Yield of two years old walnut plant- 23 walnuts/plant(Imported from Uzbakistan)

List of temperate fruit germplasm for supply from India to Uzbekistan during January – February, 2023- 2024

The list of germplasm exchanged under this project is as shown in Table 25 & 26.

Table 25. List of germplasm imported from Uzbekistan and established in the field gene bank of ICAR-CITH, Srinagar and ICAR-CITH (RS), Mukteshwar, 2023

Sr. No.	Crop	No. of Plants imported from Uzbekistan	Sr. No.	Crop	No. of Plants imported from Uzbekistan
1	Apple	26	10	Strawberry	6
2	Almond	7	11	Golden current	5
3	Walnut	4	12	Fig	3
4	Pear	17	13	Persimmon	4
5	Quince	8	14	Chinese Jujube	2
6	Plum and Cherry plum	8 and 9 (17)	15	Hazelnut	2
7	Cherry (sweet & Sour)	09 and 06 (15)	16	Lemon (Citrus 3 type)	3
8	Peach	25	17	Grape	45
9	Pomegranate	4	18	Apricot	16

Table 26. List of germplasm exported to Uzbekistan during, 2023

S.No.	Crop	Number of varieties to be exported	List of varieties exported
1	Apple	20	American Apirouge, Anna, Elstar,Gala Mast, Oregon Spur,Granny Smith, Jeromine, Michal, Red Chief, Red Gold, Schlomith, Spartan, Vance Delicious,CITH -LodhApple, Super Chief, Red Velox, Golden Delicious Reinders, Gala Redlum,Red Jona Prince, Golden Delicious (cloneB)
2	Almond	07	IXl, Merced, Non Pariel, Pranyaj, Wari s, Shalimar, California paper Shell
3	Apricot	8	CITH Apricot -1, Communis Holly, Balcota, Chinese apricot, Harcot, Erani, CITH Apricot-2, CITH apricot-3
4	Walnut	10	CITH-W-1, CITH-W-2, CITH-W-3, CITH-W-4 & CITH-W-5,CITH-W-6,CITH-W-7,CITH-W-8,CITH-W-9,CITH-W-10
5	Pear	05	Abbat, Carmine, Kashmiri Nakh, Max Red Bartlett, Willium Bartlett
6	Peach	04	Glohaven, Crest Haven, Red Clobe, Snow Queen
7	Plum	6	Stanly, Meriposa, Red Beauty, Frontier, Monarch, santa Rosa
8	Cherry	1	Van

DUS centre for temperate fruits and nuts

Characterization of almond, apple, cherry, peach, strawberry and walnut reference varieties was performed as per the DUS descriptor developed by ICAR-CITH, Srinagar. The characterized data was converted into different notes which can act as data base for comparing candidate varieties with reference varieties at any time. Maintenance of reference varieties is being done and all traits/characters are being tested at nodal centre ICAR-CITH, Srinagar for their uniformity and stability. The new germplasm block of apple has been further strengthened with total 238 varieties / hybrids of apple, making it Asia's first repository having such a huge number of varieties / hybrids of single crop at one place.

Databases of almond (13 varieties) and apple (60 varieties) were prepared. Peach database is under process. Besides, monograph of almond was compiled. Onsite DUS testing was carried for apple varieties CIVG 198 (REG/2018/5) (MODI) and CIV323 (REG/2021/0153)(ISSAAQ) at Advanced Center for Horticulture, Zanipora, PEQ Facility, Directorate of Horticulture, District Shopian, Jammu and Kashmir. Online international seminar was attended organized by PPVFRA, New Delhi on DUS Databases and DUS Data Use for Decision Making in Collaboration with Federal Plant Variety Office (BSA), Germany under Indo-German Cooperation on Seed Sector Development.

In almond, 13 genotypes were evaluated for leaf, nut and yield traits as per the DUS descriptor. Maximum leaf blade length (8.93 cm) and width (4.0 cm) was seen in Makhdoom. Similarly, the petiole length was highest in Primoskij (3.95 cm). Maximum nut weight 5.11 g was observed in California Paper Shell, while highest kernel weight 2.41 g was observed in Pranyaj. In peach, large variations were observed in fruit weigh. It ranges from 18 to 154 g with maximum weight in Red Globe (154 g) and minimum fruit size in Florida Sun (18 g). Further, fruit sweetness (B TSS) and firmness (RI) also varied considerably in different cultivars of peach. Southland Peach has maximum sweetness of 14.4 while Cresthaven revealed highest firmness.

A comparative metabolomics approach for the analyses of scab-disease resistance in apple and development of a metabolite-based non-invasive sensor for early scab-disease diagnosis

During 2023, our studies over the have considerably enhanced our understanding of apple scab, a widespread threat to the worldwide apple crop. Metabolic reprogramming in the root tissues of scab-resistant ('Prima') and scab-susceptible ('Red Delicious') apple cultivars infected with Venturia inaequalis to address a fundamental question in extensive research on metabolites contributing to scab resistance was focused. An unusual marker, syringic acid was identified, in the root tissues following Venturia inaequalis infection using gas chromatography-mass spectrometry-based metabolomics. This root-derived chemical was found to be a significant component in inhibiting scab fungal development on aerial plant parts, giving information on a long-distance signaling pathway between shoot and root. Simultaneously, use of methyl jasmonate (MeJA) produced positive results. MeJA treatment on leaf surfaces improved membrane integrity and reduced malondialdehyde levels in scab-susceptible 'Red Delicious,' suggesting its potential for defending against oxidative damage. This study solves gaps in apple scab resistance and investigates the physiological and biochemical processes of MeJA-induced scab tolerance. Furthermore, investigating the use of scab-related volatile biomarkers, such as 2-Hexenoic acid, for non-destructive chemo-typing of apple genotypes was

envisaged. Standardization of novel volatile extraction and analyses protocol from intact apple leaves using non-destructive approach was done along with the identification of VOC biomarker(s) for germplasm screening of scab resistance cultivar and development of basic circuit for sensor operation at IIT, Roorkee (Fig 23)

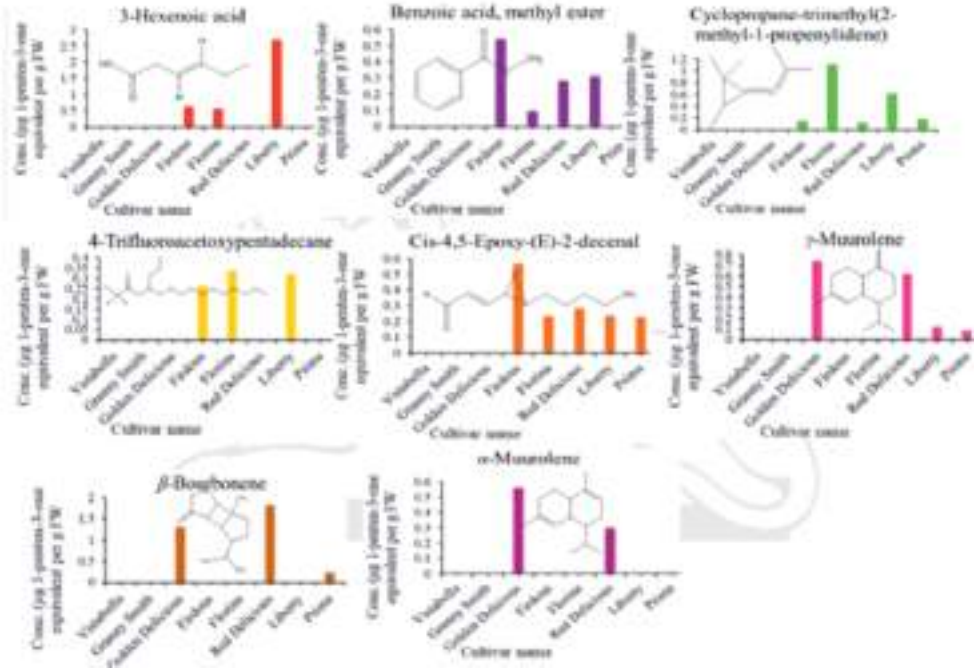
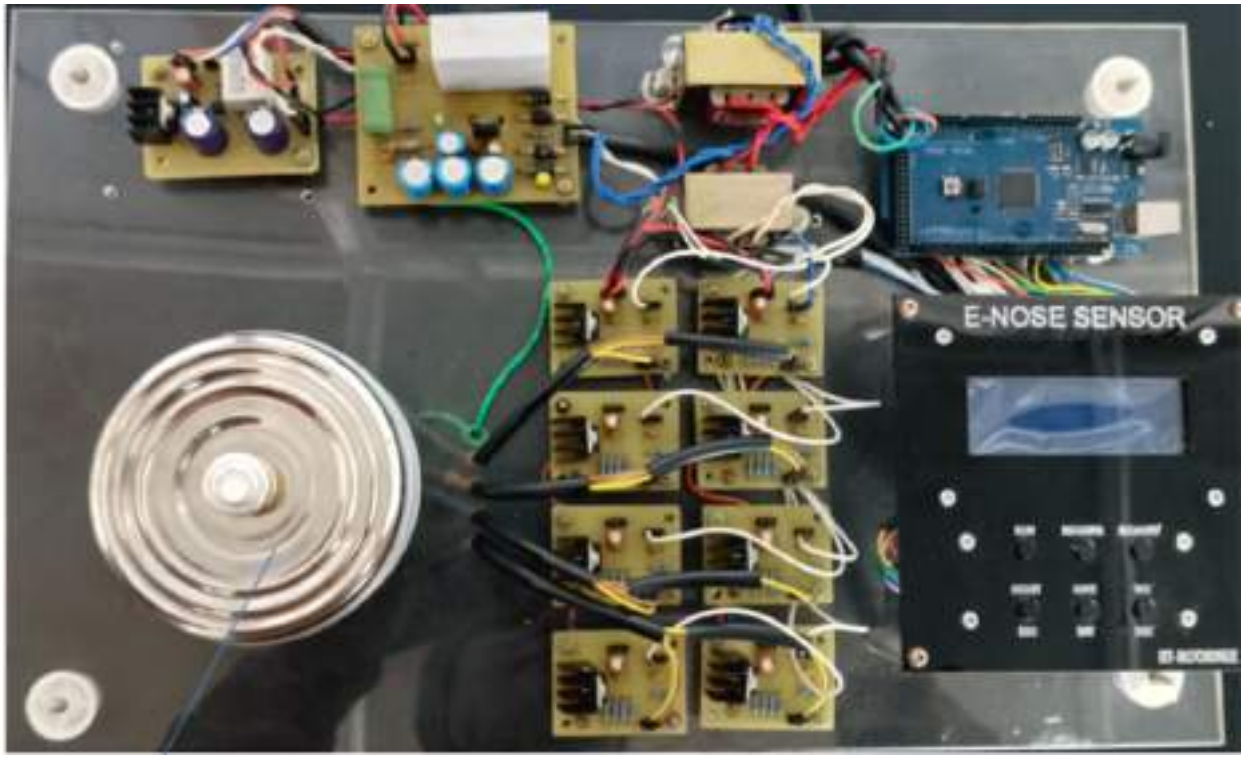


Fig 23. Biomarkers specific in some cultivars, demonstrating that genetically similar plants emit mainly the same VOCs under similar conditions



Development of basic electronic circuit for sensor

Evaluation of apple cultivars for fruit quality traits

Four apple cultivars (Prima, Firdous, Red Delicious and Golden Delicious) were evaluated for different fruit quality traits at the time of pre harvest (PH, 15 days before harvest time), harvesting (H) and during the storage period for 15 days (S1), 30 days (S2) & 45 days (S3) stored at ambient temperature. Significant loss in weight (PLW), firmness, acidity, ascorbic acid and other traits was observed. However, there was significant increase in TSS and pH of the fruits (Tables 27 &28).

Table 27. Physicochemical analysis of apple varieties at pre-harvest, harvest and during storage at ambient temperature.

Varietes	Stage	Weight(g)	TSS (%)	Firmness(RI)	Acidity (%)	pH	Ascorbic Acid (mg/100g)	Colour		
								L	a	b
Prima	PH	91.3^{k}	9.87^{l}	90.32^{a}	0.19^{hij}	4.15^{ab}	13.43^{c}	32.77^{q}	13.6^{d}	14.19^{k}
	H	101.66^{h}	12.5^{ij}	71.99^{d}	0.41^{a}	3.3^{e}	14.16^{b}	55.15^{l}	7.07^{h}	29.23^{de}
	S1	98.45^{i}	12.9^{hi}	69.13^{e}	0.38^{ab}	3.38^{de}	14.02^{b}	58.91^{h}	13.25^{d}	34.55^{b}
	S2	95.33^{j}	13.4^{gh}	64.06^{hi}	0.33^{bcd}	3.42^{de}	13.88^{b}	61.13^{f}	6.19^{h}	28.34^{ef}
	S3	93.64^{jk}	13.9^{fg}	62.56^{ik}	0.29^{de}	3.49^{cde}	13.23^{c}	63.34^{d}	4.17^{ij}	27.13^{fg}
Red Delicious	PH	111.8^{g}	12.01^{jk}	81.55^{c}	0.17^{ij}	4.19^{ab}	14.36^{b}	27.48^{r}	11.88^{e}	6.44^{m}
	H	128.0^{d}	15.84^{bc}	66.32^{f}	0.35^{bc}	3.9^{bcd}	15.95^{b}	49.11^{o}	30.83^{a}	20.15^{i}
	S1	125.82^{d}	16.22^{ab}	63.29^{ij}	0.32^{cd}	4.01^{abc}	15.83^{b}	51.65^{n}	28.15^{b}	30.14^{cd}
	S2	122.04^{ef}	16.61^{ab}	60.11^{m}	0.29^{de}	4.11^{ab}	15.69^{b}	54.19^{m}	10.65^{f}	39.77^{a}
	S3	119.66^{f}	16.92^{a}	57.44^{n}	0.27^{def}	4.2^{ab}	15.57^{b}	55.98^{k}	8.44^{g}	39.98^{a}
Golden Delicious	PH	132.66^{c}	11.67^{k}	85.89^{b}	0.15^{j}	4.22^{ab}	14.98^{b}	15.88^{s}	9.55^{fg}	12.34^{l}
	H	143.66^{a}	14.2^{ef}	69.56^{e}	0.28^{de}	3.7^{cde}	16.06^{b}	56.73^{j}	4.85^{i}	28.48^{e}
	S1	141.51^{ab}	14.7^{de}	64.97^{gh}	0.25^{efg}	3.78^{cde}	15.91^{b}	57.83^{i}	9.67^{f}	34.17^{b}
	S2	138.65^{b}	15.01^{d}	62.81^{j}	0.22^{ghi}	3.85^{cde}	15.72^{b}	60.24^{g}	3.18^{jk}	26.15^{g}
	S3	131.4^{c}	15.18^{cd}	60.33^{m}	0.2^{hij}	3.92^{bcd}	15.63^{b}	62.37^{e}	2.88^{k}	24.33^{h}
Firdous	PH	77.82^{l}	12.5^{ij}	91.23^{a}	0.19^{hij}	4.19^{ab}	19.56^{a}	39.11^{p}	14.88^{c}	16.77^{j}
	H	131.33^{c}	16.13^{ab}	72.7^{d}	0.31^{cd}	4.1^{ab}	20.5^{a}	60.89^{fg}	-6.12^{m}	30.853^{c}
	S1	127.82^{d}	16.41^{ab}	65.73^{fg}	0.28^{de}	4.16^{ab}	19.95^{a}	66.12^{c}	-3.32^{l}	28.6^{e}
	S2	124.74^{de}	16.58^{ab}	61.63^{kl}	0.24^{fgh}	4.22^{ab}	19.84^{a}	67.91^{b}	-7.13^{mn}	31.11^{c}
	S3	122.08^{ef}	16.76^{a}	60.89^{lm}	0.21^{hij}	4.27^{a}	19.77^{a}	69.55^{a}	-8.44^{n}	33.59^{b}

Table 28. Estimation of biological activities of apple varieties at pre-harvest, harvest and at storage conditions

Variety	Temperature	Stage	Phenols (mg GAE/100g FW)	Flavanoids (mg QE/100g FW)	Flavanols (mg CE/g FW)	DPPH (µmol AAE/g FW)	FRAP (µmol FeSO4 E/100g FW)
Prima	Ambient	PH	108.75^{q}	223.8 ^{j}	0.149^{rs}	10.6^{o}	117^{u}
	Ambient	H	145.95^{m}	233.7^{f}	0.162^{r}	19.0^{l}	124.75^{s}
	4^{0}C	S1	139.0^{o}	225.25^{i}	0.145^{rs}	17.51^{mn}	117.05^{u}
		S2	132.05^{p}	203.5^{p}	0.135st	16.3^{n}	109.95^{w}
		S3	131.08^{p}	201.4^{p}	0.131st	16.1^{n}	108.90^{w}
	2^{0}C	S1	142.0^{n}	229.05^{h}	0.153^{rs}	18.6^{lm}	121.0^{t}
		S2	138.35^{o}	223.05^{k}	0.139^{s}	17.9^{lm}	115.85^{v}
		S3	131.85^{p}	216.1^{m}	0.115^{t}	16.5^{n}	108.8^{x}
Red Delicious	Ambient	PH	166.8i	218.25^{l}	1.84^{d}	23.3^{j}	147.65^{n}
	Ambient	H	172.9^{b}	266.85^{a}	2.155^{a}	27.1^{h}	150.05^{m}
	4^{0}C	S1	171.2^{de}	255.7^{b}	1.935^{c}	24.5^{ij}	146.75^{o}
		S2	171.9^{cd}	245.1^{d}	1.82^{e}	20.9^{k}	144.0^{r}
		S3	171.2^{cd}	243.1^{d}	1.80^{e}	20.1^{k}	142.0^{r}
	2^{0}C	S1	174.05^{a}	253.7^{c}	1.975^{b}	25.1^{i}	147.95^{n}
		S2	172.9^{b}	242.8^{e}	1.855^{d}	24.7^{ij}	145.35^{p}
		S3	172.0^{c}	233.05^{g}	1.77^{f}	23.3^{j}	144.75^{q}
Golden Delicious	Ambient	PH	174.0^{a}	202.15^{q}	1.385^{op}	38.8^{fg}	198.95^{k}
	Ambient	H	171.6^{cd}	217.85^{l}	1.665^{h}	42.2^{ab}	242.05^{a}
	4^{0}C	S1	169.05^{fg}	192.9^{u}	1.525^{k}	40.6^{cde}	233.0^{d}
		S2	167.5^{hi}	187.7^{v}	1.40^{no}	38.8^{fg}	223.15^{g}
		S3	167.1^{hi}	186.3^{v}	1.37^{no}	37.2^{fg}	220.13^{g}
	2^{0}C	S1	170.7^{e}	212.1^{n}	1.58^{i}	41.1^{bcd}	239.0^{b}
		S2	168.85^{g}	198.0^{s}	1.44^{m}	39.9^{defg}	224.0^{f}
		S3	167.1^{i}	188.05^{v}	1.375^{p}	38.6^{g}	216.1^{i}
Firdous	Ambient	PH	170.75^{e}	199.2^{r}	1.40^{no}	41.4^{bc}	192.75^{l}
	Ambient	H	168.7^{g}	211.0^{o}	1.685^{g}	42.9^{a}	235.55^{c}
	4^{0}C	S1	168.0^{h}	196.9^{t}	1.475^{l}	42.4^{ab}	222.35^{h}
		S2	166.1^{j}	173.9^{x}	1.415^{n}	40.1^{cdef}	213.9^{j}
		S3	165.2^{j}	171.8^{x}	1.402^{n}	39.4^{cdef}	211.6^{j}
	2^{0}C	S1	169.7^{f}	198.85^{r}	1.555^{j}	40.5^{cde}	233.05^{d}
		S2	161.8^{k}	188.05^{v}	1.435^{m}	40.2^{cdef}	226.0^{e}
		S3	161.1^{l}	175.85^{w}	1.345^{q}	39.5^{efg}	222.75^{gh}

National Agriculture Innovation Fund/ Intellectual Property Management and Transfer/Commercialization of Agriculture Technology

Identification, documentation, registration, release etc of technologies and varieties

Technologies developed by the institute were documented and submitted to ICAR for certification. To popularize and commercialize the walnut varieties developed by CITH (CITH-W-1,CITH-W-2,CITH-W-3,CITH-W-4 and CITH-W-5), the technologies have been transferred to Agrinnovate for further licensing to the stakeholders. Passport data for new collections (Kale & Pear) was prepared and send to NBPGR for allotment of IC numbers. These collections are being maintained at the field gene bank of ICAR-Central Institute of Temperate Horticulture, Srinagar. Application for grant of patent for CNN and Machine Vision Equipped Orchard Spraying Robot for Canopies" have been submitted in collaboration with MMDU, Amballa. In addition, revised application for protection of CITH-W-5 has been submitted to PPV&FRA, New Delhi. To deepen the scientific collaboration son important research and development activities, seven MOUs have been signed between ICAR-CITH and other organizations during 2023.

Capacity developing measures

Technology demonstrations were laid in farmer's field for evaluation of different technologies including apple hybrids, rootstock multiplication under controlled conditions. Training programmes were organized during 2023 to generate awareness about latest developments in temperate horticulture together with focus on skill improvement. To enhance the technical knowhow of scientists and researchers, one day IPR awareness programme was organized by ICAR-Central Institute of Temperate Horticulture, Srinagar on 26th April 2023. A mega event of Regional Industry stakeholder's consultancy meeting was held from 25th -26th October, 2023 with participation from development departments, scientists, farmers, nurserymen, students and industries. The motive behind the meet was the display of latest technologies in farming for adoption by private companies or farmers and redressal of farmer's queries. Five day training programme on "Innovative Production Technologies of Temperate fruit crops for doubling farmers income" for farmers of Himachal Pradesh was organized from 24th-28th July, 2023. During the training programmes participants from different districts of Himachal Pradesh were given hands on training on different techniques involved in plant propagation, multiplication, canopy management, layout method, vertical nursery production etc.

Development of PEQ facilities at Srinagar, Mukteshwar & Dirang" for temperate fruits and nuts

The project "Development of PEQ facilities at Srinagar, Mukteshwar & Dirang" for temperate fruits and nuts" will serve as a model nursery for the farmers, besides good quality certified planting material will be available to the farmers of the Jammu & Kashmir, Uttarakhand and NEH states. Besides this project will serves as a centre of excellence for the nursery management system on scientific lines with all essential components for the successful nursery for production of quality planting material, which is currently lacking and need of the hour in the region.The project will serve as a PEQ facility for temperate fruits and nuts for Jammu & Kashmir, Uttarakhand and NEH states. Centre can handle imported planting material for PEQ of apple, walnut, almond etc. The PEQ centers will work with the objectives, to develop important PEQ

facilities for temperate fruits (apple, walnut, almond etc) at Srinagar, Mukteshwar and Dirang for the states of Jammu & Kashmir, Uttarakhand and Arunachal Pradesh respectively and production and multiplication of clonal rootstocks and important varieties of temperate fruits on large scale to meet the huge demand for temperate region of the country.

