

ICAR-CITH NEWSLETTER



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From Director's Desk

ICAR-Central Institute of Temperate Horticulture, Srinagar is the premium institute working on research and development of temperate horticulture in the country. Institute is has vast mandate for germplasm conservation, evaluation, improvement, protection and promotion of elite varieties and technologies for enhancing production, quality and spread. Current issue of ICAR-CITH, Newsletter 2023 depicts different achievements in research, extension activities, trainings, publications etc. organized by the Institute. During this period, trait specific germplasm of temperate horticultural crops with specific utilization was collected to further strengthen the existing gene bank. Under the varietal development program, various hybrids were developed in apple for scab resistance and fruit quality improvement and in pear hybrids were developed for disease resistance and self-fruitfulness. Germplasm registration through ICAR-NBPGR and technology transfer through Agrinnovate India Limited was done during this year. Crossing programs for rootstock development of apple rootstock(s) with specific reference to biotic and abiotic resistance/ tolerance was further strengthened. Various technologies and varieties of fruits were demonstrated on farmer's field with aim to uplift the socio-economic status of farmers under TSP, SCSP and MGMG schemes. The institute is giving its significant efforts to provide awareness of various technologies gener-

ated in temperate horticulture crops to different stakeholders for enhancing their productivity and quality. The institute organized programs for human resource development. The ICAR-CITH is coordinating and regularly organizing training programs, field/crop days, on and off campus trainings, demonstrations, field visits, diagnostic and control measure, discussions, supply of quality planting material/ seeds of elite varieties, publication in local language, giving radio talks, TV programmes, melas etc. I extend my best wishes to the scientists and staff members for their well-deserved promotions during 2023.

I hope that the current issue of this ICAR-CITH, Newsletter reflecting the research, extension, training, development and other activities of ICAR-CITH, Srinagar and its regional stations will enlighten the readers about ongoing activities, status, contribution and development of the institute. Feedback and suggestions for further improvement in the institute activities for upliftment of farming community engaged in temperate horticulture will always be acknowledged.

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RESEARCH HIGHLIGHTS

ICAR-CITH, Srinagar is National Active Germplasm Site (NAGS) 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. During 2023, 53 germplasm of different fruit, vegetable & ornamental crops were collected and introduced at ICAR- CITH, Srinagar in the form of plant/ scion wood/ bulbs/ runners/seeds etc. 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 years 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 physico-chemical characteristics, it was found that 'Moonlight' is having maximum consumer acceptability (optimum blend of 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 traits and 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 (158.68 g), fruit length (77.01 mm) and fruit diameter (64.79 mm) 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 92.94 g. Two new selections were made during the year which has better fruit characteristics and both of these apricots produced fruits having sweet kernels. 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' (5.84 kg) 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 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'. In olives, out of 18 cultivars, 14 cultivars fruited and heaviest fruits were produced by cultivar 'Cipressino' (5.18 g). Based on average yield, 'Coratina' was found highest yielder followed by 'Pendolino', 'Etna', 'Cerigonola', 'Zaituna' and 'Frontoio'. In almonds, 12 cultivars and 15 selections were evaluated for various nut and kernel traits. Among cultivars highest nut weight (3.61 g) and kernel weight (1.87 g) were recorded in 'Primorskij' while kernel recovery was more in 'Nonpariel' (58.76%). 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 are concerned, 260 genotypes including varieties were evaluated. The nut weight varied from 4.77 g to 26.76 g, kernel weight from 2.64 g to 12.76 g and kernel percentage from 29.67 to 72.73 per cent. In Pistachio, there are total six selections out of which four were female and two were male. The heaviest nut and kernels (0.77 g & 0.35 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 (3.85 g & 1.67 g) while maximum kernel recovery and minimum shell thickness was obtained from nuts produced by cv. Butler (51.53% & 1.33 mm).

In vegetable crops, the germplasm of kale, pea, root and exotic vegetables was collected, 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 'Pusa Chandrima' 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.

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 (>100 g), TSS (>14 °B), firmness (>75 RI), colour and ascorbic acid (24.5 mg/100 g) 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/100 g Fw) than their respective parents, Hybrid 'Priame' possess high total phenolic content (2.64 mg GAE/g Fw) 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 physio-chemical 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. The 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 are 'CITH 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, 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). 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. 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 40 genotypes 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.