Characterizing diversity, genome profile and development of robust diagnostics for *Diplodia* spp. associated with canker disease of apple *(Malus domestica* Borkh.) in north western Himalayan region of India (DST-SERB)

Apple *(Malus domestica* Borkh.) is one of the commercially grown fruits in temperate regions of India. Apple cankers are extremely destructive diseases threatening the global apple industry through direct and indirect losses. Since many species are responsible for this disease, knowing the species spectrum is important for effective management of this disease. In recent years, canker disease has become one of the most economically important diseases of apple and poses grave threat to the apple industry in Jammu & Kashmir (J&K) and Himachal Pradesh (HP) and Uttarakhand (UK) region of India. In the present study all the major apple growing areas were surveyed during 2022-23 in J&K and HP. A total of fifty samples showing typical canker symptoms were collected. Under field conditions, stem bark symptoms primarily manifest as small, sunken, reddish brown lesions. However, as the lesions grew larger, they turned depressed and produced elliptical cankers with vertical and horizontal slits, partially or totally encircling the diseased trunk or branch. The pathogens isolated were characterized by morphological and molecular means using internal transcribed spacer (ITS)-rDNA, B- Tublin and Tef-1α genes. Morphologically, all the isolates were divided into four morphogroups, group 1, group 2, group 3 and group 4 each consisting of 23, 10, 3 and 2 isolates respectively. The sizes of ITS, EF1-α and B-tub PCR amplicons of these isolates were 542 to 586, 458 to 461, and 286 to 316 bp in length, respectively. The nBLAST analyses showed that

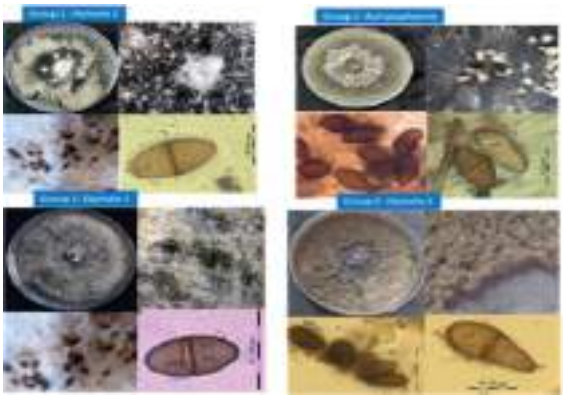
A. PEQ Centre Mukteshwar

B. PEQ Centre Dirang

C. PEQ Centre Srinagar

Chain Link Fencing	Land devlopment	Irrigation facility	Working shed

the isolates were identified (>99% of similarity) as four species belonging to the Botryosphaeriaceae family—*D.mutila* (n=3 isolates), *D.seriata* (n=2 isolates), *D.bulgarica* (n=23isolates), and *Botryosphaeria dothidea* (n= 10isolates)-when they were compared with reference sequences of ex-types and isolates from other studies using the three loci available from the NCBI nucleotide database. Multiple sequence alignments showed that all of these isolates shared 95.6 to 100, 97.1 to 100, and 7.8 to 100% nucleotide identities for the ITS fragment, B-Tub and EF1-α genes, respectively. The study revealed the most predominant pathogen species in J&K, HP and UK are *Diplodia bulgarica, Botryosphaeria dothidea* and *Diplodia seriata* respectively. The single phylogenetic analysis generated by each locus produced a similar tree topology. The phylogenetic tree revealed two main branches (Fig. 29). The upper branch (99% support) included four clusters (clades I to IV) that were well supported and separated from other species (Fig. 24). Twenty three isolates were identified as *D. bulgarica* and grouped as cladeI. Ten isolates identified as *B. dothedia* were grouped (cladeII). In clade III, three isolates were clustered as *D. mutila* and two isolates as *D.seriata* in IV clade. This study would help in better understanding the role of *Diplodia* and *Botryosphaeria* species on symptom development, epidemiology and formulation of improved disease management strategies against apple canker.



Different morpho-groups of Canker pathogens

Fig. 24. Phylogenetic tree obtained through the neighbor-joining tree method using the MEGA 7 program based on translation elongation factor 1-α (tef-1α) gene, beta Tublin (b-tub) and Internal Transcribed Spacer (ITS) genes. Bootstrap support values (%) resulting from 1000 replicates are shown at the branch points.

Walnut propagation for production of quality planting material for walnut promotion in Uttrakhand

Walnut has monopoly in area and production among temperate nut crops and important crop in India. The major walnut producing state are J&K followed by Uttarakhand, Himachal Pradesh and upto limited extent in Ladakh and Arunachal Pradesh. The cultivation of walnut is associated with many production problems and non-availability of quality planting is one of the major constraints which have led to slow increase in acreage with standard cultivars under this crop. Due to health benefit of walnut, the demand of grafted /budded plants has increased much during

last decade. Due to low propagation success in walnut as compared to other pome and stone fruits, the increase in acreage under this crop is not possible till sufficient availability of quality planting material is ensured. The propagation success depends upon many factors and success of different methods varies from region to region due to prevailing microclimate conditions. The walnut propagation is done in polyhouse conditions due to low temperature outside unsuitable for better success at ICAR-CITH, Srinagar. The walnut propagation is possible in open conditions also may be with low success but the availability of standard rootstock, its planting in time and minimum time gap from uprooting of rootstock to planting are also important factors for higher success. The propagation was also practiced at Regional Station Mukteshwar and different nurseries of Deptt of Forest, Uttarakhand i.e. especially Maldevta, Magra , Sony, Silalekh and Ladiyakata.

To see the success of cleft grafting in different walnut varieties/genotypes performed in different dates , 24 varieties / genotypes of walnut were compared for cleft grafting success performed in different dates(14th Feb, 21st Feb and 28th February, 2023) on last year planted rootstock. The highest success was recorded in CITH W5 (84.61%) while others who gave more than 80% success were CITH W 1, CITH W 6, CITH W 9 & CITH W 11 when performed on 14th February, 2023. In the grafting performed on 21st February, maximum success was recorded in CITH W 23 (66.66 %) and similarly, grafting performed on 28th February, maximum success was 54.54 percent in CITH W 19. Similar experiment was also done in newly planted rootstock for grafting success in 12 varieties/ genotypes where maximum success was recorded in CITH W4(58.33%) when performed on 15th February, 2023. From the data it was concluded that last year planted rootstock gave better success as compared to newly planted rootstock.

To see the effect of scion wood portion used for grafting, the scion wood of CITH W 1 taken from top, middle and lower portion of shoot and compared for success under open conditions in previous year planted rootstock & the highest percentage of success was recorded on bottom portion of shoot followed by middle portion & top portion, respectively.To see the effect of rootstock girth, scion girth on growth of grafted plants in CITH W 1 it was found that plant height is directly related to rootstock girth , scion girth and new growth girth and all showed high correlation coefficient with plant height. Under open conditions, Under open conditions, CITH W 1, when grafted from 25th February to 1st March gave 39.55 % success.

Planting Material supplied

In December, 2023, 1500 grafted plants of walnut were provided to UFRMP-JICA, Dehradun for further planting at different locations of Uttarakhand. About 2298 grafted plants were raised in different nurseries of Deptt of Forest, Uttarakhand mainly at Sony and Magra. Regional Station, Mukteshwar also produced about 400 plants.

Human Resource Development

The training and demonstration is another important component of the project for self sufficiency of planting material in Uttarakhand. During 2023, five one day training programmes were organized in different nurseries of Deptt of Forest, Uttarakhand (15th Feb, 2023 at Maldevta, 16th Feb.23 at Magara, 18th Feb, 2023 at Sony, 19th Feb,2023 at Silalekh and 20th Feb, 2023 at Ladiyakata) in which total 82 participants from Deptt of Forest participated.The impact of previous year trainings can be seen as these nurseries produced approximately 2298 plants.

Glimpses of training programmes/ demonstrations at Maldevta, Magra, Sony, Silalekh and Ladiyakata during February, 2023

Validation and development of DUS testing guidelines for olive

The guidelines for DUS testing for olive were finalized after compilation of results of 18 varieties of olive and Task force meeting was held on 27th April, 2023 at ICAR-CITH Srinagar in hybrid mode and submitted to PPV&FRA.

Development of DUS test guidelines for vegetable kale (Brassica oleracea L. var. Acephala)

Six-two genotypes of kale were evaluated and observations were recorded on five competitive plants marked at random in each plot over the replications on reproductive stages for the second year. DUS test guidelines of UPOV and IBPGR were used for recording observations. Observations were made on inflorescence axis, number of floral buds per plant, size of floral buds (mm), colour of floral buds, floral stalk branching, beginning of flowering, flowering duration, flower colour, flower size, flower stalk length (cm), flower stalk colour, silique length (cm), silique width (mm), silique attitude, silique surface, silique colour before drying, days to silique drying, number of seeds per silique, 1000 seed weight (g) and seed colour (Table 29).

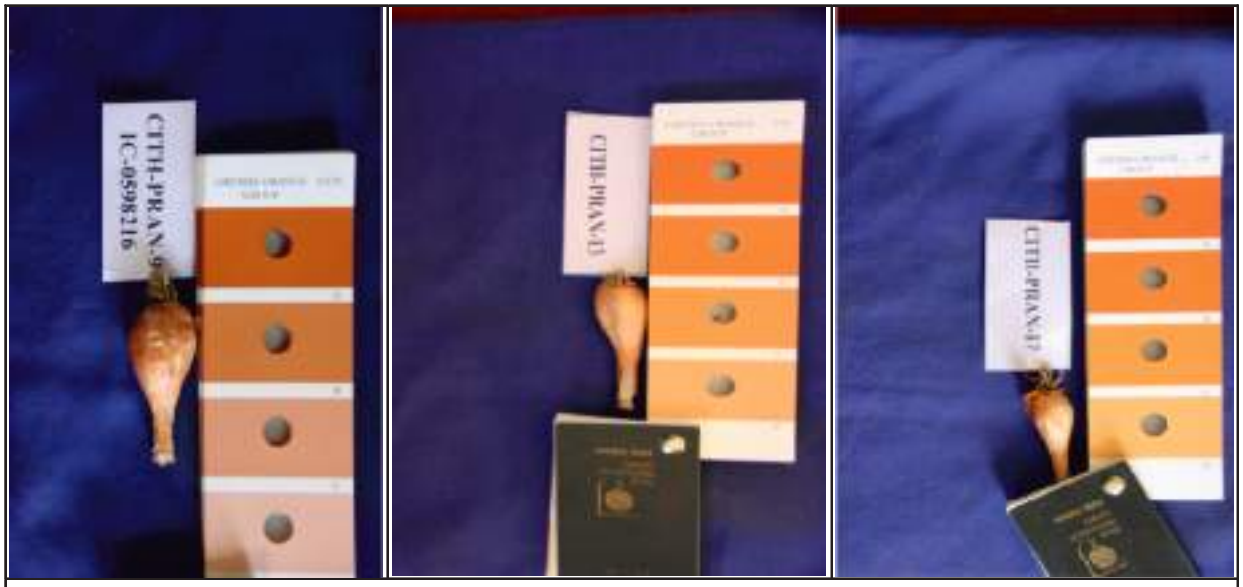
Table 29. Pooled observations on Distinctiveness, Uniformity, and Stability (DUS) descriptors

S. No.	Characteristics	States	Notes	Example Variety / genotype
1	**2**	**3**	**4**	**5**
2	Inflorescence axis	condensed	1	CITH-KC-9
		elongated	2	CITH-KC-1/17
3	Number of floral buds per plant	low (200-600)	3	Pusa Sag-3, Siberian
		Intermediate (600-1000)	5	NW-Sag-20 (R), Kawdari,
		high (>1000)	7	NW-Sag-4
4	Size of floral buds	small (3-6mm)	3	Pusa Sag-1
		medium (6-9mm)	5	CITH-KC-Sel-1
		large (>9mm)	7	NW-Sag-24
5	Colour of floral buds	green (Green N138B)	1	NW-Sag-15
		yellow (green yellow1C)	2	CITH-KC-53
		purple (purple N77B)	3	Pusa Sag-2
6	Floral stalk branching	sparse	3	Siberian
		intermediate	5	CITH-KC-Sel-1
		profuse	7	CITH-KC-Sel-5
7	Beginning of flowering	early (<240)	3	Japanese Green
		mid (240-260)	5	HW-1
		late (>260)	7	Pusa Sag-1
8	Flowering duration	short (<30)	3	CITH-KC-20
		intermediate (30-40)	5	CITH-KC-4/21
		long (>40)	7	Japanese Green
9	Flower colour	light yellow (Yellow 10A)	1	CITH-KC-42
		dark yellow (Yellow 12A)	2	Siberian

10	**Flower size**	**small**	**3**	**Japanese Green**
		medium	5	Siberian
		large	7	NW-Sag-42
11	Flower stalk colour	green (Yellow Green N144D)	1	Japanese Green
		purple (Purple N77B)	2	Pusa Sag-2
12	Flower stalk length	short (1-1.5cm)	3	CITH-KC-42
		medium (1.5-2cm)	5	NW-Sag-21
		long (>2cm)	7	NW-Sag-42
13	Silique length	short (3-5cm)	3	Japanese Green
		intermediate (5-7cm)	5	CITH-KC-26(R)
		long (>7cm)	7	NW-Sag-21
14	Silique width	narrow (1-2.5mm)	3	HW-1
		medium (2.5-4mm)	5	NW-Sag-41
		broad (>4mm)	7	CITH-KC-38
15	Silique attitude	upright	3	NW-Sag-27
		horizontal	5	NW-Sag-24
		drooping	7	Kawdari
16	Silique surface	smooth between seeds	3	CITH-KC-Sel-3
		constricted between seeds	7	CITH-KC-53
17	Silique colour before drying	green (Green 138A)	1	NW-Sag-41
		yellow (Yellow GreenN144A)	2	CITH-KC-38
		violet (Violet-Blue 92A)	3	Pusa Sag-3
		purple (red purple 65A)	4	HW-5
18	Days to silique drying	early (<315)	3	NW-Sag-24
		mid (315-320)	5	CITH-KC-3
		late (>320)	7	CITH-KC-9
19	Number of seeds per silique	few (<10)	3	Pusa Sag-1, NW-Sag-29
		intermediate (10-20)	5	NW-Sag-38, NW-Sag-33
		many (>20)	7	CITH-KC-53
20	1000 seed weight	light (2-3.5g)	3	Pusa Sag-4
		medium (3.5-5g)	5	NW-Sag-30
		heavy (>5g)	7	CITH-KC-Sel-3
21	Seed colour	brown (Brown 200C)	1	NW-Sag-29
		grey (Greyed-Orange 177A)	2	CITH-KC-Sel-3
		black (Black 202A)	3	Siberian

Development of DUS test guidelines for Pran (Allium x proliferum)

The PPV&FRA funded project 'Development of DUS test guidelines for *Pran* (*Allium x proliferum*) was initiated in 2022 when *pran* germplasm was planted in the month of October. Following dormancy during the winters, evaluation of various metric and non-metric traits was started from April, 2023 onwards till September, 2023. For first year evaluation, germplasm was evaluated for thirteen metric traits (plant height, plant spread, pseudostem length, pseudostem diameter, leaf length, leaf diameter, no. of leaves/ pseudostem , f bulb neck tickness, height and width of bulbils, polar and equatorial diameter of bulb and nmber of flowers in umbel) and 12 non-metric traits (Foliage attitude, Cranking, color, Bulb shape at stem end, Foliage waxiness, position of maximum diameter of bulb, width of bulb neck, bulb shape at root end, general shape of bulb, position of root disk on bulb, Adherence of skin after harvest in bulb and Adherence of skin after harvest)



Variability in bulb skin color

Variability in inflorescence

All India Coordinated Research Project (Vegetable crops)

Under AICRP (VC) sub-project 'Collection, evaluation, conservation and utilization of germplasm', two kale viz.Dinosaur kale and Improved Dwarf Siberian(Table 30), one kohlrabi (Table 31), four chilli (Table 32) ten paprika (Table 33) and one pakchoi collections were made. In addition, germplasm collected during previous years was conserved and evaluated for important traits. The collection CITH-Kale-3 *(Kawdari)* received IC number 0650671 from NBPGR and other accessions are under process for the same. Under sub-project 'Varietal and hybrid trials', eight IET, nine AVT-I and six AVT-II hybrid chilli entries, thirteen AVT and seven AVT-II chilli entries; six IET, seven AVT-I and eight AVT-II determinate hybrid tomato entries, six IET and nine AVT-II determinate tomato varietal entries; seven IET capsicum varietal entries and seven IET cabbage hybrid entries were tested (Table……..)

Paprika germplasm collected under AICRP-VC during 2022-23

Red Russian kale
(B oleracea L. var. pabularia)

Kohlrabi (CITH-Kohlrabi-2)

Table 30. Evaluation and conservation of kale collections (*Brassica oleracea* gp Acepahala and other *Brassica oleracea* subspecies and varieties)

Collection	Leaf length (cm)	Leaf width (cm)	Number of leaves/ plant	Leaf yield (q/ha)
CITH-Kale-1	16.77	11.17	14.00	207.41
CITH-Kale-2	21.47	14.19	14.00	326.67
CITH-Kale-3 (*Kawdari*) IC 0650671	20.26	17.52	13.50	132.16
CITH-Kale-5 (Improved Dwarf Siberian)	29.00	13.83	19.67	305.93
CD (p=0.05)	*NS*	*3.93*	*3.87*	*70.17*
SE(d)	*2.53*	*1.19*	*1.17*	*21.29*
SE(m)	*1.79*	*0.84*	*0.83*	*15.05*
CV (%)	*11.54*	*8.41*	*7.67*	*8.76*

Lacinato kale
(*B oleracea* L. var. *palmifolia*)

Improved Dwarf Siberian
(*B oleracea* L. var. *fimbriata*)

Kale germplasm conserved and evaluated during 2023

Table 31. Evaluation and conservation of kohlrabi (*Brassica oleracea* L. *gongylodes*) collections

Collection	Knob PD (cm)	Knob ED (cm)	Knob weight (g)	Leaf length (cm)	Leaf width (cm)	Knob yield (q/ha)
CITH-Kohlrabi-1	**Not enough seed produced**	-	-	-	-	-
CITH-Kohlrabi-2	8.92	9.64	957.43	17.53	11.18	354.44

Table 32. Evaluation and conservation of chilli collections

Collection	Plant height (cm)	Plant spread (cm)	Fruit length (cm)	Fruit width (cm)	Mature fruit yield (q/ha)	Mature fruit color
CITH-Chilli-1	42.00	25.66	9.60	1.43	241.71	Red
CITH-Chilli-2	42.83	28.09	6.33	1.06	158.00	Red
CITH-Chilli-3	39.50	29.83	5.70	1.12	244.86	Red
CITH-Chilli-4	38.25	26.17	6.31	1.22	239.43	Red
CITH-Chilli-5	44.92	25.50	5.78	1.24	158.00	Red
CITH-Chilli-6	43.09	25.66	5.98	1.39	143.43	Red
CITH-Chilli-7	47.44	27.67	5.59	1.56	159.14	Dark red
CITH-Chilli-8	45.50	23.83	6.27	1.31	144.29	Red
CITH-Chilli-9	46.50	26.50	6.30	1.16	136.86	Dark red
CITH-Chilli-10	45.58	26.00	7.64	1.10	186.86	Red
CITH-Chilli-11	47.16	27.67	6.40	1.21	136.29	Red
CITH-Chilli-12	44.92	25.16	5.59	1.01	121.14	Red
CITH-Chilli-13	43.33	26.50	5.91	0.92	140.00	Red
CD (p=0.05)	*3.46*	*NS*	*0.37*	*0.32*	*49.13*	-
SE(d)	*1.57*	*1.35*	*0.17*	*0.15*	*22.30*	-
SE(m)	*1.11*	*0.96*	*0.12*	*0.10*	*15.77*	-
CV (%)	*3.57*	*5.11*	*2.62*	*12.05*	*13.12*	-

Table 33. Evaluation and conservation of paprika germplasm

Collection	Plant height (cm)	Plant Spread (cm)	Fruit length (cm)	Fruit width (cm)	Mature fruit yield (q/ha)	Mature fruit shape
CITH-Paprika-1	95.00	55.00	10.92	3.66	201.35	Elongate
CITH-Paprika-2	86.67	58.83	12.54	2.10	137.90	Elongate
CITH-Paprika-3	73.33	70.33	8.81	2.43	166.50	Elongate
CITH-Paprika-4	105.00	52.67	7.41	2.43	136.86	Triangular
CITH-Paprika-5	85.33	56.67	12.32	1.55	85.56	Elongate
CITH-Paprika-6	99.33	67.33	6.70	1.93	157.61	Elongate
CITH-Paprika-7	96.67	76.00	9.77	2.37	202.05	Elongate
CITH-Paprika-8	85.00	70.33	6.14	2.83	148.98	Triangular
CITH-Paprika-9	80.00	72.83	7.26	2.22	224.75	Triangular
CITH-Paprika-10	61.67	50.67	7.27	2.50	141.42	Triangular
CITH-Paprika-11	81.33	51.67	10.64	2.57	132.04	Elongate
CITH-Paprika-12	111.67	68.67	6.55	3.33	173.40	Blocky
CITH-Paprika-13	108.33	65.83	12.04	2.29	116.00	Triangular
CITH-Paprika-14	103.33	60.33	9.07	3.23	76.12	Triangular
CITH-Paprika-15	95.00	57.67	9.33	3.73	69.54	Campanulate
CITH-Paprika-16	111.67	58.33	10.01	3.41	130.20	Triangular
CITH-Paprika-17	118.33	52.67	6.36	3.31	79.56	Blocky
CITH-Paprika-18	98.33	78.17	6.38	3.84	156.32	Blocky
CITH-Paprika-20	100.00	54.50	8.39	3.70	113.68	Elongate
CITH-Paprika-22	93.33	53.00	8.09	2.90	149.71	Blocky
CITH-Paprika-23	85.00	60.17	7.75	3.32	68.86	Triangular
CITH-Paprika-24	101.67	65.83	7.30	3.20	133.63	Blocky
CITH-Paprika-25	88.33	63.50	8.16	2.96	67.17	Triangular
CITH-Paprika-26	80.00	51.33	8.92	2.10	49.32	Elongate
CITH-Paprika-27	103.33	50.17	9.24	2.20	100.70	Elongate
CITH-Paprika-28	73.33	48.00	7.23	2.16	100.23	Elongate
CITH-Paprika-29	95.00	67.67	10.32	2.90	186.61	Elongate
CITH-Paprika-30	98.33	61.83	11.18	2.61	207.57	Elongate
CD (p=0.05)	*9.19*	*12.67*	*1.06*	*0.48*	*16.14*	-
SE (d)	*4.57*	*6.30*	*0.53*	*0.24*	*8.03*	-
SE (m)	*3.23*	*4.46*	*0.37*	*0.17*	*5.68*	-
CV (%)	*6.00*	*12.71*	*7.37*	*10.44*	*7.42*	-

All India Network Research Project on Onion & Garlic (AINRPOG)

There are two centers (Srinagar & Mukteshwar) of All India Network Research Project on Onion & Garlic (AINRPOG). The brief findings of various experiments in this project are given below

ICAR-CITH, Srinagar

The annual report of AINRPOG for the year 2021-22 was submitted. The experiments for the year 2022-23 were conducted during 2023, the results and recommendation are being compiled. Under sub-project 'Crop Improvement' experiments were conducted for morpho-agronomic evaluation of two germplasm sets (103 and 50 lines) of onion, three germplasm sets of garlic (85, 22 and 18 lines), hybridization between long day/exotic and short day onion followed by mass selection, clonal selection in long day garlic and flowering induction and true seed production in garlic and varietal and hybrid trials in red onion, white high TSS onion, short day onion, long day onion, short day garlic and long day garlic were conducted at IET (6 trials), AVT-I (5) and AVT-II (5) levels for total 118 entries.

Under sub-project 'Crop Production' three experiments were conducted. These were 'Weed management studies in onion seed crop' involving 6 treatments pertaining to chemical (oxyflurfen and quizalofop) and physical weed control, 'Effect of nano-urea on growth, yield and quality of onion' involving 15 treatments having different nitrogen formulations (nano urea and granular urea) and concentrations and 'Fertilizer scheduling through drip fertigation for long day onion' with 8 different treatments of fertilizers in combination with different irrigation methods (drip irrigation and flood irrigation).

Under sub-project 'Crop Health Management', two trials namely 'Management of diseases and pests in garlic' with 8 pesticide treatments and 'Evaluation insecticide/miticides against sucking pests and mites of garlic' involving six pesticide treatments were conducted in addition to survey and monitoring of insect-pests and diseases of onion and garlic in different districts of Kashmir valley.

ICAR-CITH Regional Station Mukteshwar

All India Network Research Project on Onion & Garlic (Long Day) is also going on at ICAR-CITH Regional Station Mukteshwar and findings are briefly presented below under different heads:

Long Day Garlic

In IET trial, total eleven genotypes were evaluated during Rabi extended summer 2022-2023. The maximum TSS was recorded in GN 22-08(32.77 °B) followed by GN 22-09 (29.60°B), GN 22-26 (28.80°B) while, the minimum TSS was observed in GN 22-13 (22.12 °B). The maximum total yield/plot was recorded in cultivar i.e. GN 22-09 (3.97 kg/plot with 198.63 q/ha yield) followed by GN 22-08 (3.85 kg/plot with 192.30 q/ha yield) and GN 22-04 (3.53 kg/plot with 176.32 q/ha yield).

In AVT-I trial, total seven genotypes were evaluated were evaluated during Rabi extended summer 2022-2023. The maximum TSS was recorded in GN 22-31 (39.40 °B) followed by GN 22-35 (38.47°B) and GN 22-33 (37.13°B). The highest yield were recorded in GN 22-28 (229.90 q/ha) followed by GN 22-30 (154.20 q/ha) and GN 22-31 (82.70 q/ha), respectively.

In AVT-II trail, total six genotypes were evaluated during Rabi extended summer 2022-2023. The maximum TSS was recorded in GN 22-41 (40.87 °B) followed by GN 22-43 (40.20°B) and GN 22-45 (37.53°B). The highest yield were recorded in GN 22-52 (132.37 q/ha) followed by GN 22-54 (105.17 q/ha) and GN 22-41 (38.43 q/ha)

respectively.

Long Day Red Onion

In IET trial, total nine genotypes were evaluated during Rabi 2022-2023. The highest TSS was recorded in RVA 22-16 (15.00 °B) followed by RVA 22-01 (14.60 °B) and RVA 22-14 (14.40 °B). The highest yield was recorded in RVA 22-22 (1104.79 q/ha) followed by RVA 22-24 (1009.56 q/ha).

In AVT-I trial, among six genotype, the highest TSS was recorded in RVB 22-23 (15.13 °B) followed by RVB 22-18 (15.0 °B) and RVB 22-34 (14.77 °B), respectively. The highest yield was recorded in RVB 22-32 (874.52 q/ha) followed by RVB 22-34 (586.76 q/ha) and RVB 22-23 (413.19 q/ha) respectively.

In LDR -AVT-II trail, total eight genotypes were evaluated and the highest TSS was recorded in RVC 22-33 (14.47 °B) followed by RVC 22-43 (14.07 °B) and RVC 22-37 (14.03 °B), respectively. The highest yield was recorded in RVC 22-36 (900.74 q/ha) followed by VL-3 (509.60 q/ha) and RVC 22-38 (423.64 q/ha) respectively.

Long Day Red Onion Hybrid

In IET hybrid trial, total six genotypes were evaluated during Rabi 2022-2023. Among all genotype, the highest TSS was recorded in RHA 22-49 (15.00 °B) followed by RHA 22-62 (14.13 °B) and RHA 22-47 (13.90 °B), respectively. The highest yield was recorded in RHA-22-58 (820.40 q/ha) followed by VL-3 (627.30 q/ha) and RHA-22-62 (595.21 q/ha).

In AVT-I hybrid trial, total seven genotypes were evaluated for their growth, yield and its contributing traits during Rabi 2022-2023. The highest TSS was recorded in RHB 22-59 (14.67°B) followed by RHB 22-62 (14.67 °B). The highest yield was recorded in VL-3 (575.08 q/ha) followed by RHB 22-67 (534.61 q/ha) and RHB 22-64 (509.51 q/ha) respectively.

MEETINGS, EVENTS AND MOU SIGNED

4

Organization of meetings and events for benefit of stakeholders is the regular feature of the Institute. During 2023, institute organized majority of meetings and events on physical mode. Institute has organized number of programmes and participated in the programmes organized by other agencies as resource persons. The events and meetings organized by ICAR- CITH, Srinagar and its Regional Stations viz. Mukteshwar & Dirang are presented below and summarized in the Table 34 .

Eexpert delegation on Clean Plant Programme (CPP) Meeting

An expert delegation on Clean Plant Programme (CPP) from Asian Development Bank, Ministry of Agriculture and Farmers Welfare, Experts from US and National Horticulture Board for identifying the clean plant centres visited the farm-field, polyhouses and laboratory facilities of ICAR-Central Institute of Temperate Horticulture, Srinagar on 27th January, 2023. Dr. M. K. Verma Director and Scientific Staff of ICAR-CITH, Srinagar emphasized about the role of Institute in genesis of High Density Plantation system and production of quality planting material in apple and other temperate fruit crops. A stakeholder meeting was also organized at SKUAST-K, Srinagar under the chairmanship of Dr. Nazir Ahmad Ganie, Vice Chancellor, SKUAST-K, Srinagar. The meeting was attended by scientists of ICAR-CITH, Srinagar, SKUAST-K, Srinagar and about fifteen stakeholders involved in import and production of QPM in these crops. During the meeting two projects were presented one each from ICAR-CITH, Srinagar and SKUAST-K, Srinagar for strengthening the facilities at these centres to act as clean plant centres in network mode. Expert committee interacts with stakeholders for identifying their problems and needs and also create awareness among the stakeholders about the importance of clean plant programme. On 28th January expert committee also visited some private and public nurseries like Barkat Agro Farm, Center for Excellence etc. At the end it was found that Clean Plant Programme is the need of an hour for producing and supplying disease free quality and true to type quality plant material of apple, walnut and almond.

Glimpses of meeting and visit on Clean Plant Programme (CPP)

Table 34. List of various events organized during the year 2023

S. No	Event	Date	Organizers/ Coordinators
1	Expert delegation on Clean Plant Programme (CPP) Meeting	27th January, 2023	J I Mir, M K Verma & Staff
2	ICAR-Industry Stakeholder Consultation Regional Meet	25th to 26 th Oct, 2023	J I Mir, M K Verma & Staff
3	World Intellectual Property Day	26th April, 2023	J I Mir
4	Task Force meeting on Development and validation of DUS guidelines of Olive under Indian conditions	27th April, 2023	J I Mir
4	19th Institute Research Council Meeting	30th to 31 st August 2023	Md Abas Shah & O C Sharma
5	19th Research Advisory Committee Meeting	5th to 6 th December, 2023	J I Mir
6	Sports week	23rd to 29 th August 2023	Muneer Ahmad Sheikh
7	9thInternational Yoga	21st June, 2023	Puneet Kumar, Arun Kishore, Mrs Chandani & Shoaib Nissar Kirmani
8	Hindi Diwas and Hindi Week-2023	14th September2023& to21st Sep, 2023	Geetika Malik, Arun Kishore, Puneet Kumar , Jyoti Priya
9	Vigilance Awareness Week	30th October to 5 th November, 2023	Geetika Malik, Arun Kishore &O C Sharma
10	National Unity Day/ *Rashtriya Ekta Diwas*	31st October, 2023	O C Sharma, Geetika Malik , Eshan Ahad & Arun Kishore
11	World Soil day	5th December, 2023	O C Sharma & M K Verma
12	Swachhta Abhiyan- Special Campaign 3.0	2nd October to 31 st October, 2023	Puneet Kumar& Arun Kishore
13	Swachhta Pakhwara	16th to 31 st December, 2023	Puneet Kumar& Arun Kishore
14	National Farmers Day (*Kisan Diwas*)	23rd December, 2023	Puneet Kumar& Arun Kishore

World Intellectual Property Day

ICAR-CITH, Srinagar celebrated World Intellectual Property Day under ITMU unit on 26th April, 2023 with theme, Women and IP: Accelerating Innovation and Creativity. Dr Javid Iqbal Mir (Senior Scientist and PI NAIF) welcomed the participants and gave details about the programme. Dr Neeru Bhushan, ADG (IPTM), ICAR, New Delhi addressed the audience about the power of innovation and creativity and to explore how intellectual property (IP) supports our drive to build a better future. She stressed the scientific community to protect their novel scientific work as patents, designs, copyrights etc. Dr M K Verma, Director ICAR-CITH, also stressed the scientific community to learn how to get the IP for their work and design projects in such a way so that at least one IP should be obtained from such project. Presentations were also given by Dr Vikram Singh (Senior Scientist, IPTM New Delhi), Dr Reena Prusty, Scientist (Fruit Science, CITH Srinagar) and Dr Salwee Yasmin (RA NAIF,CITH Srinagar) who highlighted the importance of IP in horticulture and overall scenario of IP in India and particularly in ICAR. Dr Rashmi (Principal Scientist, CSIR-


World Intellectual Property Day at ICAR-CITH, Srinagar

HQ, New Delhi), Dr K K Srivastava (Principal Scientist, CISH Lucknow) were special invitees in the programme. All the scientific, technical staff along with RAs, SRFs participated in programme with all zeal and zest.

ICAR-Industry Stakeholder Consultation Regional Meet

ICAR-Industry Stakeholder's Consultation Regional Meet was organised by Agrinnovate India Limited (AgIn) in collaboration with ICAR-Central Institute of Template Horticulture (ICAR-CITH) Srinagar and Sher-e-Kashmir University of Agricultural Science & Technology, Kashmir at SKUAST-K Shalimar. The first day of meet was held on 25th October, 2023 under the Chairmanship of Prof. Nazir Ahmad Ganai, Hon'ble Vice Chancellor, SKUAST-K. The major objective of the meet was to promote Public Private Partnership and providing a platform for our key stakeholders including innovators of R & D Institutes of ICAR and State Agricultural Universities engaged in Agriculture & Allied sector to present their technologies to clients/ technology partners and receiving the feedback from them for providing the research a definite direction for the positive outcome. The meet had participation from prestigious hilly regional Institutes i.e., SKUAST-K; Dr YSPUH&F, Solan, ICAR-CITH, Srinagar; ICAR-VPKAS, Almora, Uttrakhand; ICAR-NRC Orchid, Sikkim; ICAR-CPRI, Shimla, Himachal Pradesh; ICAR-CIPHET, Ludhiana; DIHAR, Leh, IIT, Roorkee, STPI and BARC Srinagar working for the technologies, products, seed & planting material production suitable for hilly regions of the country. The meeting had also participation from reputed industries, progressive farmers, nurserymen and entrepreneurs working in the areas of agriculture promotion and development for the hilly regions. The ICAR Institutes and SAUs gave detailed presentation on their technologies, products and elite varieties available with them for transfer through Agrinnovate India Limited for enhancing the production and productivity of important crops in hilly region of North Western Himalayan region. The meet also gave an opportunity for the ICAR institutes to showcase their strength to Industry and progressive farmers of the hilly region and opportunities to collaborate. Dr. Praveen Malik, CEO, Agrinnovate India Limited (AgIn) briefed the stakeholders about mandate of the company. He also mentioned that the AgIn is working towards bridging the gap between ICAR institutes, SAUs and industry front. He also appraised that the organisation has been promoting the process of technology transfer and commercialisation through Public Private Partnership (PPP) and invite more participation from private players of industries to collaborate with government and support in innovation of more refined technologies in the field of agriculture and allied sectors.

Prof. Nazir Ahmad Ganai, Hon'ble Vice

Chancellor, SKUAST-K, Srinagar had appreciated the efforts of AgIn for organizing Regional Stakeholders Consultation Meet and gave a light to the need for organizing such regional meets for future collaboration. He further emphasized that such collaborations are fruitful for making agriculture as a commercial venture in North Western Himalayan region for enhancing the farmer's income and nutritional security. On 26th October, 2023 all participants visited Kanwal Industry, Srinagar; FIL industry Srinagar; Technology Centre of ICAR-CITH, Srinagar and Indian International Saffron Trade Centre (Saffron Park), Dussu Pampore for identifying the researchable areas and requirement of technological support to the stakeholders.The meet acted as a platform for both buyers (Clients/Industries/Progressive farmers) and sellers (Institutes/Universities) to interact and provided wide spectrum opportunities to the innovators to collaborate in developing and commercializing their technologies. The meet acted as seamless conduit between the industry and institutes to present their needs discuss problems and inbuilt ideas amongst the innovators enabling them to identify and provide effective solutions.

19th IRC Meeting

The 19th Institute Research Council Meeting was held from 30th to 31st August, 2023 under the chairmanship of Dr M K Verma, Director, ICAR-CITH, and Srinagar. All the scientists of ICAR-CITH, Srinagar, Regional stations and KVK attended the meeting in physical and virtual mode. Project wise presentations were made by different PI's and results/outcomes along with the activities to be taken up in next year were discussed in details. After presentations a detailed discussion was held on outcome of various projects and Chairman gave critical inputs on experimentation for obtaining realistic and reproducible results. Lot of suggestions came from Chairman and from the house to improve the presentations. Some new proposal were also discussed and approved by the house.

Glimpses of ICAR -Industry Stakeholder Consultation Regional Meet

Discussion during 19 th IRC meeting

19th RAC

The 19th Research Advisory Committee Meeting was held from 5th to 6th December, 2023 under the chairmanship of Dr T A More, Ex Vice Chancellor, MPKV Rauri at ICAR-CITH, Srinagar. The other members who attended the meeting were Dr R K Awasthe, Dr A T Sadashiva, Dr V K Barnwal, Sh Chhering Angchok, Sh Ab Jabar Parrey, Dr M K Verma, Director, Dr B P Patel, ADG, Dr J I Mir (Member Secretary).All the scientists of ICAR-CITH, Srinagar, Regional stations attended the meeting. During the meeting after formal welcome, Action taken Report was presented by Dr M K Verma, Director ICAR-CITH, Srinagar. The committee praised for taking action on all points After that crop improvement projects were presented by Dr J I Mir followed by Crop Production by O C Sharma, Plant protection by Dr S U Nabi, post-harvest by Sh Puneet Kumar, vegetables by Dr Geetika Malik, Regional Station Mukteshwar by Dr Arun Kishore and Dirang by O C Sharma. A healthy discussions was held during the presentations. Lastly the members gave their suggestions and finally Chairman gave his critical in puts. After that visit to technology park, labs and field was held and committee was made awar of various experiments. Next day field visit to farmers field was held and recommendations were finalized.

Sports Week

The ICAR- Central Institute of Temperate Horticulture Srinagar (J&K) celebrated National Sports week from 23rd to 29th August 2023 to inculcate the sportsmanship in everyone and making life healthy and happy to improve the output at work place. The programme was inaugurated by Dr M K Verma, Director ICAR-CITH, Srinagar on 23rd August, 2023. On this occasion, the employees took the pledge in letter and spirit for sport activities for the overall development of the human kind and several activities were organized for men and women like race, badminton, carrom, chess, volleyball, cricket and tug of war. On 29th August 2023, winners were complimented with medals, trophies and certificates. The function was graced by the Chief Guest Shri Mohammad Iqbal Choudhary, Director, Department of Agriculture Production & Farmers Welfare Kashmir, Govt. of Union Territory of Jammu & Kashmir and Guest of Honour, Shri Majid Dhar, In-charge J&K Cricket Association, Srinagar (J&K). Both the guests are very good sport persons, who very

Glimpses of 19th RAC Meeting

clearly emphasized the benefits of the sports in daily life of the people in general and for sound health and physique in particular. They stressed upon for improvement in the sport standards among the players through creation of sports facilities through institutional support and assistance from the Ministry of Sports for creation of sports infrastructure specifically indoor games keeping in view the cold climatic conditions during winters in Kashmir valley. The Director, ICAR-CITH, Srinagar Dr. M. K. Verma presided over the function and also motivated the employees to play and work for healthy life and improving happiness index under stressful life in Kashmir conditions. He apprised the officers/ officials of ICAR-CITH, Srinagar that participation in sports is useful for the physical and mental health. He urged all the employees to take part in different indoor/ outdoor sports on regular basis. The week-long program was coordinated by Dr. Muneer Ahmad Sheikh, In-charge Sports activities who successfully conducted all the activities with zeal and enthusiasm.

International Yoga Day

ICAR-Central Institute of Temperate Horticulture observed 9thInternational Yoga Day on 21st June, 2023 at ICAR-CITH, Srinagar, Regional Station Mukteshwar (Uttarakhand), Dirang (Arunachal Pradesh) and KVK Baramulla (J&K). The staff of ICAR-NBPGR-RS, Srinagar and ICAR-IGFRI-RS, Srinagar also enthusiastically participated in the program. The theme of the day was "Yoga for Vasudhaiva Kutumbakam" which signifies that "World is One Family".The permanent as well as contractual staff at all stations took part in the programme and showed extra zeal and enthusiasm while performing and participating in this great event. In the programme organized at ICAR-CITH main campus, Dr. M. K. Verma, Director (ICAR-CITH, Srinagar) highlighted the importance including its history and need of yoga invigorating overall mental and physical status of a person, meditation and spread the message about establishing harmony between mind and body by mean of Yoga. Sh. Puneet Kumar (Scientist) gave remarks on the celebration of the day and role of different Asanas followed by demonstration of various basic exercises and yoga

Glimpses of sports week organized at ICAR-CITH, Srinagar

Glimpses of Yoga day at ICAR-CITH, Srinagar

Glimpses of Yoga day at ICAR-CITH, RS Mukteshwar, Dirang and KVK Baramulla

and all participants performed various exercises and asanas. At Regional station Mukteshwar, Dr. Arun Kishore briefed about importance of Yoga Day followed by demonstration of yoga asana and postures and repeated by the staff.Yoga Day was also celebrated at ICAR-CITH RS Dirang (Arunachal Pradesh) in which Miss Chandni (Scientist) described about the benefit of incorporating Yoga in our day-to-day life, followed by all staff members performed yoga. At KVK Baramulla programme was organized at their office premises in which permanent and contractual staff participated and Dr. Shoaib Nissar Kirmani briefed about the importance of Yoga in human life followed by demonstration of various asana and meditation.

Hindi Diwas and Hindi Week-2023

The Hindi Diwas was celebrated on 14th September, 2023 at ICAR-CITH, Srinagar and Regional Station Mukteshwar. The programme started with the west wishes to all staff of ICAR-CITH on Hindi Diwas by Dr O C Sharma who emphasized on promotion of Hindi in their day to day official work. He also elaborated in detail the importance and history of the language. All staff of Institute assured to work more in Hindi at all the plate forms as well as in official work. The messages of Secretary DARE & DG ICAR and Hon'ble Minister of Agriculture & Farmers Welfare on Hindi Diwas were also readout. During the week, which was celebrated from 14th September to 21st September, 2023. various hindi promoting activities were organized, which included essay writing competition, hindi translation competition, poem recitation, extempore, poster making and antakshari. Employees from all sections including contractual work-force participated with full fervor in all the competitions. The Saptah concluded on 21st September in an elaborate closing ceremony graced by on-dais presence of chief guest Dr. Narendra Kumar Bhatia, Director, Central Institute of Sericulture Research and Training, Pampore -Srinagar, Dr. M. K. Verma, Director, ICAR-CITH, Srinagar, Dr. Rajesh Kumar, Scientist, CISR&T, Pampore, Dr. O. C. Sharma, Principal Scientist and Dr. J. I. Mir, Principal Scientist, ICAR-CITH, Srinagar. All other scientific, administrative, finance, technical and contractual staffs attended the closing ceremony, wherein, cash prize distribution was done among the winners of various functions. Felicitation of Hindi Saptah-2023 coordinators Dr. Geetika Malik, Dr. Puneet Kumar and Dr. Jyoti Priya and competition evaluators Dr. J. I. Mir, Dr. Sajad Un Nabi and Dr. Sudhakara N. R. was also done followed by special felicitation of

Dr. O. C. Sharma for his outstanding participation and performance in all competitions during the week and presenting of token of respect to the Director, ICAR-CITH, Srinagar. The closing ceremony ended with remarks of Director, ICAR-CITH, Srinagar and with the address by the chief guest.

Hindi Diwas was also celebrated at ICAR-CITH, RS Mukteshwar on 14th September, 2023.also. In the programme Dr Arun Kishor scientist In charge welcomes the chief guest and guests. Smt Ranjana Farfal Principal Kendriya Vidhyalay IVRI Mukteshwar told to the audience for more use of hindi in office and research work; Dr Sher Singh Principal Scientist IVRI and Mr Pavan Lohani PGT Teacher KV IVRI Mukteshwar stressed use of hindi in day to activities. The programme was attended by the all staff of CITH RS and theprogramme was ended with the vote of thanks by shri Diwan Chandra on the same day.

Glimpses of Hindi Diwas & Hindi Week at ICAR-CITH, Srinagar




Glimpses of Hindi Diwas at ICAR-CITH, Mukteshwar

Vigilance Awareness Week

ICAR- Central Institute of Temperate Horticulture, Srinagar observed Vigilance Awareness week from 30th October to 5th November, 2023. The theme of the Vigilance Week was " Say no to corruption; commit to the Nation" ("भ्रष्टाचार का विरोध करें; राष्ट्र के प्रति सम्पर्पति रहे").The programme was started with welcome address and importance of vigilance week by Vigilance Officer on 30th October, 2023 followed by address of Dr O C Sharma who emphasized to adopt various practices for achieving transparency, accountability and corruption free governance. A Pledge ceremony was held in which all staff members took pledge. All the staff of the institute took part in observance of vigilance awareness week with enthusiasm and zeal. At inaugural function, the participants shared their views on vigilance awareness and how we, as common man, can contribute to making India a corruption free nation. Some information on functions and powers of CVC was also sought by the participants, which was answered on the spot by the Vigilance Officer. Posters were displayed at various locations at main campus and its units for benefit of people. A lecture on CVC Act, 2003 was delivered by Mr Fayaz Ahmad Dar, Sr Finance and Accounts Officer of the institute for the benefit of participants on 2nd November, 2023 followed by a healthy discussion on various rules and regulations. Dr M K Verma, Director, ICAR-CITH, urged the staff to work in rule frames. He also told about the ways by which we can reduce the corruption and how individual can contribute for its eradication. The vigilance awareness week was also celebrated at ICAR-RS Mukteshwar.

Glimpses of Vigilance Awareness Week at ICAR -CITH, Srinagar

National Unity Day/ Rashtriya Ekta Diwas

The National Unity Day/ Rashtriya Ekta Diwas was celebrated at ICAR-CITH, Srinagar on 31st October, 2023 and all staff of ICAR-CITH attended the programme. During the programme Dr O C Sharma highlighted the commitment of the Sardar Vallabhbhai Patel towards work and about his life. He told that Unity Day is celebrated on the occasion of birth anniversary of Sardar Vallabhbhai Patel. He also highlighted and acknowledged the struggle and sacrifices of Sardar Vallabhbhai Patel and importance of unity day. Pledge was also taken by the staff for their dedication to preserve the unity, integrity and security of Nation. He also told that country like India is full of diversity in relation to religion, casts, languages, civilization and culture. So to integrate the country the contribution of Saradar Balbhbhai Patel will always be remembered. The major reforms made in his life were also

discussed. Lastly, he urged the staff to work for integration and development of the Nation. Later on Run for Unity was organized byr the permanent staff followed by out sourced labour from various villages.






Glimpses of National Unity Day


World Soil Day Celebration at ICAR-CITH, Srinagar

World Soil Day

ICAR-CITH, Srinagar celebrated World Soil Day on 5th December, 2023 with theme as "Soil and Water : A Source of Life". Participants from different categories viz. Scientists, staff, research scholars and farmers participated in the program. The program started with the importance of the soil and water as a source of Life by O C Sharma followed by address of Director, ICAR-CITH, Srinagar who highlighted various aspects of soil and water in our life. A healthy discussion was held that how each one can contribute. Total 95 farmers participated in the programme.

National Farmers Day

National Farmers Day/ Kisan Diwas was observed on 23rd December, 2023 at ICAR-CITH, Srinagar and ICAR-CITH, RS-Mukteshwar. The farmers were invited to our institutes on occasion of celebration of Kisan Diwas. The Director ICAR-CITH, Srinagar inaugurated the program with formal welcome address of the farmers. The program was started with the briefing of significance of observation of Kisan Diwas, followed by the discussion with the farmers. During this program the farmers expressed their view on current scenario of horticulture in Kashmir and shared their problem. Also, the discussion was held on adoption of modern techniques and production of quality planting material as well as high quality produce. The farmers were also assured any kind of technical support from our institute to resolves their problems and the upliftment of farmers economic status. The program was concluded with serving high tea to all of them. Dr. Arun Kishore (Scientist), ICAR-CITH, RS-Mukteshwar organized the Kisan Diwas and distributed pea and garlic seeds among twenty-two farmers at Sunkiya village in Mukteshwar.


Inauguration of *Kisan Diwas* at IACR-CITH, Srinagar


Discussion with farmers at ICAR - CITH, Srinagar


Closing ceremony of *Kisan Diwas* at ICAR-CITH, Srinagar

Swachhta Abhiyan

Special Campaign 3.0

The special campaign 3.0 was observed from 2nd October to 31st October, 2023 and under these various activities were conducted in the institute to make the institute cleaner and greener. The campaign started with celebration of Gandhi Jayanti and in following days number of cleaning and sweeping drives were organized in various locations of institute such as main building, biotechnology building, residential area, guest house, central library, vehicle garage etc. Also, some of under-utilized space was freed. The proper waste management methods were discussed with the lab workers to enhance the safety and workability insides the labs. Two programmes under Swachhta abhiyan with the theme of "swachhata hi seva and Garbage free India" were organized at weekly intervals at CITH RS Mukteshwar, in which people were aware about cleanness and safe disposal of garbage.

Paying homage to Mahatma Gandhi Ji

Under-utilized space freed

Cleaning and arrangement of stationary in central store

Cleaning in village

Cleaning on roads leading to Institute at ICAR-CITH, Srinagar

Swachhta Pakhwada

Swachhta Pakhwada-2023 was observed from 16th to 31st December, 2023 at ICAR-CITH, Srinagar. Various activities were conducted during this occasion, in which all the staff members actively and enthusiastically participated. Swachhta pakhwada-2023 events included various sweeping and cleaning drives at different location, primarily near generator room, water storage room, vehicle garage, guest house, along that awareness campaign were organized to sensitize our staff about plastic Shramdaan, waste water utilization. And the pakhwada was concluded with Swachh Bharat abhiyan quiz. Kisan Diwas was also celebrated at ICAR-CITH, Srinagar.Farmer awareness programme on cleanliness and sanitation was organized at CITH RS Mukteshwar and Sunkiya village. Cleaning of the station premises was done during all the working days in which roads, channels, water bodies as well as office, chambers, laboratories, farm office, surrounding the residential quarters of the premises were cleaned. Conducted swachhata under Mera Gaon Mera Garurav in Sunkiya village on 23rd December, 2023. Also organized farmer awareness programme on distribution of pea and garlic seed with respect to Swachchta on the occasion of Kisan Divas at Sunkiya in which total 22 farmers ware participated.

Cleaning near generator room

Cleaning drive in vehicle garage

Cleaning drive near water storage room

Celebration of Kisan Diwas

Swachhta Events at ICAR-CITH, Srinagar

Glimpses of Swachhata Programmes and Kisan Diwas at ICAR- CITH, Mukteshwar

MOU's Signed

- ICAR-CITH and Association for innovation development of entrepreneurship in agriculture (a-IDEA) Entered Into MOU for Mutual Cooperation on 26th May,2023 for promoting entrepreneurship in agri and allied sectors.
- ICAR-CITH and Galgotias University, Greater Noida, Uttar Pradesh entered Into MOU For Mutual Cooperation 13th July, 2023 for promotion of students training and quality post graduate research in agriculture and allied sciences and dissemination of technologies generated.
- ICAR-CITH and Himalayan Institute for Environment, Ecology & Development (HIFEED), Dehradun entered Into MOU for Mutual Cooperation 15th July, 2023 for For implementation of training and capacity building initiative and to enhance the livelihood of farmers and other beneficiaries throughout the region, fostering sustainable growth and development in the sector.
- ICAR-CITH and M/s. CNHI Industrial Technology Services (India) Private Limited entered Into MOU for Mutual Cooperation 22nd July, 2023 contract research in the form of Technological Mentoring in Field Evaluation and Optimization of Robotic Apple.
- ICAR-CITH and ADOFSS Producer Company Limited, Udalguri, BTR (Assam) entered Into MOU for Mutual Cooperation 27th September, 2023 providing training, promotion of horticulture and technical support to the the stakeholders of NEH region, thereby improving not only their livelihood but of farmers also.
- ICAR-CITH and DRDO-DRL, Tejpur, Assam Entered Into MOU For Mutual Cooperation for collaborated R&D in the field of temperate horticulture in NEH region on 5th November, 2023.

ICAR-CITH and Assam Agriculture University , Jorhat Entered Into MOU for promotion of students training and quality post graduate research in cutting edge areas on 22nd November, 2023.

MOU between ICAR-CITH and M/s. CNHI Industrial Technology Services (India) Private Limited

MOU between ICAR-CITH and Assam Agriculture University , Jorhat

EXTENSION AND OTHER PROGRAMS

5

Extension Activities

The temperate horticultural crops are the backbone of economy of hilly farmers but the productivity of quality produce of these crops is low as compared to advanced countries. To improve the production of quality produce with minimum/judicious use of farm inputs, thus reducing the cost of cultivation and improving the net returns is the main aim of any research programme at ICAR-CITH, Srinagar. ICAR-CITH has emerged as a hub for generating farmer-friendly technologies which in turn are boosting the productivity of quality produce and benefiting the farmers with higher returns. These technologies were generated after need based quality research on different aspects in different horticultural crop. There is a lot of scope for the increasing productivity of quality produce of temperate horticultural crops in different regions of the country having temperate climatic conditions. The Central Institute of Temperate Horticulture, Srinagar and its regional stations are putting continuous efforts to make the farmers/ officers of line departments and other stakeholders apprised about various new technologies generated in temperate horticultural crops for improving the productivity of quality produce through various extension means. Institute and its Regional stations are actively organizing various training programmes, demonstrations, participating in kisan melas/ gosthies, TV & radio programmes, print media, advisories through various social media etc for the benefit of farmers. Several programmes were organized during the year for officers, farmers and students and details of various programmes organized by ICAR-CITH during 2023 are presented under various headsbelow and briefly presented in Table 35.

ICAR-CITH, Srinagar

Training programmes for officers

Five days training programme for Agricultural Officers

A five days training programme entitledHigh value temperate vegetable crops: production and entrepreneurshipfor the officers from Department of Agriculture was organized at ICAR-CITH, Srinagar from 28th November to 2nd December, 2023. In this programme, total 26 officers participated from almost all districts of Kashmir. The programme was inaugurated by Prof Dil Ahmad Makhdoomi, Director Extension Education, SKUAST-K who stressed the importance & role of vegetables cultivation in economy of farmers. Dr M K Verma, Director, ICAR-CITH, Srinagar highlighted the role of Institute in development of varieties & technology for the benefit of farmers. Dr O C Sharma stressed on the off season vegetable production & Seed production of vegetables. Dr Geetika Malik stressed on scientific way of vegetable. In this programme various aspects of high value vegetables like breeding, production, plant protection, postharvest, protected cultivation seed production and marketing were covered by various scientist from different organizations. The programme was Coordinated by Dr Geetika Malik, Dr Vishal Dinkar & Sh Puneet Kumar.

Glimpses of Five days training programme

One day training/ visit of participants of short course

One day training/ visit of participants of short course on Advances in management of physiological disorder in horticultural crops with special reference to natural farming system held at SKUAST- K w.e.f 20th February to 1st March, 2023 was organized on 23rd Feb, 2023 in which 16 participants participated. During the training/ visit participants were made aware of various research activities going on in the Institute including natural farming research by Dr O C Sharma. The technologies generated by the Institute in temperate horticultural crops were also demonstrated in the field during farm visit of various blocks

Visit of participants of short course on Advances in ma nagement of physiological disorder in horticultural crops with special reference to natural farming system

Exposure visit for staff of ATAMA, Gawalier

One day exposure visit for staff of ATAMA, Gawalier under Deputy Project Coordinator ATAMA, FW& Agriculture Development , Gawalier was organized on 16th March, 2023 in which 8 officers participated. The participants were exposed to various technologies generated by the Institute to boost the productivity. The field visit of various blocks was also organized where Dr O C Sharma demonstrated various technologies.

Study visit for Under Secretaries, GOI organized

As a part of the Level E Training Programme of ISTM, DoPT, Govt of India, 32 Under Secretaries alongwith two other officials, GOI visited the ICAR-CITH, Srinagar on 11th October, 2023. The participants were aquatinted with the implementation of various Govt of India initiatives. During the programme, Dr O C Sharma briefed about various research and extension activities going on at ICAR-CITH, Srinagar. The technologies generated by the Institute were also displayed and demonstrated in the field. Discussion was also held with Dr Geetika Malik, Dr W H Raja, Dr Md Abas Shah, Sh Puneet Kumar and Miss Jyoti Priya regarding problems and their solution to boost the productivity of quality produce in the farmers field.

Visit of staff of ATAMA, Gwalior

Glimpses of visit of Under Secretaries, Govt. of India

Study visit for Under Secretaries, GOI organized

As a part of the 75thLevel E Training Programme of ISTM, DoPT, Govt of India, 20 Under Secretaries along with one course Director, GOI visited the ICAR-CITH, Srinagar on 4thNovember, 2023. The programme was organized before their promotion to Deputy Secretaries in Govt of India. The participants were aquatinted with the implementation of various Govt of India initiatives. During the programme, Dr O C Sharma briefed about various research and extension activities going on at ICAR-CITH, Srinagar. The technologies generated by the Institute were also displayed and demonstrated in the field. Discussion was also held with Dr Vishal Dinkar & Dr Ronit Jaiswal regarding problems and their solution to boost the productivity of quality produce in the farmers field. Saffron cultivation along with high density plantation were demonstrated in the field and participants appreciated the efforts of the institute.

Glimpses of visit of Under Secretaries, Govt. of India on 4th November, 2023

Table 35. List of train ing programmes organized for officers/ staff of line department / Under Secretaries by ICAR-CITH, Srinagar

S.N.	Name of Programme	Venue	Duration (Days)	Date	No. of Participants	Organizers/ coordinators
1	High value temperate vegetable crops: production and entrepreneurship	ICAR-CITH, Srinagar	5 days	28th November to 2nd December, 2023	26	Geetika Malik, Vishal Dinkar & Puneet Kumar
2	Advances in management of physiological disorder in horticultural crops with special reference to natural farming system	ICAR-CITH, Srinagar	1	23rd Feb, 2023	22	O C Sharma
3	Exposure visit of staff of ATAMA, Gawalier under Deputy Project Coordinator ATAMA, FW& Agriculture Development , Gawalier	ICAR-CITH, Srinagar	1	16th March, 2023	8	O C Sharma
4	Study visit of Under Secretaries, GOI as a part of the Level E Training Programme of ISTM, DoPT, GOI	ICAR-CITH, Srinagar	1	11th October, 2023	34	O C Sharma, W H Raja, Geetika Malik & Md Abas Shah
5	Study visit of Under Secretaries, GOI as a part of the 75 th Level E Training Programme of ISTM, DoPT, GOI	ICAR-CITH, Srinagar	1	4th November, 2023	21	O C Sharma, Vishal Dinkar & Ronit Jaiswal

Five training programmes of one day duration organized for staff of UFRMP & Department of Forest, Uttarakhand

During February 2023, five one day training programmes were organized in different nurseries of Deptt of Forest, Uttarakhand on various aspect of walnut propagation and mother orchard management. The programmes were conducted at Maldevta, Magra, Sony, Silalekh and Ladiyakata. Total 82 Forest staff & farmers participated in the programmes. The brief of programs is as presented in Table 36.

Table 36. One Day training programmes organized for Staff of UFRMP & Department of Forest, Uttarakhand

Date	Topic	Venue	No. of Participants	Category of participants	Coordinators
15th Feb, 2023	Walnut propagation	Maldevta-Dehradun	10	Forest staff	O C Sharma & B A Ganai
16th Feb.23	Walnut propagation & mother orchard management	Magra	12	Forest staff	O C Sharma & B A Ganai
18th Feb, 2023	Walnut propagation	Sony	18	Forest staff & Farmers	O C Sharma & B A Ganai
19th Feb,2023	Walnut propagation	Silalekh	20	Forest staff & Farmers	O C Sharma, & B A Ganai
20th Feb, 2023	Walnut propagation	Ladiyakata	22	Forest staff	O C Sharma, & B A Ganai
Total	**5**		**82**		




Walnut propagation programme at Maldevta | *Walnut propagation programme atMagra*




Walnut propagation programme atSony | *Walnut propagation programme atSilalekh*




Walnut propagation programme atLadiyakata

Training programmes/ visits for students

ICAR- CTH, Srinagar is well equipped with labs as well as experimental orchards/ germplasm blocks of many temperate horticultural crops. These facilities makes it as center of attraction for the students and researchers. During the year, 15 visits/ training were organized for students. The details of students visit/ training from different organizations are presented in under various heads and briefly inTable 37.

Three days training programme on laboratory techniques

A three days training programme on Identification of Bioagents using molecular approaches was organized at ICAR-CITH, Srinagar from 25th to 27th September, 2023 in which 10 students from SKUAST-K as well as other states participated. This programme was organized for the participants of training programme entitled Hands on training on laboratory techniques for potential bio-control agents" held at SKUAST-K, Srinagar from 14th September to 13th October, 2023. The training programme from SKUAST-K side was coordinated by Dr Efath Shahnaz, Associate Professor, DARS-Budgam. The students were given hands on training on DNA isolation, PCR amplification, Gel electrophoresis, DNA elution, Sequence analysis and primer designing. Also students were made acquainted with the importance of bioagent applications for management of insect pests and exploration of microbiome for plant health management. Students were exposed to different technologies developed by the institute during field visit. The programme was coordinated by DrSajad Un Nabi and Dr M Abas Shah who were assisted by SRFs Dr Shugufta, Dr Zahoor and Dr Aafreen. Coordinators are highly thankful to Director ICAR-CITH and the whole staff for kind support and help.

Three days training programme on laboratory techniques

One day training cum exposure visit for students from Kerala Agriculture University

A group of 100 students of BSc. Hons (Agriculture) along with 4 faculty members from College of Agriculture, Kerala Agriculture University visited ICAR-CITH, Srinagar on 10th March, 2023 during their study visit. Students were very keen to learn about the temperate horticultural crops. Director ICAR-CITH, Dr M K Verma highlighted the achievements regarding research and technologies of the Institute followed by presentation on different fruits by Dr J I Mir and field visit by O C Sharma. Lastly students weehapply and thanks the institute for enlightening the students regarding various crops especially temperate fruit crops.

Visit of students from Kerala Agriculture University

One day training cum exposure visit for students from Maharasthra

A group of 18 students from College of Agriculture, Muktainagar MPKV, Maharasthra visited ICAR-CITH, Srinagar on 21st April, 2023 during their study visit. The students were made aware of various temperate horticultural crops, their flowering and fruiting season etc. Different technologies generated by the Institute were also shown to the students in the field.

Visit of students from College of Agriculture, Muktainagar, MPKV, Maharasthra

Visit of student s from NEOTIA University, West Bengal

One day training cum exposure visit for students from NEOTIA University, West Bengal

A group of 32 students of BSc. IVth Year) along with 2 faculty members from School of Agricultural and Allied Sciences, NEOTIA University, West Bengal visited ICAR-CITH, Srinagar on 24th June, 2023 during their study visit. Students were very keen to learn about the temperate horticultural crops. During their visit, Dr O C Sharma, Dr Sudhakara N R & Dr Ronit highlighted the achievements regarding research and technologies of the Institute followed by field visit where various crops along with their fruiting were sown to students. Detailed discussion regarding various technologies generated by the Institute were also discussed in detail.

One Day Programme for participants of Eight Day's High End Workshop

One Day Programme/ farm visit was organized for participants of Eight Day's High End Workshop on High-tech nursery techniques for production of elite clones and new varieties of temperate fruits was organized on 26th July, 2023 at ICAR-CITH, Srinagar in which 11 students from different states like Jammu & Kashmir, Punjab, Rajasthan etc participated. The programme was organized by Deptt of Fruit Science, Faculty of Horticulture, SKUAST K from 21st to 28th July, 2023 and funded by DST SERB under Accelerate Vigyan Scheme.

One day training cum exposure visit for students from Govt Degree College, Kokernag Distt Anantnag

Twenty five UG(Vth Smester) students along with 2 faculty members from of Govt Degree College, Kokernag Distt Anantnag visited ICAR-CITH, Srinagar on 30th August, 2023. The students were very keen to learn about various lab techniques and instruments. Visit was organized to various labs in ICAR-CITH by Dr Salwee Yasmin and working , principles, utility and output of various instruments were discussed in detail. Students were also made aware about various temperate horticultural crops.

Visit of students participants of Eight Day's High End Workshop on High -tech nursery techniques

Visit of students from Govt Degree College, Kokernag Distt Anantnag

One Day visit of Students from Govt Boys High School, Rakhshalina

One day visit was organized for the students of Govt High School Rakhshalina Zone 1, B K pora distt Budgam on 18th March, 2023 in which 28 student and six teachers participated. The participants were made aware bout various horticultural crops being grown at ICAR-CITH, Srinagar by Dr O C Sharma.

One Day visit of Students from Foundation World School

One day visit was organized for the students of Foundation World School, Humhama & Mamth Campus distt Budgam on 15th April, 2023 in which 240 student and 27 teachers/staff participated. The participants were made aware bout various horticultural crops being grown at ICAR-CITH, Srinagar by Dr M K Verma, Dr O C Sharma & Sudhakara NR.

Visit of Students from BEACON Public School, Rangreth

Two visits were organized for the students of BEACON Public School Rangreth, Srinagar. One visit was organized on 9th May, 2023 in which 49 students along with 5 teachers participated while other visit was organized on 10th May, 2023 in which 50 students and four teachers participated. The students were made aware of various fruit, vegetable and flower crops.farm visit was also organized for the students.

Visit of students from Govt Boys High School, Rakhshalina Zone 1, B K Pora

Visit of students from Foundation World School

Visit of Students from BEACON Public School, Rangreth on 9th &10th May, 2023

Visit of Students from Islamic Public School, Karalpora

One day visit was organized for the students of Islamic Public School, Karalpora distt Budgam on 18th May, 2023 in which 80 student and 6 teachers/staff participated. The participants were made aware about various technologies for boosting farm production in horticultural crops. A field trip was also organized for students in which various crops were sown. The programme was attended by Dr Vishal Dinkar & Sudhakara N R

Visit/ training of Students from Govt High School, Karalpora

The students of Govt High School, Karalpora, Distt Budgam visited ICAR- CITH, Srinagar on 13th June, 2023. Total 38 student along with 8 teachers participated in the training cum visit programme. The participants were made aware bout various horticultural crops being grown at ICAR-CITH, Srinagar. The students were also apprised about job opportunities in agriculture sector..

Visit of Students from Hunnar School, Kanipora-Karalpora

One day visit was organized for the students of Hunnar School, Kanipora-Karalpora distt Budgam on 19th August, 2023 in which 60 student and 5 teachers/staff participated. The students were made aware about various fruit, vegetable and ornamental plants. Field trip was also organized to identify various crops.

Visit of Students from Foundation World School, Mamath Distt Budgam

One day visit was organized for the students Foundation World School, Mamath Distt Budgam on 11 September, 2023 in which 85 student (45 boys +40 girls) and 5 teachers/staff participated. The students were made aware about various horticultural crops along with their exposure to various labs. The job and self employment opportunities in agriculture and temperate horticulture were also discussed. Dr M K Verma, Director also intracted with students andgave crtical guidance regarding carrier point of view.

Visit of Students from Islamic Public School, Karalpora

Visit of students from Govt High School, Karalpora

Visit of students from Hunnar School, Kanipora-Karalpora

Visit of Students from Foundation World School, Mamath Distt Budgam

One day training/exposure visit on breeding techniques

One day training programme on Breeding techniques in temperate fruit crops was organized at ICAR-CITH, Srinagar from 4th October, 2023 in which 40 students from SKUAST-K. This programme was organized for the participants of training programme entitled Plant Breeding (Perspectives and Modern Techniques held at SKUAST-K, DARS, Old Air Field, Srinagar from 3rd October to 7th October, 2023. The students were given hands on training on breeding techniques, varieties developed, germplasm wealth and lab techniques/ instruments used for efficient breeding by Dr J I Mir, Dr Md Abs and O C Sharma. Students were exposed to different technologies developed by the institute during their visit.

Visit of participants of training programme on Breeding methods on 4th October, 2023

Table 37. List of schools/colleges / institutes who visited the ICAR -CITH during the year 2023

Date	Name of School/ University/ Training	No. of Students/participants	Organized By
25th to 27 th September, 2023	Identification of Bio -agents using molecular approaches	11	S U Nabi &M Abas Shah
10th March, 2023	College of Agriculture,Villanikkaray, KAU	100 students+4 staff	O C Sharma
18th March, 2023	Govt Boys High school, Rakhshalina Zone 1, B K pora Distt Budgam	26 students +8 staff	O C Sharma
15th April, 2023	Foundation World School, Humhama &Mamth Campus	240 students +27 staff	O C Sharma……..
21st April, 2023	Visit of students from College of Agriculture, Muktainagar, MPKV Maharashtra	18	OC Sharma
9th May, 2023	BEACON Public School, Rangreth, Srinagar	49+5 staff	O C Sharma, Vishal Dinkar, Ronit, Kavitha
10th March, 2023	BEACON Public School, Rangreth, Srinagar	50+4 staff	O C Sharma, Puneet, Sarad, reena
18th May, 2023	Visit of Islamic Public School, Karalpora Distt Budgam	80	Vishal Dinkar & Sudhkara NR
13th June, 2023	Govt High School, Kralpora Distt Budgam	38 students+8 staff	O C Sharma/
24th June, 2023	School of Agricultural and Allied Sciences, NEOTIA University, West Bengal (BSC. IV th Year)	32 students +2 staff	O C Sharma, Sudhakara N R and Ronit
26th July, 2023	Visit of participants of Eight Day's High End Workshop held at SKUAST K	11 students+1 staff	J I Mir & W Hraja
19th August, 2023	Visit of Hunnar School, Kanipora-Karalpora Distt Budgam	60 students+5 staff	O C Sharma & Vishal Dinkar
30th August, 2023	Visit of UG students (V th semester) from Govt Degree College Kokernag Distt Anantnag	25 students+2 staff	Salwee Yasmin
11th September, 2023	Visit of Foundation World School, Mamath Distt Budgam	85 (45 boys +40 girls+ 5 teachers)	W H Raja, Mubeena, S U Nabi , Salwee Yasmin & Md Abas
4th October, 2023	Breeding in Temperate horticultural crops	40	JIMir, Md Abas Shah & O C Sharma

Visit of students from Kerala Agriculture University on 10th March, 2023

Visit of students from Govt Boys High School, Rakhshalina Zone 1, B K Pora on 18th march, 2023

Visit of Islamic Pu blic School, Karalpora Distt Budgam on 18th May, 2023

Visit of students from Foundation World School on 15th April, 2023

Visit of students participants of Eight Day's High End Workshop on High-tech nursery techniques on 26th July, 2023

Visit of students from Hunnar School, Kanipora-Karalpora on 19th August, 2023

Visit of students from Govt Degree College Kokernag,Distt Anantnag on 30th August, 2023

Visit of students from BEACON Public School, Rangreth on 10th May, 2023

Visit of students from School of Agricultural and Allied Sciences, NEOTIA University, West Bengal (BSC. IVth Year)on 24th June, 2023

Visit of students from BEACON Public School, Rangreth on 9th May,2023

Visit of students fromGovt High School, Kralpora Distt Budgam on 13th June, 2023

Visit of Foundation World School on 11 th September, 2023

Visit of trainees of training on breeding methods on 4th October, 2023

Training/ Visit for Army/ Air force Family Welfare Associations

Besides organizing training programmes for various stakeholders, ICAR- CITH,Srinagar also organized training programme/ visits for the army / airforce family welfare time to time as per their demand. The programmes organized are presented below and briefly summarized in Table 38.

Three Days Training Programme for Air Force Family Welfare Association

A three days training program was organized for Air Force Family Welfare Association (AFFWA), Srinagar from 13thto 15th June 2023 at ICAR-CITH, Srinagar in which 23 participants from the Air Force Family Welfare Association (AFFWA), Srinagar participated. The programme was inaugurated by Dr. M. K. Verma, Director, ICAR-CITH, Srinagar, whoemphasized that how we can

incorporate fruits and vegetables into our daily livesin his speech. He impressed for adoption of a healthy lifestyle, growing fruits and vegetables crops in the backyard or kitchen garden. He also highlighted the relationship between eating habits and provided them with advice that how to produce value added products out of them and prevent food wastage at the kitchen level. During the training, Sh. Sharath Kumar N (Scientist, Food Technology) andby Sh. Puneet Kumar, Scientist (AS & PE) delivered lecture on various aspects of postharvest management of fruits and vegetables, equipment and tools essential for production of value added products at home scale, ingredients present in value-added goods including preservatives, additives, thickening agents, antioxidants, etc and food grade chemical like pectin, potassium metabisulphite, oxalic acid, calcium chloride, etc. The various products made by trainees were marmalade and cherry preserve/compote, pulp and jam from sweet cherries, apricot fruit bar,tomato ketchupfro pureedtomato, apple pickles, kiwi fruit slices etc. A competition to produce various ready-to-serve products based on saffron was also organized for the participants. A field visit regarding know how about various horticultural crops was organized by O C Sharma. During the training a lecture on mushroom was also delivered by Dr V P Sharma, Director, Directorate of Mushroom, Chambaghat-Solan who emphasized the importance of mushroom for diet and its beneficial role in human health. In valedictory function, Dr V K Pandey (Principal Scientist) from Horticulture Science SMD was Chief Guest who highlighted the importance of value addition to avoid wastage/ losses.The participation certificates were provided to trainees along witha memento to the competition winners.

Glimpses of Three Days Training Programme for Air F orce Family Welfare Association

Table 38. Training programmes/ visits conducted for Army/ Air Force Family Welfare Associations

Date	Training	No. of participants	Organized By
13th to 15th June 2023	Postharvest processing and value addition of fruits and vegetables	23+2=25	Puneet Kumar, Sharad& O C Sharma
29th May, 2023	Temperate fruit and vegetable production	15+8=23	OC Sharma, J I Mir &Geetika Malik

One Day Training/ visit for ladies from Chinar Core & JAKLI

One day training/ farm visit was organized for the ladies from Chinar Corp, Batwara and JAKLI Rangreth, Srinagar on 29thMay , 2023 in which 15 ladies and 8 army personnel particiaped. Mrs. NayanjotAujla w/o Lt Gen. ADS Aujla, GOC Chinar Corps also participated. During the program, participants were made aware about various R&E activities going on at the Institute. The participants praised the efforts of the Institute during the farm visit of different blocks of the various crops.

Farm visit of ladies from Chinar Core & JAKLI

Training Programmes/ visits for Farmers

Training programme/ Farm visit organized for Farmers of Jammu and Kashmir. The farmers are the final user of any technology generated by and agricultural organization. During the year, 14 farmer groups sponsored by various agencies from different states visited the Institute for one day training/ farm visit. The farmers were made aware of various technologies generated at ICAR-CITH in various horticultural crops. The details of various programmes are presented below and in Table39.

Five Days training programme organized for the Farmers of Himachal Pradesh

A five days training programme was organized on innovative production technologies of temperate fruit crops for doubling farmers income for the farmers of Himachal Pradesh from24th to 28thJuly, 2023 at ICAR-CITH, Srinagar. Total 20progressive farmers fromdistt Shimla along with one official from GIZ participated in the programme. During the programme, various lectures were delivered on various innovative technologies followed by practical demonstrations for enhancing quality production of temperate fruits. All aspects like research and development needs in temperate fruits, varietal diversity, planting material production, high and medium density plantation in different temperate fruits, pollination management, training & pruning, orchard floor management practices, diseases and pest management, soil & water management, postharvest management and natural farming etc were covered. Some visits to different organizations/ orchards were also organized during the trainings. The participants were highly satisfied with the training and assured to implement in their fields to boost the productivity of temperate fruits in future. The course Director for the programme was DrM K Verma and coordinators wereDrMdAbas Shah, Dr. Sudhakara N R ,Dr W H Raja and Dr O C Sharma.Theprogramme was sponsored by GIZ-Green InnivationCentres for Agriculture and Food Sector- India . The programmes is briefly summarized in Table….

Glimpses of five days training programme for the farmers of Himachal Pradesh from 24th to 28July, 2023

One day study cum Farm visit of farmers from Maharashtra

One day study cum Farm visit of members of Grapes Grower Association, Maharashtra was organized on15th June, 2023 in which 48 farmers participated during their study visit to Srinagar. DrSudhakaPandey, ADG was Chief Guest at the occasion and interacted with the farmers. He assured that their research needs will be taken on priority. The farmers were later made aware of various technologies generated by ICAR-CITH, Srinagar for the benefit of farmers in various crops by various scientists followed by farm visit. The programmes is briefly summarized in Table 39.

Ladakh

The brief of programmes/ visits conducted for the farmers of Ladakh are presented in Table 40 and detail as below:

One day training cum farm visit was organized for the farmers from different villages of DisttLeh on 23rd August, 2023. In thisprogramme 26 farmers along with two officials participated. The farmers were brought by Sub Divisional Agriculture Officer, Leh, Deptt of Agriculture, UT of Ladakh. Director, ICAR-CITH, Srinagar interacted with the farmers regarding the problems faced by the farmers. He also discussed various technologies available in horticultural crops to boost their farm production. Dr O C Sharma, demonstrated various technologies like nursery production, high density plantation, protected cultivation of vegetables and ornamentals etc in the field. Detailed discussions were also held on various temperate horticultural crops and their scope in Ladakh. The visit was organized to ICAR-NBPGR and IGFRI RS Srinagar. Another one day training cum farm visit was organized for the farmers/ members of Himmothan Society, from different villages of DisttLeh on 11th September, 2023. In this programme8participantsfrom different villages of Lehparticipated. Dr O C Sharma interacted with the farmers regarding the problems faced by and also discussed various technologies available in horticultural crops to boost their farm production. He demonstrated various technologies like nursery production, high density plantation,

Table. Training programme/ visit organized for the farmers of Himachal Pradesh & Maharasthra

Sr No	Date	Organization	No of participants	Co ordinator
1	24th to 28thJuly, 2023	Innovative production technologies o f temperate fruit crops for doubling farmers income for the farmers of Himachal Pradesh	20	MdAbasShah, Sudhakara N R , W H Raja and Dr O C Sharma.
2	15th June, 2023	Grapes Grower Association, Maharashtra Study cum Farm visit of farmers from Maharashtra	48	O C Sharma, W H Raja, S U Nabi, Sudhakara

Study cum Farm visit of farmers from Maharashtra on 15th June,2023

protected cultivation of vegetables and ornamentals etc in the field. Detailed discussions were also held on various temperate horticultural crops and their scope in Ladakh. The visit was organized to ICAR-NBPGR and IGFRI RS Srinagar. Third one day exposure visit cum training was organized for he farmers from Batalik, Kargil&Chiktan zone of district Kargil, UT of Ladakhon 27th October, 2023 in which 40 women farmers participated. Dr M K Verma, told to the farmers regarding problems and prospects of temperate horticulture in Ladakh. Dr O C Sharma and Dr J I Mir demonstrated various technologies generated by the institute in temperate horticulture. Field visit was also organized in which detailed discussion was held on fruit and vegetable production. Besides this two programme, one for farmers of district Kargil& one for Leh were organized under TSP.

Table 40. List of visits/ trainings organized for farmersof Ladakh at ICAR-Central Institute of Temperate Horticulture during the year 2023

SrNo	Date	Training/ visit/Topic	Sponsoring Department/Organization	Zone/ Area/ District	No of participants	Facilitator/ Coordinator
1	23rd August, 2023	Technological advances in temperate horticultural crops	Deptt of Agriculture, UT of Ladakh.	SDAO, Leh	26	O CSharma
2	11th September, 2023	Nursery production and high density plantation in temperate fruit crops	Himmothan Society Leh	DisttLeh	8	O CSharma
3	27th Oct, 2023	Problems, prospects of temperate Horticulture in disttKargil	Department of Horticulture, Kargil	Kargil, Chiktan&Batalik zone	40	O C Sharma, J I Mir & M K Verma

Training of farmers from DisttLeh on 23rd August, 2023

Training of women farmers from Achinathang village of Khaltsi, DisttLeh on 11th September, 2023

Training of women farmers from Kargildistt on 27th October, 2023

Jammu & Kashmir

To boost the productivity of temperate horticultural crops in J&K, ICAR-CITH, Srinagar is continuously organizing training programme for the farmers of Jammu& Kashmir. Being the technological hub, various organizations also bring the farmers to this Institute to learn various techniques being followed at the Institute. The various training/ exposure/farm visit are presented below and consolidated in Table 41.

One day exposure visit for the participants of Skill development programme

One day exposure visit for the trainees from SKUAST-K under Skill Development Programme on Canopy Management was organized on 6th January, 2023. The scientists of Institute, Dr J I Mir, Dr Abas A Shah, Dr Sajad Un Nabi, Dr M.A Sheikh practically demonstrated various aspects like canopy management, pesticide safe & need based use. They also provided pruning tips in temperate fruit crops. Total 15 participants participated in the programme.

One day training/ visit of farmers to ICAR CITH from DisttKulgam

One day training/ visit of farmers to ICAR CITH from DisttKulgam was organized on 14th February, 2023 in which 20 farmers participated. Scientist of the Institute DrMdAbas and Dr S U Nabi made aware the farmers like training and pruning as well as safe use of pesticides in horticultural crops. They also stressed upon adoption of new technologies in temperate horticultural crops

One day training cum visit for the farmers from district Srinagar

One day training cum visit was organized for the farmers from district Srinagar on 14th March, 2023 sponsored by Chief Horticulture Officer Srinagar under ATMA. The farmers were made aware regarding various technologies generated in temperate horticultural crops by Dr S U Nabi and 20 farmers participated in theprogramme.

One day training / visit organized for farmers of DisttShopian

One day training/ visit was organized for the participants of six days training programme on Efficacy of organic and biopesticides/ ITK against apple pests especially aphid on 27th July, 2023 organized by Ambri Apple Research Centre, SKUAST K PahnoodisttShopian from 24th to 29th July, 2023. In theprogramme 28 farmers of district alongwith two scientists participated in the programme. The scientists of Entomology and Fruit Science delivered lecture and demonstrated the technologies for the management of different pests with major focus on aphids.

One day training / visit organized for farmers of DisttGanderbal

One day training/ visit was organized for the farmers of disttGanderbal at ICAR-CITH, Srinagar on 21st September, 2023 on the topic Development of elite walnut plants- a potential enterprise for youths. The programme was organized by KVK Ganderbal and Directorate of Planning and Monitoring. In this programme total 50 male & female farmersparticipated.During the programme, Dr M K Verma, Director ICAR-CITH, Srinagar highlighted various technologies

developed by the Institute in walnut as well as on other temperate fruit crops. Dr J I Mir, Dr W H Raja and Dr OC Sharma interacted with the farmers and delivered different aspects walnut multiplication. Practical demonstration on propagation was aso demonstrated to the farmers.

Training cum workshop on advanced production and protection technologies in temperate horticultural crops

ICAR-CITH, Srinagar organized one day Training cum workshop on production and protection technologies in temperate horticultural crops on 5th October, 2023 at Gogoland, Srinagar. The programme was organized by 41 Bn BSF Srinagar and the farmers from different villages vizHumama, Gogo, Bachroo, Lalgaon, Gudsathu, Ichgam and Naru of disttBudgam participated besides the participation of BSF staff. Total 40 participants were present in the programme. During the programme, Dr M K Verma, Director ICAR-CITH, Srinagar highlighted the importance of various temperate horticultural crops which are the main source of livelihood of farmers. He also highlighted scope of various crops for higher returns per unit area. DrGeetika Malik unlighted the participants with cultivation technologies of different temperate vegetables for boosting the farm income. DrMdAbasShah, told various plant protection measures to be followed in various crops. DrMunner Ahmad Sheikh told regarding the quality planting material importance and orchard management practices. At last the vegetable seedlings were also provided for the farmers. Total about 50 participants participated in the programme.

One day training / visit organized for farmers of DisttBaramulla

One day training/ visit was organized for the farmers of disttBaramulla at ICAR-CITH, Srinagar on 27th October, 2023 on the topic Diversification in temperate fruits. The programme was sponsored byDeptt of Sheep Husbandary, Baramulla. In this programme total 26 farmers participated. During the programme, Dr O C Sharma, highlighted importance of diversification in fruit and vegetable crops as well as various crops for diversification in Kashmir for future. After that various technologies generated by the Institute were shown to the farmers in the field.

One day training / visit organized for participants of training programme held at SKUAST-K

One day training/ visit was organized at ICAR-CITH, Srinagar on 24th November, 2023 for the participants of training programme entitled The green house advantages : empowering entrepreneurship in vegetable cultivation organized by SKYUAST-K from 20th to 26th November, 2023. In this programme total 21 participants participated. During the programme, DrO C Sharma, Dr J I Mir and DrGeetika Malik interacted with the participants. DrGeetika Malik gave detailed lecture on green house cultivation, cultivation technology of various crops followed by field demonstration of various crops.

Table 41. List of visits/ trainings organized for farmers at ICAR-Central Institute of Temperate Horticulture during the year 2023

SrNo	Date	Training/ visit/Topic	Department/Organization	Zone/ Area/ District	No of participants	Facilitator/ Coordinator
1	6th January, 2023	Skill Development Programme on Canopy Management	SKUAST K	Srinagar	15	Dr J I Mir, Dr Abas A Shah,DrSajad Un Nabi
2	14th February, 2023	Plant Protection measures in temperate fruits	Deppt of Horticulture	Kulgam	20	MdAbas Shah & S U Nabi
3	14th March, 2023	Recent technologies and plant protection measures in temperate fruit crops	Deptt of Horticulture,Srinagar	Srinagar	20	S U Nabi
4	24th July, 2023	Visit cum training on temperate horticultural crops	Dett of Agriculture, Srinagar	Srinagar	15+2 officers	Geetika Malik & O C Sharma
5	27th July, 2023	Visit of participants of training entitled as Efficacy of organic and biopesticides / ITK against apple pests	Ambri Apple Research Centre	Shopian	32+2 staff	MdAbas Shah, W H Raja &Muneer Ahmad Sheikh
6	4th August, 2023	Exposure visit cum training programme on production and protection measures in temperate horticultural crops	Deptt of Agriculture, Shopian	Shopian	30+4staff	Dr S U Nabi, Dr Geetika Malik and O C Sharma
7	18th August, 2023	Exposure visit cum training programme on production of temperatehorticultural crops	KVK Srinagar	Srinagar	25+1staff	W H Raj, O C Sharma &MdAbas Shah
8	22nd August, 2023	Training cum exposure visit of farmers of DusttPulwama (Integrated approaches in farming)	ICAR-CITH Srinagar (MIDH)	Pampore-Pulwama	25	W H Raja & O C Sharma
9	21st September, 2023	Development of elite walnut plants- a potential enterprise for youths	KVK Ganderbal& Directorate of Planning and Monitoring	DisttGanderbal	50	O C Sharma, J I Mir & WH raja
10	5th October, 2023	Training cum workshop on production and protection technologies in temperate horticultural crops	14 Bn BSF, Srinagar	Gogoland-Budgam	40	M K Verma, GeetikaMalik,MdAbas Shah &Muneerahmad sheikh
11	27th October, 2023	Diversification in temperate fruits	Deptt of Sheep Husbandary, Baramulla	Baramulla	26	O C Sharma
12	24th November, 2023	The green house advantages : empowering entrepreneurship in vegetable cultivation	SKUAST-K	Srinagar	21	Geetika Malik


Training/ visit of farmers on Canopy Management on 6th January, 2023


Training/ visit of farmers from DisttKulgam on 14 th February, 2023


One day training/ visit on advance technologies and plant protection measures in temperate fr uit crops on 14th March, 2023


Efficacy of organic and biopesticides / ITK against apple pests on 27th July, 2023


Visit cum training on temperate horticultural crops on 24th July, 2023


Exposure visit cum training programme on production and prote ction measures in temperate horticultural crops on 4th August, 2023


Exposure visit cum training programme on production of temperate horticultural crops on 18th August, 2023


Training cum exposure visit of farmers of DisttPulwama on 22nd August, 2023


Development of elite walnut plants - a potential enterprise for youths on 21st September, 2023


Diversification in temperate fruits on 27th October, 2023




Green house advantages : empowering entrepreneurship in vegetable cultivation on 24th November, 2023

ICAR-CITH, Regional Station Mukteshwar

Visits/ training for Students

ICAR-CITH, RS Mukteshwar is also continuously organizing exposure visit of students from different schools, colleges/ institutions and universities to make aware the students, with temperate horticultural crops and hill farming. Total 11 programs were conducted for students. The details of students visit from different organizations are presented in Table 42.

Date	Department/ Organization	Zone/District	Number	Facilitator/ Coordinator
Students				
19th April, 2023	Exposure visit of 9th and 10th students from Government inter college.	Chaurlekh, Dhari, Nainital	60	Dr ArunKishor, Rashmi E. R.
19th April, 2023	Exposure visit of B Sc (I st&IInd Year) students from SardarBallabhBhai Patel University of Agriculture and Technology Meerut	Meerut, UP	27	Dr ArunKishor, Rashmi E. R.
11th August, 2023	Exposure visit of PGDM students from L.B.S.I.M New Delhi	New Delhi	25	Dr ArunKishor
12th October, 2023	Exposure visit of B.Sc Botany (I st&IIIrd Year) students from Kirori Mal College, DU	New Delhi	51	Dr ArunKishor
17th October, 2023	Exposure visit of B Sc botany students from Zakir Husain college, Delhi University	New Delhi	21	Dr ArunKishor
27th October, 2023	Exposure visit of B.Sc Botany (I st, IInd&IIIrd Year) students from Kirori Mal College, Delhi University	New Delhi	45	Dr ArunKishor
30th October, 2023	Exposure visit of B.Sc Botany (I st, IInd&IIIrd Year) students from Kalindi College, Delhi University	New Delhi	20	Dr ArunKishor
30th October, 2023	Exposure visit of B.Sc Botany (I st, &II nd Year) students from DeshBandhu College, Delhi University	New Delhi	39	Dr ArunKishor
6th November,2023	Exposure visit of B.Sc Botany (IIIrd Year) students from Dayal Singh College, Delhi University	New Delhi	23	Dr ArunKishor
5th December, 2023	Exposure visit of PG students from ICAR - IVRI Bareilly	Bareilly UP	20	Dr ArunKishor
Farmers				
21st December,2023	Exposure visit of farmer brought by ICAR-VPKAS Almora	Darima	17	Dr ArunKishor


Exposure visit of 9th and 10th students from Government inter college on 19April,2023


Exposure visit of B Sc (Ist&IInd Year) students from SardarBallabhBhai Patel University of Agriculture and Technology Meerut on 19th April,2023


Exposure visit of PGDM students from L.B.S.I.M New Delhi on 11th August, 2023


Exposure visit of B.Sc Botany (Ist&IIIndYear) students from Kirori Mal College, DU on 12th October,2023


Exposure visit of B Sc botany students from Zakir Husain college, Delhi University on 17th October, 2023


Exposure visit of B.Sc Botany (Ist, IInd&IIIndYear) students from Kirori Mal College, Delhi University on 27th October,2023


Exposure visit of B.Sc Botany (Ist, IInd&IIIndYear) students from Kalindi College, Delhi University on 30th October,2023


Exposure visit of B.Sc Botany (Ist, &IInd Year) students from DeshBandhu College, Delhi Universityon30th October,2023

Exposure visit of B.Sc Botany (IIIndYear) students from Dayal Singh College, Delhi University on 06th November,2023

Exposure visit of PG students from ICAR -IVRI Bareilly on 5th December, 2023


Exposure visit of B.Sc Botany (IIIndYear) students from Dayal Singh College, Delhi University on 06th October, 2023


Exposure visit of PG students from ICAR -IVRI Bareilly on 5th December,2023

Training / visits/ demonstrations for Farmers

To disseminate the different technologies generated by the institute in temperate horticultural crops, ICAR-CITH, RS Mukteshwar is continuously organizing training programmes(off campus & on campus), exposure visits, demonstrations etc for the benefit of the farmers to boost the productivity of their farms. During the year one four day, one two days, and -four one day programmes, 6 diagnostic and 3 demonstrations were organized. The programmes organized during 2023 are presented in Table 43.

Table 43. Training, Demonstration, awarenessprogrammes, field/ diagnostic visits organized by CITH RS, Mukteshwar

Date	Training/Demonstration/ Diagnostic visits etc.	Days	Date & Venue	No of participants	Nodal Person
6th to 9 th February,2023	Training on production techniques of apple an d pear	4	CITH RS Mukteshwar	146	Dr ArunKishor, Mr Umesh Joshi consultant JICA Hort. Mr PankajOjha MS JICA Hort.
2nd to 3rdFebruary, 2023	Training on production techniques of apple and pear	2	CITH RS Mukteshwar	107	Dr ArunKishor, Mr Umesh Joshi consultant JICA Hort. Mr PankajOjha MS JICA Hort.
5th January,2023	Training and pruning of temperate fruits	1	Dutkanedhar	10	Dr ArunKishor
13th January,2023	Farmer Awareness Programme on training & pruning of high density apple orchard and demonstration on scientific cultivation of onion	1	Sunkiya	15	Dr ArunKishor
12th April,2023	Diagnostics visit at Famer field	1	Supi	8	Dr ArunKishor, Rashmi E.R.
27th April, 2023	Diagnostics visit at Famer field	1	Dutkanedhar	10	Dr ArunKishor, Rashmi E.R.
11th May,2023	Demonstration on scientific cultivation of Tomato Under MGMG	1	Sunkiya	7	Dr ArunKishor, Rashmi E.R.
5th June, 2023	Awareness programme on the occasion of World Environment day	1	CITH RS Mukteshwar	9	Dr ArunKishor, Rashmi E.R.
22nd July, 2023	Diagnostics visit at Famer field	1	Sunkiya	8	Dr ArunKishor
24th July, 2023	Diagnostics visit at Famer field	1	Khujeti	6	Dr ArunKishor
21st September,2023	Diagnostics visit at Famer field	1	Burashi	7	Dr ArunKishor
21st September,2023	Diagnostics visit at Famer field	1	Amaravati	6	Dr ArunKishor,
23rd December, 2023	Demonstration of scientific cultivation of pea and garlic on the occasion of national farmer day	1	Sunkiya	22	Dr ArunKishor,
29th December,2023	Farmer Awareness programme on training and pruning of temperate crops	1	Amaravati	6	Dr ArunKishor,


Diagnostics visit at Famer field on 21th September, 2023 at Amaravati


Farmer Awareness programme on training and pruning of temperate crops on 29th December, 2023 at Amaravati


Exposure visit of farmer brought by ICAR-VPKAS Almora on 21st December,2023


Visit of Chief Agriculture Officer Nainital on 13 th June, 2023 at CITH Mukteshwar


Visit of D.G.P. (HOME) UP on 18 th April,2023 at CITH Mukteshwar


Visit of Ex-Director ICAR-CPRI on 15th May, 2023 at CITH Mukteshwar

ICAR-CITH, Regional Station, Dirang

The NEH region is bestowed with diverse climatic conditions suitable for growing a number of horticultural crops and offers a great scope for increase in area and production of temperate horticultural crops. Keeping in view the scope of temperate horticulture in NEH region, ICAR-CITH, Regional Station, Dirang is continuously working for the benefit of farmers of the NEH Region through the need based research, dissemination of technologies, human resource development and supply of quality planting material for increasing the area, production and productivity of temperate horticultural crops in the region. As the institute is in early stages and has started germplasm collection, production of quality planting material and establishment of mother blocks of elite germplam. The infrastructure development is going on and work on development of PEQ facility for NEH region is going on. During the year 2023, Institute has organized many programmes in different areas of different states for the benefit of farmers. Total 7 programes were organized for the benefit of farmers and details of training programs along with the planting material/ farm input distribution among the beneficiaries of NEH region are briefly presented in Tables44 .

Trainings cum Distribution of planting materials of temperate fruit cropsin Arunachal Pradesh

For the NEH region of the country, CITH frequently organizes programmes on the distribution of agri-tools and planting materials. This year, CITH distributed planting materials for temperate fruits like apple, walnut, peach, plum,

and apricots in temperate regions of Arunachal Pradesh (AP) like Nyukmadung and SangtiTawang, as well as in some areas of Assam. These distribution programmes, respectively, benefited 24, 16, 44, and 10 beneficiaries. The state of Arunachal Pradesh received a total of roughly 6000 apple, 150 plums, 200 apricot, 100 peach and 840 walnut plants in 2023.By increasing output, boosting farm efficiency, and encouraging the use of cutting-edge methods, CITH contributes to the general growth and improvement of temperate horticulture through the distribution of planting materials. The institute helps farmers to optimize their farming methods, save labour costs, increase yields, and boost the profitability of their horticulture businesses by giving them access to superior-quality planting supplies.

Training and temperate fruit crops planting material distribution programme in Nyukmadungvillage of West Kameng (D) of Arunachal Pradesh

Training cum temperate fruit crops planting material distribution programme in KVK Tawang village of Tawang (D) of Arunachal Pradesh

Training cum temperate fruit crops planting material distribution programme in Sangti and Khaso village of West Kameng (D) of Arunachal Pradesh

Table 44.Training/farm input distribution programmes organized during 2023 in NEH region

S. No.	Date	One day training programme	Input material Supplied	Venue	No. of Benefic-iaries	Co-ordinators
1.	9th March, 2023	Temperate fruit production for livelihood and nutritional security	Apple Walnut Peach Plum and Apricot	Knyukmadung Village, West Kameng	24	Dr Sudhakara N R , DorjeeDragpa Sh K R Vashisht Vishal Mhetre
2.	10th March, 2023	Temperate fruit production for livelihood and nutritional security	Apple Walnut Peach Plum and Apricot	Sangti,Khaso and Lachang West Kameng	16	Dr Sudhakara N R & DorjeeDragpa Vishal Mhetre
3.	13th March, 2023	Temperate fruit production for livelihood and nutritional security	Apple Walnut Peach Plum and Apricot	KVK Tawang Tawang	44	Dr Sudhakara N R & DorjeeDragpa Vishal Mhetre Sh K R Vashisht
4.	15th March,2023	Temperate fruit production for livelihood and nutritional security	Apple Walnut Peach Plum and Apricot	Assam	10	Dr Sudhakara N R
5	20th May,2023	Importance of biopesticides and their scope in organic farming	Biopesticide kit and Pusa seed kit	Assam Agricultural university at Jorhat	50	Dr Javid I Mir, Dr Wasim, Dr Sajad and Dr Vishal
6	29th September,2023	Importance of horticulture in improving rural livelihoods and long-term nutrition	Mango and Guava	Kaijuli (V) Mazbat (Tq) Udalguri (D)	172	Dr M K Verma Dr Wasim H Raja Dr Sudhakara N R Dr Vishal Mhetre
7	2nd October, 2023	Advancements in temperate fruit crops through increased production of high-quality planting materials	Sprayer, a hand hoe, 1 kg of pea seeds, two bottles of bio - control agent, and water can	KVK Tawang	50	Dr M K Verma Dr Sudhakara N R Dr Vishal Mhetre

Bio-input distribution and farmers training programme at Assam Agricultural University

Bio-input distribution and farmers training programme was organized in collaboration with Assam Agricultural university at Jorhat under NEH scheme on 20th May,2023 in which 50 farmers participated. The farmers were acquainted with importance of biopesticides and their scope in organic farming especially under north eastern region. Scientists from ICAR-CITH Srinagar(DrJavid I Mir, DrWasim, DrSajad and Dr VishalDinkar) highlighted the importance of NEH Scheme and programmes conducted under this scheme. DrPopy Borah from AAU Jorhat gave details about the use and importance of biopesticides. Director Research AAU Jorhat was the Chief guest and Dr B K Samrah Director NECAB was guest of honour for the function. Lastly the biopesticide kit and Pusa seed kit was distributed among the farmer beneficiaries. ICAR- CITH is highly thankful to AAU Jorhat and all other officers and officials of varsity for their help and support.

Glimpses of programme organized at AAU Jorhat

Training Programme cum Distribution Programmeat Kaijuli village of Assam

ICAR-CITH Srinagar in collaboration with ADOFSS Former producing organisation has organised one day training cum distribution programme on Importance of horticulture in improving rural livelihoods and long-term sustainable nutrition at Kaijuli village, MazbatTaluk of Udalguri district in Assam on 29th September 2023. In this programme, Director, DrWasim H Raja (Fruit Scientist), DrSudhakara N R (Soil Scientist) from ICAR CITH Srinagar and Dr Vishal Mhetre (Senior Technical Officer), ICAR-CITH, RS, Dirang enlighted about the importance of the horticulture in human nutrition. ICAR CITH Srinagar has also distributed the 12000 plants comprising Mango, Guava and Jamun plants to the participants of the training programme (Table 45). The list of planting materials of different varieties of different crops that were procured from ICAR-CISH Lucknow are presented in the Table.. A Total of 172 participants has participated and benefitted from this training cum planting material distribution programme.

Table 45.List of different varieties of different fruit crops supplied to the beneficiaries

Sl No	Mango		Guava		Jamune
1	Dasheri	1800	Lalit	1800	300
2	Mallika	1200	Mallika	1200	
3	Ambika	500	Ambika	500	
4	Langhra	1000	Langhra	1000	
5	Arunika	1000	Arunika	1000	
6	Ramkela	360	Ramkela	360	
7	Amrapali	150	Amrapali	150	
	Total	**6010**	**Total**	**5690**	**300**

Training programme cum farm input distribution programmeat KVKTawang

ICAR-CITH has conducted a one day training programmeon Advancements in temperate fruit crops through increased production of high-quality planting materials cum agricultural tools distribution programme on at KVK, Tawang on 2nd October 2023. In this programme, Director, ICAR CITH Srinagar, DrSudhakara N R Soil Scientist and Dr Vishal Mhetre (Senior Technical Officer, RS, Dirang) interacted with the trainees and addressed the problems in temperate fruit crops production of the region. ICAR CITH Srinagar has also distributed the agricultural tools comprising sprayer, a hand hoe, 1 kg of pea seeds, two bottles of bio-control agent, and water can to the participants of the training programme. The A Total of 50 participants were present and

benefitted from the programme.

Implementation of Tribal Sub Plan (TSP)

ICAR-CITH, Srinagar is continuously executing the Tribal Sub Plan for the benefit of tribal farmers of different areas of Jammu & Kashmir as well as Ladakh region. The institute is providing need based training as well as supplying the farm inputs like planting material of fruit and vegetable crops , knapsack sprayer &Secateur etc. During the year 2023, six programmes were organized for the tribal farmers of six districts viz Srinagar, Bandipora, Anantnag & Ganderbal of J&K, Leh and Kargil of Ladakh in which 320 farmers participated. The programmes carried out are summarized in Table. 46 and detail is presented below:

One day exposure visit -cum-training and agriculture input distribution programme of tribal farmers of Fakir Gujri, district Srinagar

One day exposure visit cum training cum planting material and agricultural tool kit distribution programme was organized for tribal farmers of Fakir Gujri area of district Srinagar under Tribal sub Plan (TSP) at ICAR-CITH Srinagar on 13th of February 2023. Total 50 tribal farmers/beneficiaries participated in the programme from tribal areas of Fakir Gujri (Srinagar).The coordinator of the programmeDrSajadUnNabi highlighted the importance of the programme conducted under Tribal sub Plan by ICAR-CITH Srinagar. Farmers were made acquainted with important cultivation practices of important temperate fruit crops as

Table 46.List of training programmes/ agricultural farm input distribution under TSP during 2023

Sr No.	Name of Programme	Venue	Date	No. of Participants	Organizers/ coordinators
1	Cultivation practices of important temperate fruits & vegetable crops	ICAR-CITH, Srinagar	13th of February 2023	50	Sajad Un Nabi, W H Raja, MdAbas Shah, O C Sharma & M K Verma
2	Production of important temperate fruit crops	Izmarg,Gurez district Bandipora	20th July 2023	50	Sajad Un Nabi, J I Mir, W H Raja, MA Sheikh & M KVerma
3	Integrated farming approaches to enhance their income from various commodities from small piece of land	Aru district Anantnag	19th August 2023	50	S U Nabi&Ajaz Ahmad Wani
4	Orchard management and plant protection measures in fruit crops	ICAR-CITH, Srinagar	27th of September 2023	52	S U Nabi, J I Mir, Puneet Kumar , M A Sheikh &O C Sharma
5	Fruit & v egetable production in Ladakh	ICAR-CITH, Srinagar	18th September, 2023	20	SU Nabi, J I Mir, Geetika Malik Md Abas Shah, Puneet Kumar & O C Sharma
6	Advanced production technologies of temperate fruits production	ICAR-CITH, Srinagar	14th October, 2023	98	O C Sharma, Geetika Malik,Sudhakar N R & Ajaz Ahmad Wani
	Total farmers			**320**	

well as vegetable crops by scientists of ICAR-CITH Srinagar. DrWasim H. Raja made farmers acquainted with modern horticulture practices for commercial horticulture. Director of the institute DrM.K.Verma stressed the tribal farming community to adopt the modern practices of cultivation of fruit and vegetable crops. On spot demonstration of budding and grafting was shown by Dr Om Chand Sharma, Principal Scientist, ICAR-CITH Srinagar. Farm visit was also conducted in which technologies related to fruit and vegetable were demonstrated to farmers by fruit and vegetable scientists of the institute. The farmers participated with zeal and were highly satisfied with the training programme. Finally at the end of the programme, planting material of elite cultivars (10 plants), 1 Knapsack sprayer and 1 Secateur was distributed among the beneficiaries.

Training –cum input distribution for tribal farmers of Gurez, District Bandipora

Training cum distribution programme was conducted under TSP Scheme for the tribal farmers of district Bandipora at Izmarg, Gurez in collaboration with KVK/ MAR&ES-SKUAST-K on 20th July 2023 in which 50 tribal farmers participated. DrSajadUnNabi nodal officer-TSP highlighted the importance of TSP Programmes conducted under the scheme Tribal sub plan. Dr Bilal A Bhat, Head KVK and Scientist in charge MAR&ES-SKUAST-K, gave detailed information regarding the work being carried out by the centre for the welfare of farmers in the region. Director ICAR-CITH Srinagar, Dr M. K. Verma acquainted the farmers regarding importance of training programmes and gave the future line of action regarding walnut varietal introduction, off season nursery of vegetables and

Glimpses of programme organized for the farmers of Fakir Gujri, district Srinagarunder TSP

Kala Zeera cultivation under TSP Scheme for tribal farmers of the area. Scientists from ICAR-CITH and MARES Gurez gave detailed information about various aspects of fruit and vegetable production under Gurez conditions. Dr J.I. Mir acquainted the farmers regarding important walnut verities and protection of local verities under PPV&FRA. DrWasim H Raja highlighted the importance of temperate fruit production and its importance for increasing the farmer's income. Dr Shah Nawaz scientist SKUAST-K gave detailed importance of apiculture industry in context to Gurez conditions. DrMudasir also gave detailed importance of vegetables and their cultivation practices. Dr Praveen also highlighted the importance of training and awareness programmes. ICAR-CITH is highly thankful to MARES Gurez Scientist In-charge Dr Bilal and his team for their support and also to all the farmers who participated in the programme. At the end of the programme 100 Tarpaulins for agricultural use were distributed among the beneficiaries.

One day awareness cum agri-inputs distribution programmefor tribal farmersof Aru, district Anantnag

One day training cum awareness programme on integrated farming systems was organized under Tribal Sub Plan at AruPahalgam village of district Anantnag on 19th August 2023 in collaboration with ICAR-IGFRI RS Srinagar and Department of Agriculture and Farmers Welfare, Kashmir. Total 50 tribal farmers (male & female)

Glimpses of programme organized for the farmers of Gurez, District Bandiporaunder TSP

participated in the programme. DrSajadUnNabi nodal officer-TSP highlighted the importance of TSP programmes conducted under the scheme Tribal sub plan. Farmers were made acquainted with the importance of developing integrated farming approaches to enhance their income from various commodities from small piece of land. Scientists from ICAR-CITH and ICAR-IGFRI gave all details regarding fodder production, walnut production etc to tribal farmers. At the end of the programme one Tarpaulin, and mineral mixture and seeds were distributed among the tribal beneficiaries

One day exposure visit cum training programme for tribal farmers of Ganderbal district

One day awareness programme-cum-exposure visit was organized for tribal farmers of district Ganderbal at ICAR-CITH Srinagar on 27th of September 2023 in collaboration with Department of Agriculture, FTEC Ganderbal. Total 52 tribal farmers participated in the programme. Farmers were made acquainted with use of biopesticides for pest and disease control, cultivation of elite varieties of temperate fruit crops especially in walnut and apple.

Glimpses of programme organized for the farmers ofAru district Anantnagunder TSP

DrSajadUnNabi nodal officer-TSP highlighted the importance of programmes conducted under the scheme Tribal sub plan. DrO.C.Sharma and DrJavid I Mir acquainted the farmers with various fruit and vegetable crops along with their importance in income generation. At the end of the programme knapsack sprayers were distributed among the tribal beneficiaries.

One day exposure visit cum awareness cum of tribal farmers of district Leh -Ladakh to ICAR-CITH Srinagar

Awareness-cum-exposure programmeof tribal women farmers of Khaltsi area of district Leh - Ladakh was organized at ICAR-CITH Srinagar on 18thSepember, 2023 in collaboration with Department of Horticulture, Leh-Ladakh. Total 20 tribal farmers participated in the programme. During the programme, Dr M K Verma, Director ICAR-CITH, interacted with these farm women and highlighted the scope of horticulture in Ladakh. He also stressed for any technological help from the Institute. After that DrBabitaSalaria also highlighted the role of women in horticulture. DrSajadUnNabi nodal officer-TSP highlighted the importance of TSP Programmes conducted under the scheme Tribal sub plan. Farmers were made acquainted with use of biopesticides for pest and disease control, cultivation of elite apricot varieties for processing etc. DrO.C.Sharma and DrGeetika Malik conducted the field visit and made farmers acquainted with various fruit and vegetable crops along with their importance in income generation. At the end of the programme, knapsack sprayers were distributed among the tribal beneficiaries.

Glimpses of programme organized for tribal farmers ofWangath valley of District Ganderbalunder TSP

Glimpses of programme organized for tribal women farmers from Achinathang area of district Leh–Ladakhunder TSP

Training on advanced production technology in temperate horticultural crops organized for tribal farmers of DisttKargil, Ladakh

One day training cum exposure programme was organized advanced production technology in temperate horticultural crops at ICAR-CITH Srinagar for the tribal farmers of District Kargil under Tribal Sub Plan on 14th October, 2023 in which 98 tribal farmers from 48 villages of 7 blocks of district Kargil participated. The farmers who participated were from the villages viz. Khaws, Nam Suru, MaitaKargee (Taisuru Zone); Barsoo, Brakoo, Patto&Sankoo(Sankoo Zone); pyem, GomaGargil, MenjeeGoma, Lankoor, Baroo,Akchamal, Apati,TumailBarchay, Kargil Town, Choskore, Silikchay,Silmo&Darchik (Kargil A &B Zone); Shargole, Mulbeck, Pashkum&Tharumsu (Shargole Zone); Hardass, Chuliskambo, Kaksar, Shimsha, Kheber, Jas Gond,&Kharboo (Drass Zone); Sanjak, Khangrol, Hagnis, Chitken, Samrah,Shakar&Kukshow (Chiktan Zone) and Trespone, Saliskot, G M Poie, Kamore&Tambis (TSG Zone).During the programme various advanced production technologies of temperate fruits production were discussed and demonstrated by byDr O C Sharma. DrGeetika Malik, discussed prospects of various vegetable crops in Ladakh. She also demonstrated various technologies to be followed for getting higher returns. DrSudhakaraN talked about the methods to be followed for improving soil health and balance use of fertilizers for getting sustainable yield. A farm visit of various fruit & vegetable crops was also organized where various technologies generated were demonstrated for boosting quality production. At the end of the programme, knapsack sprayers were distributed among all the beneficiaries so that they can protect their crops from pests and diseases. The farmers and officers were happy, thanked the Institute and urged for organizing more programmes for the benefit of tribal farmers.

Glimpses of training programme cum distribution of inputs for the farmers of DisttKargil under TSP held at ICAR-CITH, Srinagar on 14th October, 2023

Schedule Caste Sub Plan (SCSP)

The ICAR-Central Institute of Temperate Horticulture, Srinagar, Jammu & Kashmir executed the Schedule Caste Sub Plan (SCSP) during 2023.Aseries of programswere organized in SC-dominated areas of Jammu and Kashmir and Uttarakhand under the SCSP Scheme. The institute is continuously helping the farmers by providing trainings and farm inputs to enhance their farm income. Total 6 programmes were organized i.e. two in J&K and 4 in Uttarakhand in whicj 792 farmers were benefited. The detail of programmes organized under the scheme in Jammu& Kashmir and Uttarakhand presented below:

Schedule Caste Sub Plan (SCSP)- Jammu& Kashmir

ICAR-CITH, Srinagar is continuously implementing the Schedule Caste Sub Plan (SCSP) in Jammu region. The institute is helping the farmers by providing trainings coupled with supply of farm inputs and planting material. In Jammu & Kashmir, two programmesviz. Livelihood improvement of farmers by cultivation of horticultural crops on modern scientific lines and Engagement of youth for scientific vegetable cultivation- opportunities for self-employment were organized in which training and farm inputs were provided for 444 farmers(Table 47) . First programmewas conducted for the farmers of Panchayathalqa Bhatiyari, district Jammu on 20th November while another programme was organized for the farmers of Panchayat halqa Deoli, district Jammu on 21st November, 2023.

Table 47. Training Programmes and farm input prigramme organized for SC farmers of J&K under SCSP Scheme

S. No.	Program	Location	Date	No. of Participants	Organizer
1.	Livelihood improvement of farmers by cultivation of horticultural crops on modern scientific lines	PanchayathalqaBhatiyari, district Jammu	20th November, 2023	200	Dr. Abas Shah, and Dr. Puneet Kumar
2.	Engagement of youth for scientific vegetable cultivation- opportunities for self-employment	PanchayathalqaDeoli, district Jammu	21st November, 2023	244	Dr. Abas Shah, and Dr. Puneet Kumar

Schedule Caste Sub Plan (SCSP)-Uttarakhand

ICAR-CITH, RS Mukteshwar is continuously implementing the Schedule Caste Sub Plan (SCSP) inUttarakhand. The station is helping the farmers by providing trainings coupled with supply of farm inputs and planting material.Odlohar-Simsyari village was selected in the Bageshwar district under SCSP and the scheme was implemented in the village since 2021. The basic data/document were collected and verified and total 100 farming families are selected for the benefit. Total three awareness programme namely Farmer Awareness Programme on onion cultivations cum distribution of planting materialon 1st February, 2023; Crop diversification through horticulture and livestock production cum distribution of farm input in collaboration with IVRI Mukteshwaron 28th March, 2023 and FAP on management of horticultural crops after post monsoon cum vegetable seed kit distributionon 6th September, 2023were organized for the farmers. Apart from this one new village Gahena in Ramgarh block of Nainital was selected in leadership of Hon'ble Director, ICAR-CITH during his visit to CITH Regional Station Mukteshwar in which total 296 schedule caste farming families were selected for giving the benefits of the scheme and on his presence a famer awareness program on Hill agriculture for livelihood enhancement and farm input distribution was organized at the station in which total 50 farmer participated. The list of programmes is presented in the Table48.

Table 48. Training Programmes organized for SC farmers under SCSP Scheme (2023)

Date	Programme	Venue	Participants	Co ordinators
1st February, 2023	Farmers awareness programme on distribution of planting material cum demonstration cum temperate fruit crops	Odlohar-Simsiyari of district Bageshwar	100	Dr Arun Kishore&Vinod Chandra
28th March, 2023	Crop Diversification through horticulture and livestock production cum distribution of farm inputs	Odlohar-Simsiyari of district Bageshwar	100	Dr Arun Kishore, Vinod Chandra, Diwan Chandra, Puran Chandra, Pushpender Kumar , GovindGiri&Shabir Ahmad
2nd July, 2023	Training cum FAP on hill agriculture for livelihood enhancement and farm input distribution	CITH, Mukteshwar for farmers of Gahena	50	Dr Arun Kishore, Vinod Chandra, Diwan Chandra, Puran Chandra, Pushpender Kumar , GovindGiri&Shabir Ahmad, Narain Singh
6th September, 2023	FAP on manag ement of horticultural crops after post monsoon cum vegetable seed kit distribution	Odlohar-Simsiyari of district Bageshwar	100	Arun Kishore &Diwan Chandra

Farmer Awareness Programme on onion cultivations cum distribution of planting metrical under SCSP on 1st February, 2023at Odlohar-Simsyari village of Bageshwar district of Uttarakhand

Training Programme on Crop Diversification through Horticulture and Livestock Production cum Distribution of Farm Input in collaboration with IVRI Mukteshwar under SCSP on 28th March,2023 at Odlohar-Simsyari village of Bageshwar district of Uttarakhand

FAP on Hill Agriculture for Livelihood Enhancement and Farm Input Distribution Under SCSP on 02nd July, 2023 at Mukteshwar

FAP on management of horticultural crops after post monsoon cum vegetable seed kit distribution on 06th September, 2023 at Gahena village in Ramgarh block of district Nainital, Uttrakhand

MeraGaonMeraGauravProgramme

ICAR- CITH RS, Mukteshwar has adopted Sunkiya village under MeraGaonMeraGaurav. The village is situated at 1750 meter above mean sea level (29° North latitude and 79° East longitudes) in Dhari block of Nainital district. Eight trainings, 2 diagnostic/field visits three demonstrations in which total more than 99 farmers participated. The farmers of the village were also supported with different technological literatures on temperate fruits and vegetables. Further, three swachhata campaign and waste decomposition awareness programme were conducted. Also provided technical support to the farmers of the village as and when approached.

Glimpses of various programmes organized under MGMG

Exhibition (s)

To demonstrate the different technologies generated at ICAR-CITH, institute along with regional stations used to participate in different exhibitions organized by various agencies to exhibit its technologies/ varieties tie to time. The list of participation in various exhibitions is presented below in Table 49.

Table 49.List of exhibitions organized on various occasions during 2023

Date	Department/ Organization	Venue	Facilitated By
12th to 15th September, 2023	Global symposium on Farmers Rights	NASC complex New Delhi	J I Mir, Puneet Kumar,Muneer Ahmad Sheikh & M K Verma
10th to 13th October, 2023	Agriculture Science Congress	ICAR-CMFRI, Kochi	J I Mir, S U Nabi, Muneer Ahmad Sheikh& M K Verma
15th October,2023	KisanJawanVigyanMela at DRDO - DIBER, Haldwani	DRDO-DIBER, Haldwani	Dr ArunKishor
19th October2023	KisanMela	ICAR-VPKAS, Almora	Dr ArunKishor
15th August, 2023	Independence Day	Dirang	Dr Vishal Mehtre
2nd to 4th March, 2023	PusaKrishiVigyanMela (PKVM) 2023	ICAR-IARI, New Delhi	Dr W.H.Raja,DrSudhakara N R& ManzoorAhmad
6th to 9 th November, 2023	10th Indian Horticulture Congress 2023	Assam Agricultural University, Khanapara, Guwahati, Assam	Dr W.H.Raja, Dr Supreeth B.G, Vishal Mhetre, K R Vashistha& Mr DorjeeDrakpa

Glimpses of various exhibitions at different occasionsby ICAR-CITH, Srinagar

Exhibition by ICAR-CITH, RS Dirang on various occasions

Glimpses of various exhibitions at different occasionsby ICAR-CITH, RS Mukteshwar

Radio/ TV Talks

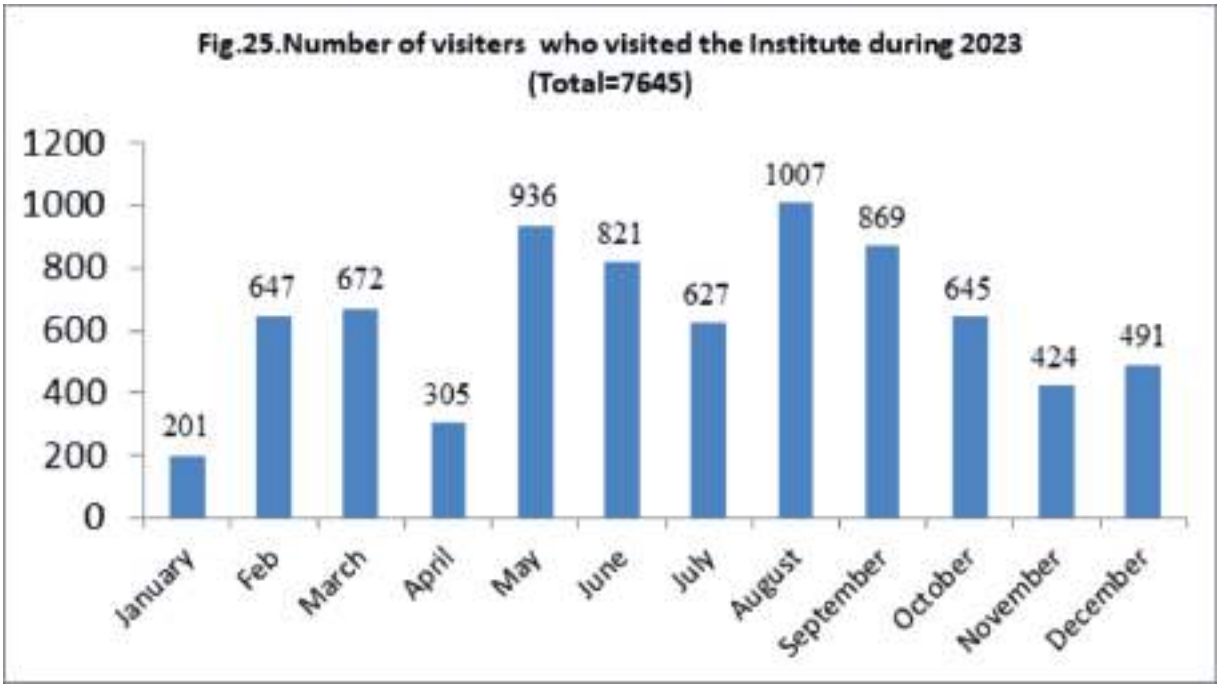
The technological dissemination through mass media for their adoption on a larger scale and boost the income of farmer's community, scientists of ICAR-CITH, Srinagar continuously delivered need-based talks on various topics beneficial for farmers and line departments. A total 17 no of TV/Radio talks were delivered by various scientists during the year are presented in theTable 50.

Table 50. Radio/ TV talks delivered by scientist of ICAR-CITH during 2022

Sr No	Name of Scientist	No. of talks
1.	Dr M K Verma	2
2.	Dr J I Mir	2
3.	Dr W H Raja	8
4.	Dr Sajad Un Nabi	3
	Total	**17**

Farmers/ visitors visit to ICAR-CITH, Srinagar

The well managed orchards and technologies generated by Institute in different crops has become the center of attraction for visitors / farmers. During 2023, total 7645 farmers/ visitors visited ICAR-CITH, Srinagar and month wise detail is presented below in Fig25.



TRAININGS AND CAPACITY BUILDING

6

To update the knowledge and skill of staff, training and capacity building is the regular feature of the Institute.ICAR-CITH, Srinagar is deputing its staff regularly for various need based training programmes organized time to time by various organizations for up gradation of knowledge and skill of the staff. During 2023, following officers were deputed for below mentioned trainings (online/offline) and have successfully completed the trainings.

Trainings attended by Scientific Staff

Dr M K Verma, Director

- Attended Executive Development Program held at ICAR-NAARM, Hyderabad from 22nd to 27th May, 2023.

Dr Arun Kishore, Scientist Sr Scale (Fruit Science)

- Attended 21 days summer school on Emerging challenges and opportunities in biotic and abiotic stress management organized by Astha foundation, Meerut (U.P.) India *via* virtual mode from 10th to 30th August, 2023.

Dr Mohd Abas Shah, Scientist Sr Scale (Entomology)

- Attended five days training program GCA Approved RPAS Pilot Training from PBC's Aero Hub, Pune from 23 to 29 November, 2023.

Dr Sajad Un Nabi, Scientist (Plant Pathology)

- Attended 10 days training programme on Biosecurity and biosafety : Policies, diagnostics, phytosanitary treatments and issues organised by ICAR-NBPGR New Delhi from 4th to 14th September, 2023.

Sh Puneet Kumar Scientist (ASP&E)

- Attended ten days CAFT training on Artificial intelligence and advances in ICT for smart agricultural food processing organized by ICAR-Central Institute of Agricultural Engineering, Bhopal from 23rd February to 4th March, 2023 at ICAR-CIAE, Bhopal.
- Attended training on The remote pilot training (CAT-1 VLOS) organized by RPTO, Mahatma Phule Krishi Vidyapeeth, Rahuri in partner with Groundzero Aerospace, Mumbai from 2nd to 3rd December (online). 15th December to 18th December, 2023 (offline) at MPKV, Rahuri.
- Attended training on The remote pilot training (CAT-1 VLOS) organized by RPTO, Mahatma Phule Krishi Vidyapeeth, Rahuri in partner with Groundzero Aerospace, Mumbai from 15th December to 18th December, 2023 (offline) at MPKV, Rahuri.

Dr. Ronit Jaiswal, Scientist (Agricultural Statistics)

- Successfully completed 113th Foundation course for ARS (FOCARS) at NAARM, Hyderabad dated on 18th July 2023 to 17th October 2023.
- Successfully completed one month Orientation foundation training at ICAR-CITH, Srinagar dated from 19th October to 19th November, 2023.
- Successfully completed 90 days Attachment training (PAT) at NIT Patna from 29th November, 2023 to 26th

February, 2024.

Shri. Sharath Kumar N, Scientist (Food Technology)

- Successfully completed 113th Foundation course for ARS (FOCARS) at NAARM, Hyderabad dated on 18th July 2023 to 17th October 2023.
- Successfully completed one month Orientation foundation training at ICAR-CITH, Srinagar dated from 19th October to 19th November,2023.
- Successfully completed the Professional attachment training (PAT) at Department of Food Engineering, NIFTEM, Thanjavur, Tamil Nadu from 15th December 2023 to 15th March, 2024.

Miss Rashmi E R, Scientist (Plant Pathology)

- Successfully completed 113th Foundation course for ARS (FOCARS) at NAARM, Hyderabad from 18th July to 17th October,2023.
- Successfully completed one month Orientation foundation training at ICAR-CITH, Srinagar from 19th October to 19th November,2023.
- Attended Professional attachment training (PAT) at ICAR-IIHR, Bangalore from 21st November,2023 to 21st February,2024.

Miss Chandni, Scientist (Vegetable Science)

- Successfully completed 112th FOCARS (Foundation Course for Agricultural Research Services) at NAARM, Hyderabad from 11th April to 10th July,2023.
- Successfully completed one month Institute orientation training programme from 21stJuly to 24th August, 2023 at ICAR-CITH, Regional Station, Mukteshwar, Uttarakhand.
- Successfully completed three months Professional attachment training programme at ICAR- Research Complex for Eastern Region Farming System Research Centre for Hill and Plateau Region (FSRCHPR), Plandu, Ranchi from 4th September to 4th December, 2023.
- Successfully completed Online training programme on Next generation sequencing and data analysis organized by ICAR-NAARM, Hyderabad from 16th to 20th October, 2023.

Miss Reena Prusty, Scientist (Fruit Science)

- Successfully completed the 3 months FOCARS (Foundation Course for Agricultural Research Service Probationers) organized by ICAR-NAARM, Hyderabad from 18th July to 17th October, 2023.
- Successfully completed 1 month Orientation program at ICAR-CITH, Srinagar from 19th October to 18th November, 2023.
- Successfully completed 3 months Professional attachment training program (PAT) at Division of Physiology, ICAR-IARI, New Delhi under the guidance of Dr. C. Viswanathan, from 28th November, 2023 to 25th February, 2024.

Dr. Kavitha R Scientist (Fruit Science)

- Successfully completed 113th Foundation course for ARS (FOCARS) at NAARM, Hyderabad dated on 18th July 2023 to 17th October 2023.
- Successfully completed 1 month Orientation foundation training at ICAR-CITH, Srinagar from 19th October to 18th November, 2023.
- Successfully completed the Professional

attachment training (PAT) at Division of Fruit Crops, ICAR-IIHR, Bengaluru under the guidance of Dr. M. Sankaran, from 28th November, 2023 to 22th March, 2024.

Supreetha B G, Scientist (Fruit Science)

- Successfully completed 113th Foundation course for ARS (FOCARS) at NAARM, Hyderabad dated on 18th July 2023 to 17th October 2023.
- Successfully completed one month Orientation foundation training at ICAR-CITH, Srinagar dated from 19th October to19th November, 2023.
- Successfully completed the Professional attachment training (PAT) at ICAR-IIHR, Bangalore from 23rd November, 2023 to 23rd February, 2024.

Trainings attended by Administrative Staff

Sh Diwan Chandra, AAO

- Attended two days training on Technical Service Rules organized by ICAR-NAARM, Hyderabad from 10th to 11th July, 2023

AWARDS/ REWARDS/ RECOGNITION

7

Dr M K Verma, Director

- Chaired one technical session on New age horticulture for nutritional security during International Conference on Next-Gen Preparedness for Food Security and Environmental Sustainability held at AAU, Jorhat, Assam, India from 22nd to 24th November, 2023.
- Chairman Steering Committee, International Conference on Technology-driven Agriculture to Face the Imminent Challenges of the Future (ICTA-2023) held at College of Agriculture, Galgotia University, Greater Noida, India from 19th to 21st December, 2023.
- Chairman, Technical Session-IX of International Conference on Next-Gen Preparedness for Food Security and Environmental Sustainability held at AAU, Jorhat, Assam, India from 22nd to 24th November, 2023.
- Chairman, Technical Session-II, Annual Zonal KVK Workshop 2023, Zone-I held at Dehradun on 26th June, 2023.
- Keynote lecture on Precision production systems through architectural management in temperate fruits in Global Conference on Precision Horticulture for Improved livelihood, nutrition and environmental services held at JISL, Jalgaon, Maharashtra from 28th to 31st May, 2023.
- Keynote Lecture on Temperate Fruits for Profitability and Nutritional Security: India vis-à-vis International Scenario in International Conference on Next-Gen Preparedness for Food Security and Environmental Sustainability hels at AAU Jorhat from 22nd to 24th November, 2023.
- Expert Lecture on High Density Plantations and Promising KVK Technologies for Zone-1 during Annual Zonal KVK Workshop 2023 of Zone-I held at Dehradun, Uttarakhand on 26th June, 2023..
- Invited Lecture on Gaining an Insight on Perspective on Temperate Horticulture (Fruit Crops) during National Dialogue for Shaping the Future of Indian Horticulture – A Way Forward held at NAAS Complex, New Delhi on 26th August 2023.
- Lead lecture on Potential of Underutilized Fruit and Nut Crops of Temperate Region during International Seminar on Exotic and Underutilized Horticultural Crops: Priorities and Emerging Trends held at ICAR-IIHR, Bangalore on 17th October, 2023.
- Lead lecture on "Can Horticulture Contribute in Diversification, Sustainability, Higher Economy from Small and Marginal Hill Farmers?" during National Symposium on Sustainable Mountain Agriculture: Challenges and Opportunities for Achieving Zero Hunger and Nutritional Security held at ICAR-VPKAS, Almora, Uttarakhand on 5th July, 2023.
- Invited lecture on Current Trends in Standardization of Rootstocks in Apple: Recent Insights" during 10th Indian Horticulture Congress 2023 on Unleashing Horticultural Potential for Self-Reliant India held at Guwahati, Assam from 6th to 9th November, 2023.

- Invited lecture on New Developments in training and pruning of temperate fruit crops during 10th Indian Horticulture Congress 2023 on Unleashing Horticultural Potential for Self-Reliant India held at Guwahati, Assam from 6th to 9th, November 2023.
- Invited lecture on Current trends in standardization of rootstock in apple during 10th Indian Horticulture Congress 2023 on Unleashing Horticultural Potential for Self-Reliant India held at Guwahati, Assam from 6th to 9th, November 2023.
- Lead lecture on Underutilized Temperate Fruit Species in The Western Himalayas: Scope for Enhancing Rural Livelihoods and Improving Food Security during National Seminar on Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas organized by Indian Society of Plant Genetic Resources at Shoolini University, Solan, Himachal Pradesh from 27th to 28th November, 2023.
- Invited lecture on Current Status and Potential of Temperate Horticulture during National Seminar on Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas organized by Indian Society of Plant Genetic Resources at Shoolini University, Solan, Himachal Pradesh from 27th to 28th November, 2023.
- Lead lecture on Sustainable Development and Nutritional Security through Diversification of Temperate Fruit Crops during National Conference on Future of Agriculture and Agriculture for Future Indian Perspective held at SKUAST – K, Srinagar, J&K.
- Keynote lecture on Temperate Horticulture – Future challenges and solutions in Global Conference on Precision Horticulture for Improved livelihood, Nutrition and Environmental Services held at JISL, Jalgaon, Maharashtra from.28th to 31st May, 2023

Dr O C Sharma, Principal Scientist (Horticulture)

- Nominated as Technical Expert for Board of Studies in Botany of Central University of Kashmir, Ganderbal for three years.
- Nominated as External Expert (Horticulture) for finalization of research programmes of college of Horticulture & Forestry Pashighat, CAU Imphal.

Dr J I Mir, Principal Scientist (Agricultural Biotechnology)

- Invited lecture on Canopy management and varietal diversity in apple during five days training programme on Innovative production technologies of temperate fruit crops for doubling farmers income sponsored by GIZ-Green Innovation Centres for Agriculture and Food Sectors, India for stakeholders from Himachal Pradesh held at ICAR-CITH, Srinagar from 24th to 28th, July 2023.
- Invited lecture on Unlocking the potential of varied fruit crops fidelity testing and virus indexing for quality control and genetic resistance to the participants of SERB sponsored workshop on Hitech nursery techniques for production of elite clones and new varieties of temperate fruits organized by Division Fruit Science, SKUAST-K, Srinagar on 26th July, 2023.
- Lead lecture during 10th Indian Horticulture Congress held at College of Veterinary Science Campus, Assam Agricultural University, Khanapara, Assam on 6th November, 2023.

Dr Arun Kishor, Scientist-SS (Fruit Science)

- Received Young Scientist Award from Society for Scientific Development in Agriculture & Technology (SSDAT) in the VIIIth International Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences held at University of Agricultural Sciences, Raichur, Karnataka, India *via* virtual mode from 18th to 20th December, 2023.

Dr. Wasim Hassan Raja, Scientist SS (Fruit Science)

- Received Best Presentation Award for Technology-Vertical expansion of Nursery under green house condition for multiplication of clonal rootstocks of Apple during Progressive Horticulture Conclave (PHC 2023) organized by the GBPUA&T, Pantnagar & ISHRD, Uttarakhand from 3rd to 5th February, 2023.
- Delivered invited lecture on scope and potential of Temperate Horticulture on North Eastern States during International Conference on Next-Gen Preparedness for Food Security and Environmental Sustainability organized by Assam Agricultural University, Jorhat, Assam, India Norwegian Institute of Bio economy Research, Norway from 22 to 24November, 2023.
- Delivered invited lecture on Establishment of Hi-Tech Nursery and model Horticulture Nursery for the production of quality planting material for the temperate fruits in Kashmir region, during one day Training/awareness programme, organized by NHB in co-ordination with KVK Baramulla on 19th June 2023
- Delivered invited lecture on innovative techniques for the multiplication of clonal rootstocks of apple under protected conditions in the workshop sponsored by DST SERB and organized by SKAUST-K, Shalimar, Srinagar from 21^{ist} to 28th July 2023.
- Delivered lecture on Application of Artificial Intelligence in Agriculture in the Summer School Training Program jointly organized by the School of Agriculture, Galgotias University and ICAR-Central Institute of Temperate Horticulture, from 8th to 19th August, 2023
- Convenor of Technical session in International Conference New age horticulture for nutritional security, International Conference on Next-Gen Preparedness for Food Security and Environmental Sustainability Organized by Assam Agricultural University, Jorhat, Assam, and Norwegian Institute of Bio economy Research, Norway from 22nd to 2th November, 2023.

Dr S U Nabi, Scientist-SS (Plant Pathology)

Received Best Oral Presentation Award for presentation on Real time detection and transmission of viruses (*ApMV* and *ApNMV*) associated with mosaic disease of apple (*Malus domestica*) in the IPS Platinum Jubilee Conference 2023 held at University of Mysore, Mysuru, Karnataka from 2ndto5th Feb, 2023.

PUBLICATIONS

8

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Review Papers

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Book Chapters

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- Bharadwaj C, Kumar Neeraj, PusuluriSrinija, Patil B S, GoswamiAmit, Verma M K, Sultana Rafat, Varshney Rajeev and Singh Sanjay 2023. Modern Breeding Approaches to Enhance Genetic Gains in Horticultural crops. *In:* Training Manual on Advances in experimental designs and genomics for tailoring horticultural crops. ICAR-Indian Agricultural Research Institute, New Delhi, pp. 128-135.
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- KishorArun, Kumar Yogesh, NabiSajadUn, Rashmi E.R. and Chandni. 2023. Cultivation and Management Practices of Kiwi Fruit [*Actinidiadelic*Planch] in Hilly Regions of Uttarakhand.GRISAAS-An Edited Book (3)
- Madhu G S, Harish D, Mir J I, Nabi SU and Sharma O C 2023. Conservation and Use of Temperate Fruit and Nut Genetic Resources. *In*: Fruit and Nut Crops - Handbook of Crop Diversity: Conservation and Use of Plant Genetic Resources. Edited by RajasekharanPEandRao V R. Singapore , Springer,. https://doi.org/10.1007/978-981-99-1586-6_6-1.
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Technical bulletins

- Kumar Dinesh, Verma M K, Ahmed Nazeer, Srivastava K K, Verma R K, Sharma O C. and Mir JavidIqbal 2023. Intensive Almond Production Technologies. Technical bulletin, ICAR-CITH Srinagar, 24p
- NabiSajad Un, Mir Javid I, VermaMahendra K, Raja Wasim H, Sudhakara N R, Abas Mohammad, KishorArun, Sharma Om Chand, Sheikh Muneer A, ParveenShuguftaManzoor, Subaya and Yasmin Salwee2023. Temperate Fruit Viruses and Strategies For Production of Virus Free Planting Material, Technical bulletin, ICAR-CITH Srinagar, 33p.

Popular articles/pamphlet/folders

- Chandni and ArunKishor. 2023. Greening the Hills: A Bounty of Opportunities through Vegetable-Based Integration in Uttarakhand Orchards**.** The Agriculture Magazine. 3(3):711-713.
- Geetika Malik, AzraLateef, SajadUnNabi and Mohd. Abas Shah 2023. Protection practices in chilli. Extension folder published by Director, ICAR-CITH, Srinagar.
- Geetika Malik, AzraLateef, Sharath Kumar N and JyotiPriya 2023. Physiological disorders and their control in cauliflower. Extension folder published by Director, ICAR-CITH, Srinagar.
- Geetika Malik, AzraLateef, Vishal Dinkar and Sudhakar N R 2023. Pran. Extension folder published by Director, ICAR-CITH, Srinagar.
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Participation in Workshops/ Conference/ Meeting

9

M K Verma, Director

- Attended International Conference on Next-Gen Preparedness for Food Security and Environmental Sustainability held at AAU Jorhat from 22nd to 24th November, 2023.
- Attended Annual Zonal KVK Workshop 2023 of Zone-I held at Dehradun, Uttarakhand.
- Attended National Dialogue for Shaping the Future of Indian Horticulture – A Way Forward held at NAAS Complex, New Delhi on 26th August, 2023.
- Attended International Seminar on Exotic and Underutilized Horticultural Crops: Priorities and Emerging Trends held at ICAR-IIHR, Bangalore on 17th October, 2023.
- Attended National Symposium on Sustainable Mountain Agriculture: Challenges and Opportunities for Achieving Zero Hunger and Nutritional Security held at ICAR-VPKAS, Almora, Uttarakhand on 5th July, 2023.
- Attended 10th Indian Horticulture Congress 2023 on Unleashing Horticultural Potential for Self-Reliant India held at Guwahati, Assam from 6th to 9th November, 2023.
- Attended National Seminar on Plant Biodiversity for Food, Nutrition and Health Security in North-West Himalayas from 27th to 28th November, 2023 (Virtual).
- Attended National Conference on Future of Agriculture and Agriculture for Future Indian Perspective held at SKUAST – K, Srinagar, J&K.

O C Sharma, Principal Scientist (Horticulture)

- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.
- Attended interaction meeting of External Expert (Horticulture) for finalization of Research Programmes of College of Horticulture & Forestry, Pashighat, CAU Imphal on 6th June, 2023.
- Attended meeting on Clean Plant Programme held at SKUAST-K, Srinagar on 28th January, 2023.

Dr J I Mir, Principal Scientist (Plant Biotechnology)

- Attended 53rd REAC meeting of SKUAST-K, Srinagar on 21st January, 2023.
- Attended consultation workshop for Indian Clean Plant Programme at Hotel Ambassador, New Delhi on 30th January, 2023.
- Attended meeting on progress of PEQ under the chairmanship of Joint Secretary, Agriculture & Farmers Welfare at Krishi Bhawan on 9th February, 2023.
- Attended Institute review meeting with Hon'ble Minister of Agriculture & Farmers Welfare at Krishi Bhawan, New Delhi on 16th February, 2023.
- Attended meeting on progress of PEQ under the chairmanship of Horticulture Commissioner, MIDH at Krishi Bhawan

on 7th May, 2023.

- Attended stakeholders meet cum national seminar on start up opportunities in medicinal plants organized by RCFC-NR-II, at SKUAST-K, Srinagar on 20th March, 2023
- Attended Indo-German workshop on E-processing and management of DUS data in variety examination organized by PPV&FRA, New Delhi in collaboration with Federal Ministry of Food and Agriculture, Germany at ICAR-NBPGR, New Delhi from 25th to 26th May,, 2023.
- Attended global symposium on "Farmers Rights" organized by PPV&FRA held at ICAR convention centre, NASC complex New Delhi from 12th to 15th September, 2023.
- Attended Agriculture Science Congress at Hotel De Meridian Kochi organized by ICAR-CMFRI, Kochi from 10th to 13th October, 2023.
- Attended meeting on progress of PEQ under the chairmanship of Special Secretary, Agriculture & Farmers Welfare at Krishi Bhawan on 7th May, 2023.

Dr Arun Kishore, Scientist SS(Fruit Science)

- Attended VIIIth International Conference on Global Research Initiatives for Sustainable Agriculture & Allied Sciences jointly organized by Astha foundation, Meerut (U.P.) and University of Agricultural Sciences, Raichur, Karnataka, India *via* virtual mode during 18th to 20th December, 2023.
- Attended SAC meeting of KVK, Jeolikot on 17th May,2023 organized by KVK, Jeolikot.
- Attended RAC meeting of GBPUAT Pantnagar on 30th January, 2023 organized by Director Extention GBPUAT Pantnagar.
- Attended SLEC meeting as Member of SLEC Committee of HMNEH and DOHFP, Directorate of Horticulture & Food Processing, Uttarakhand on 19th July,2023.

Dr Geetika Malik, Scientist SS (Vegetable Science)

- Attended 41st Annual Group Meeting of AICRP-Vegetable Crops held at SKUAST-K, Shalimar, Srinagar from 3rd to 4th June, 2023.
- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.

Dr W H Raja, Scientist SS (Fruit Science)

- Attended Progressive Horticulture Conclave (PHC 2023) organized by the GBPUA &T Pantnagar & ISHRD, Uttarakhand from 3rd to 5th February, 2023
- Attended 10th Indian Horticulture Congress 2023 on Unleashing Horticultural Potential for Self –Reliant India held at College of Veterinary science campus, Assam Agricultural University, Khanapara, Guwahati, Assam from 6th to 9th November, 2023.
- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.

Dr Mohd Abas Shah, Scientist SS (Entomology)

- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th

October, 2023.

Dr Sajad Un Nabi, SS (Plant Pathology)

- Attended Annual Meeting and National Platinum Jubilee Conference held at University of Mysore, Mysuru, Karnataka from 2nd to 5th February, 2023 organized by Indian Phytopathological Society.
- Attended XVI Agricultural Science Congress 2023 & ASC Expo held from 10th to 13th October 2023 held at Kochi, Kerala, India.
- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.

Sh Puneet Kumar, Scientist (AS&PE)

- Attended four days symposium on First Global Symposium on Farmers rights organized by PPV & FRA from 12th to 15th September, 2023 at ICAR, Convention Centre, New Delhi.
- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.

Dr Vishal Dinkar, Scientist (Plant Breeding and Genetics)

- Attended National Symposium on Crop Health Management: Safeguarding Crop Through Diagnostics and Innovations' organised by ICAR-VPKAS, Almora during 29th to 30th September, 2023.
- Attended National Institute of fashion Technology (NIFT), Srinagar official language implementation committee (OLIC) meeting as external Hindi officer on 17th August, 2023.
- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.

Miss Jyoti Priya, Scientist (Plant Physiology)

- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th October, 2023.

Dr. Ronit Jaiswal, Scientist (Agricultural Statistics)

- Successfully completed 4th Indian Workshop on Applied Deep Learning (IWADL-2023) organized by the Department of Computer Science & Information Systems at BITS Pilani, KK Birla Goa Campus from 12th to 16th June, 2023.

Reena Prusty, Scientist Horticulture (Fruit Science)

- Attended Global Conference on Precision Horticulture for Improved livelihood, Nutrition and Environmental Services organized by ASM Foundation, New Delhi and Jain Irrigation System Ltd held at Jalgaon, Maharashtra from 28th to 31st May, 2023.

Dr. Kavitha R Scientist (Fruit Science)

- Participated on in Global Conference on Precision Horticulture for Improved livelihood, Nutrition and Environmental Services organized by ASM Foundation, New Delhi and Jain Irrigation System Ltd. Held at Jalgaon, Maharashtra from 28th to 31st May, 2023.

Shri. Sharath Kumar N Scientist (Food Technology)

- Attended Regional Industry Stakeholder Consultation Meeting organized by ICAR-CITH, Agrinnovate and SKUAST-K, Srinagar from 25th to 26th

LIST OF ONGOING PROJECTS

10

I. Institute Research Projects	
A. Project: Crop improvement and Biotechnology **Sub projects**	
1.	Survey, collection, characterization and documentation of temperate horticultural crops
2.	Breeding for development of superior varieties/hybrids in solanaceous vegetables
3.	Development of superior cultivars/ hybrids in temperate fruits through conventional and non conventional methods
4.	Characterization and diversity analysis of flowering related gene/ genes in almond
5.	Development of CMS lines in long day onion [*Allium cepa* L]
6.	Rootstock breeding in apple (*Malus* x *domestica*)
B. Project: Crop Production and Propagation **Sub projects**	
1.	Assessment of soil carbon dynamics and carbon sequestration potential of selected temperate fruit crops of Arunachal Pradesh
2.	Impact of combined application of phosphorous and silicon on apple rootstock performance under various soil moisture regimes
3.	Development and evaluation of integrated nutrient management module for high-quality temperate vegetable production
4.	Pre harvest fruit drop management in apple
5.	Development of almond based saffron inter cropping system
6.	Canopy management and plant architectural engineering in temperate fruits
7.	Development of different techniques for enhancing the multiplication rate of temperate fruits under protected/open conditions
8.	Standardization of integrated nutrient management of vegetables as intercrop in apple orchard
C. Project: Crop Protection **Sub projects**	
1.	Diagnosis, transmission and management of virus/virus like diseases of temperate fruit crops
2.	Elucidating the diversity, species spectrum and screening of germplasm against *Alternaria* spp. infecting temperate fruits
3.	Bionomics, modeling and management of sucking pest complex of temperate fruits
4.	Bioprospecting of Rhizo-cum-endospheric Microbiome/Microbiota of temperate fruit Rootstocks for management of soil and foliar diseases
5.	Biology, ecology and management of fruit flies infesting temperate fruits
D. Project: Post Harvest Management **Sub projects:**	
1.	Development of edible coating enriched with anti -microbial bioactive compounds for various stone fruit

A. Ongoing externally funded projects Sub projects	
1.	Network project on onion and garlic (co-operation centre)
2.	All India coordinated research project (Vegetable Crops)
3.	*National Agriculture Innovation Fund/* Intellectual Property Management and Transfer/Commercialization of Agriculture Technology
4.	DUS Centre for temperate fruits and nuts
5.	Walnut propagation for production of quality planting material for walnut promotion in Uttrakhand
6.	Validation and development of DUS testing guidelines for olive
7.	Development and validation of DUS guidelines in Kale under Indian conditions
8.	Augmentation of plant genetic resources and capacity building of researchers in India and Uzbekistan
9.	Production of quality planting material of elite walnut cultivars and demonstration of improved agro technology for walnut orchards in Kashmir and Arunachal Pradesh
10.	Augmentation of plant genetic resources and capacity building of researchers in India and Uzbekistan
11.	Characterizing diversity, genome profile and development of robust diagnostics for *Diplodia* spp. associated with canker disease of apple (*Malus domestica* Borkh.) in north western Himalayan region of India (DST-SERB)
12.	Development of DUS guidelines for Pran (*Allium proliferum*)
13.	Capacity building for improving skill and efficiency in transfer of technologies in farmers field under J & K State
14.	A comparative metabolomics approach for the analyses of scab -disease resistance in apple and development of a metabolite -based non-invasive sensor for early scab-disease diagnosis.
15.	Development of PEQ facilities at Srinagar, Mukteshwar & Dirang" for temperate fruits and nuts

RESEARCH REVIEW AND MANAGEMENT COMMITTEES

11

Research Advisory Committee of ICAR-CITH, Srinagar (9th January, 2021 to 8th January, 2024)

1.	**Dr T A More** Ex -Vice Chancellor, MPKV, Rahuri	**Chairman**
2.	**Dr R K Avasthe** Joint Director, ICAR Research Complex, Sikkim	**Member**
3.	**Dr A T Sadashiva** Ex-Head, ICAR-IIHR, Bangalore	**Member**
4.	**Dr Bhardendu Vatsya** Cofounder farmogo Exotica Private Limited Plot No 22/1 Telegaon Floriculture MIDC, Maval, Pune, Maharastra 410507	**Member**
5.	**Dr R K Pal** Ex Director, NRC Pomegranate, Solapur	**Member**
5.	**Dr V K Baranwal** National Professor, ICAR-IARI, New Delhi	**Member**
6.	**Shri Abdul Jabbar.Parey** S/O Sh Mohd Jamal Parrey, R/O Yorekhoshipora, Qazigund, Distt. Kulgam (J&K)	**Non Official Member**
7	**Shri ChheringAngchok** 34 Tyapa, Sakara, Leh, Ladakh, 194101	**Non Official Member**
8.	**Dr V B Patel** Asstt. Director General (F&PC) Horticultural Science Division ICAR, KAB-II, Pusa, New Delhi-110012	**Ex – Officio Member**
9	**Dr. M K Verma** Director, ICAR-CITH, Srinagar	**Ex – Officio Member**
10	**Dr.Javid Iqbal Mir** Principal Scientist & Head	**Member Secretary**

Institute Management Committee (IMC)

1.	**Dr M K Verma** **Director** ICAR-CITH, Srinagar	Chairman
2.	**Director Horticulture,Kashmir** Govt. of J&K, Raj Bagh, Srinagar	Member
3.	**Director** Horticulture & Food Processing, Deharadun, Uttarakhand	Member
4.	**Vice Chancellor Nominee** **SKUAST-K, Srinagar**	Member
5.	**Dr. O P Awashty** Head, Division of Fruit and Horticulture Technology, ICAR- IARI, New Delhi.	Member
6.	**Dr Anil Sharma** Head, ICAR-CPRS,Jalandhar	Member
7.	**Dr Dinesh Kumar** Principal Scientist, Crop Production CISH, Lucknow	Member
8.	**Dr Suresh Kumar Upadhaya** Professor, Horticulture,CSKHPKV Palampur	Member
9.	**Shri Abdul Jabbar.Parey** S/O Sh Mohd Jamal Parrey, R/O Yorekhoshipora, Qazigund, Distt. Kulgam (J&K	Member / Progressive Farmer
10.	**Shri ChheringAngchok** 34 Tyapa, Sakara, Leh, Ladakh, 194101	Member / Progressive Farmer
11.	**Dr V B Patel** Asstt. Director General (F&PC) Horticultural Science Division ICAR, KAB-II, Pusa, New Delhi-110012	Member/Council representative
12.	**Sr Amitabh Singh** Sr F&AO. ICAR Headquarter Amitabh	Member
13.	**Administrative Officer** ICAR-CITH, Srinagar (J&K)	Member Secretary

Distinguished Visitors

- Sh Sanjay Garg (IAS), Secretary ICAR, New Delhi visited the institute on 28th January, 2023 and was made aware of various research activities going on in the institute as well as problems faced by the Institute were also discussed

Glimpses of visit of Sh Sanjay Garg (IAS), Secretary ICAR, New Delhi

- Dr Tilak Raj Sharma, DDG (Crop Science & Horticulture Science) visited ICAR - CITH, Srinagar on 9th October, 2023 and was apprised regarding various research activities. Field and labs visit was also held followed by exhibition of various researches out puts in Technology Park. Dr T R Sharma, DDG praised the work being carried by the institute and suggested some measures for further improvement.

Glimpses of visit of Dr Tilak Raj Sharma, DDG (Crop Science & Horticulture Science

- Dr Prabhat Kumar, Horticiture Commissioner, Deptt of A&FW, Ministry of Agriculture visited the Institute on 7th May, 2023 and apprised about various horticultural R&D activities going on at the Institute.

- Dr Udham Singh Gautam, DDG (AE), ICAR, New Delhi visited ICAR -CITH, Srinagar on 27th December, 2023 and was apprised to various research and extension activities going on in the Institute. He also visited various fields and labs.

- Dr Bidyut C Deka, Vice Chancellor, AAU and Dr H C Sharma, Ex Vice Chancellor, Dr YSPUHF Solan visited ICAR -CITH Srinagar on 14th May, 2023 and visited various fields of different crops as well as interacted with scientists.

Glimpses of visit of Dr Bidyut C Deka, V C AAU and Dr H C Sharma, Ex VC Dr YSPUHF Solan

- Dr Boga Neeraja Prabhakar VC , SKLSHU, Siddipet, Telangana visited Institute on 6th June, 2023. She also visited experimentation fields of various crops

Glimpses of visit of Dr Boga Neeraja Prabhakar VC , SKLSHU, Siddipet, Telangana

- Dr Sudhakar Pandey, ADG 1(FVS& MP), visited the Institute on 15th June,2023 and was apprised with various activities going on in the Institute.

Glimpses of visit of Dr Sudhakar Pandey, ADG 1(FVS&MP)

- Dr Praveen Malik, CEO, Agriinnovate India Ltd (under DARE, Ministry of Agriculture & Farmers Welfare), New Delhi visited ICAR -CITH, Srinagar on 26 th October 2023 and discussion was held about various technologies.
- Dr Jitendra Kumar,ADG NASF, ICAR, New Delhi visited ICAR -CITH, Srinagar on 22nd October, 2023.
- Dr K V Prasad, Director ICAR-DFR Pune visited the Institute on 19th April, 2023
- Dr Sanjay Kumar, Director ICAR -IISS, Mau visited ICAR -CITH Srinagar on 4 th August, 2023
- Dr S P Das, Director, ICAR -NRC for Orchids visited ICAR-CITH, Srinagar on 20th October, 2023.
- Dr Lakshmi Kant, Director ICAR -VPKAS, Almora visited ICAR -CITH, Srinagar on 26 th October, 2023.
- Dr Shantanu Kumar Dubey, Director ICAR -ATARI, Kanpur visited ICAR -CITH, Srinagar on 22 nd December, 2023 and was apprised with various research & Extension activities. He also inaugurated the demonstration on drone.
- Dr V P Sharma, Director, ICAR-DMR visited the Institute on 15th June, 2023.
- Dr. Vipin Chaudhary, Network Coordinator (VPM) & Principal Scientist along with Sh. Surjit Singh Bharat, from ICAR -CAZRI, Jodhpur paid a visit to the ICAR -CITH campus on the 10th of October 2023 . They were made aware about the emerging problem of rodents in orchards.

Glimpses of visit ofDr. Vipin Chaudhary regarding rodents problem in orchards at ICAR -CITH

Personnel (As on 31st December, 2023)

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ICAR-CITH Head Quarter, Srinagar

RMP

- Dr. Dr. M K Verma, Director

Scientific

- Dr O C Sharma, Principal Scientist (Horticulture)
- Dr. J.I. Mir, Principal Scientist (Agricultural Biotechnology)
- Dr. Geetika Malik, Scientist SS (Vegetable Science)
- Dr. Wasim Hassan Raja, Scientist SS (Fruit Science)
- Dr. Mohd. Abas Shah, Scientist SS (Agriculture Entomology)
- Dr. Sajad Un Nabi Naingroo, Scientist SS(Plant Pathology)
- Dr Sudhakara N R, Scientist (Soil Science)
- Sh. Vishal Dinkar, Scientist (Plant Breeding and Genetics)
- Sh. Puneet Kumar, Scientist (AS&PE)
- Dr Reena Prusty, Scientist (Fruit Science)
- Dr Kavitha R, Scientist Horticulture (Fruit Science)
- Dr Ronit Jaswal, Scientist (Agricultural Statistics
- Sh Sharath Kumar N, Scientist (Food Technology)
- Miss Jyoti Priya, Scientist (Plant Physiology)

Administrative

- Sh. Fayaz Ahmad Dar, Sr F&AO
- Smt. Shahida Rafiq, P S to Director
- Sh. Showkat Ahmad Mir, AAO
- Sh. Reyaz Ahmad Mir, AAO
- Sh. Tariq Ahmad Mir, P A to Director
- Sh. Mehraj-ud-Din Meer, Assistant
- Sh. Mohd. Muzafer Lone,LDC
- Sh. Rouf Ahmad Sheikh, LDC

Technical

- Sh. Eshan Ahad, Sr.Technical Officer (T-6)
- Dr. Muneer Ahmad Sheikh, Senior Technical Officer (T-6)
- Sh. Mehraj-ud-Din Bhat, Sr. Technical Assistant (T-4)/Driver
- Sh. Farman Ali, Technical Officer (T-5)/ Driver)
- Smt. Mubeena, Technical Assistant (T-3)
- Sh Ishtiyaq Ahmad Sheikh, Sr.Technician (T-2)/ Field

Skilled Supporting Staff

- Sh. Ajaz Ahmad Wani, SSS
- Sh. Bashir Ahmad Dar, SSS
- Sh. Showkat Ahmad Dar, SSS
- Sh. Abdul Rashid Bhat, SSS
- Sh. Bashir Ahmad Ganai, SSS
- Sh. Zubair Ahmad Swathi, SSS
- Sh. Madan Lal, SSS
- Sh. Ghulam Nabi Bhat, SSS
- Sh. Shabir Ahmad Mir, SSS

ICAR-CITH-RS, Mukteshwar (Uttarakhand)

Scientific Staff

- Dr. Arun Kishor, Scientist SS (Fruit Science)

- Miss Rashmi E R, Scientist (Plant Pathology)
- Miss Chandni, Scientist (Vegetable Science)

Administrative

- Sh. Diwan Chandra, AAO
- Sh. Pushpendra Kumar,(UDC)

Technical Staff

- Sh. Vinod Chandra, Sr. Technical Officer (T-6)
- Sh. Puran Chandra, Technical Assistant (T-1-3)

Skilled Supporting Staff

- Sh. Narayan Singh, SSS
- Sh. Govind Giri, SSS

ICAR-CITH-RS, Dirang (Arunachal Pradesh)

Scientific Staff

- Ms Supretha B G, Scientist (Fruit Science)

Technical Staff

Sh Mhetre Vishal Balasaheb, Senior Technical Officer

- **Administrative**
- Sh. Khushi Ram, LDC

New Joining/Transfers/Promotions/ Probations

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New Joining

- Dr. M K Verma, Principal Scientist (Fruit Science), Division of Fruits and Horticultural Technology, ICAR- IARI New Delhi joined as Director on 27th January, 2023
- Dr Reena Prusty joined as Scientist Horticulture (Fruit Science) on 11th April, 2023 (online) and physically 19th April, 2023 at ICAR-CITH, Srinagar (J&K).
- Dr Kavitha R joined as Scientist Horticulture (Fruit Science) on 11th April, 2023 (online) and physically 19th April, 2023 at ICAR-CITH, Srinagar (J&K).
- Dr Ronit Jaswal joined as Scientist (Agricultural Statistics) on 11th April, 2023 (online) and physically 18th April, 2023 at ICAR-CITH, Srinagar(J&K).
- Sh Sharath Kumar N joined as Scientist (Food Technology) on 11th April, 2023 (online) and physically 19th April, 2023 at ICAR-CITH, Srinagar(J&K)..
- Miss Jyoti Priya joined as Scientist (Plant Physiology) on 10th August, 2023 at ICAR-CITH, Srinagar(J&K).
- Miss Rashmi E R joined as Scientist (Plant Pathology) on 11th April, 2023 at ICAR-CITH, Regional Station Mukteshwar (Uttarakhand)
- Miss Chandni joined as Scientist (Vegetable Science) on 21st July, 2023 at ICAR-CITH, Regional Station Mukteshwar (Uttarakhand)
- Miss Supretha B G joined as Scientist Horticulture (Fruit Science) on 11th April, 2023 (online) and physically 20th April, 2023 at ICAR-CITH, Regional Station Dirang (Arunachal Pradesh).

Promotions

- Dr Sajad Un Nabi, Scientist (Plant Pathology) is placed to next higher grade in PB-3 [Rs 15600-39100+RGP of Rs 7000/-(Revised Research Pay Level-11)] *w.e.f.* 24th November, 2020.

Transfers

- Sh Shabir Ahmad Mir, SSS was transferred & relieved from ICAR-CITH, RS Mukteshwar on 18th July, 2023 and joined ICAR-CITH, Srinagar on 21st July,