Under crop production during 2023, institute has supplied about 18,035 plants of different temperate fruit crops besides the supply of 13,958 scion wood; 1,340 plants & 2,707 seedlings of flowers; about 30.36 kg vegetable seeds & 1,535 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 1,500 grafted plants of walnut were provided to UFRMP for establishment of mother orchards as well as for planting in farmer's field. The revenue generated during the financial year from farm was 60.15 lakh 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 pH of surface soils were slightly acidic in nature and was increasing with depth indicating it's shifts towards neutrality. Irrespective of depth, the organic carbon content was very high in all orchards. In apple orchards the organic carbon content decreased with increasing depth. The primary and secondary nutrients like available nitrogen, phosphorous, potassium, calcium, magnesium and sulphur content were the 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 (P_1 -15:10:15 NPK g/pot + 15 g silicon) the soil moisture regime of 40% field capacity (W2) with rootstock MM-111 recorded highest growth parameters. However, with increased phosphorous levels (@ P_2 and P_3 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. To control pre harvest fruit drop by the application of 1-naphthalene acetic 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. 10 ppm, 20 ppm, and 30 ppm. 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 30 ppm treatment showed a lower fruit drop (3.16%). 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 semi erect, sole and erect type. The highest almond yield was recorded in spreading type. The highest cumulative yield was 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. Crocin content was 2.50% in sole, 2.70% in erect, 2.30 in spreading and 2.20% under semi spreading type of va-

rieties. 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, 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, Tatura Trellis 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, Odlohar-Simsyari, Bageshwar villages of Uttarakhand 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 rootstocks viz. MM-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-29' and 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.

Under crop protection, studies on the incidence of green apple revealed that it 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 Vanhoutte spirea 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 Vanhoutte spirea bushes. The overwintering survival of green apple aphids was studied on intact shoots on apple trees and on excised shoots. Overall, $43.0 \pm 2.99\%$ egg survivals was observed up to 13-03-2023 after which most of the eggs started hatching. Significant difference was observed in survivorship 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 $41.25 \pm 9.25\%$. 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%) reduc-

tion in the number of GAA eggs on apple shoots.

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 *Podosphaera leucotricha*. 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, flavonoids 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 (6.87-15.66 mg/g FW) was seen in entire virus infected genotypes in comparison to healthy ones (5.45-15.42 mg/g fw). 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 *Alternaria* spp. infecting apple (*Malus domestica* Borkh.), molecular characterization was done for thirty isolates from all the temperate fruit crops. Evaluation of various spray schedules 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. In Bio prospecting of Rhizo-cum-endospheric Microbiota of temperate fruit rootstocks for management of soil and foliar diseases, the rhizospheric and endophytic microbial communities of two apple rootstocks (M27 and MM 106) 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.

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 was 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 are the regular features of the institute, 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 etc were 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 in Uttarakhand. A three days training programme on Identification of Bioagents using molecular approaches was organized for students/ research scholars at ICAR-CITH, Srinagar. Besides this, 14 one day visits/ trainings were organized for students of different schools, colleges & universities in different states. A three day 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 farmer's 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 agencies were 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, 6 programmes were conducted for the farmers of district Srinagar, Anantnag, Bandipora & Ganderbal of J&K as well as Leh and Kargil district of Ladakh in 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 Uttarakhand 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/ pamphlets 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

MEETINGS AND EVENTS

Institute is continuously organizing various meetings and events for benefit of stakeholders. During 2022, 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.



Meeting and visit on Clean Plant Programme (CPP)



World Intellectual Property Day at ICAR-CITH, Srinagar



ICAR-Industry Stakeholder Consultation Regional Meet



19th RAC Meeting



19th IRC Meeting



Hindi Diwas & Hindi Week at ICAR-CITH, Srinagar



Vigilance Awareness Week at ICAR-CITH, Srinagar



World Soil Day Celebration at ICAR-CITH, Srinagar



Kisan Diwas at ICAR-CITH, Srinagar



Swachhta Pakhwada



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



**MOU between ICAR-CITH and Assam
Agriculture University, Jorhat**



Distribution of inputs under TSP programme



Distribution of inputs under SCSP programme



Mera Gaon Mera Gaurav programme at Sunkiya village



Exhibition of ICAR-CITH, technologies and varieties



A five days training programme on high value temperate vegetable crops



Walnut propagation programme at Silalekh



Three days training programme on laboratory techniques



Student visits and exposure from other states to ICAR-CITH, Srinagar



Five days training programme for the farmers of Himachal Pradesh

AWARDS AND RECOGNITIONS

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.

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, Karnataka from 2nd to 5th Feb, 2023.

TRANSFERS / PROMOTIONS/ NEW JOINING

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 Jaiswal, 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).

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, 2023.

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.

Technologies ready for certification and commercialization

<p>Technology-I</p>	<p>Development of an electronic nose for the optimum harvesting time and fruit quality in Apple – A non invasive method</p>
<p>Contributors</p>	<p>Lead: D. Sircar (IIT Roorkee), and Javid Iqbal Mir (ICAR-CITH) Associated: Partha Roy (IIT Roorkee), Bhairavnath Wagmode (IIT Roorkee), Shashank Sagar Saini (IIT Roorkee), Pratibha (IIT Roorkee), M. K. Verma, O. C. Sharma, W. H. Raja, S. U. Nabi and S. Yasmeen</p>
<p>About the technology</p>	<p>The technology involves a low cost SMART-Sensor which will tell farmers when the fruit is properly ripe and ready to harvest. Usually, climacteric fruits such as apple exhibit their best organoleptic and commercial quality when harvested in appropriate time. The ripening stage, during which apples are harvested, actually determines the quality and shelf life of those fruits. When fruits are harvested at the unripe stage, their taste, aroma and nutritional qualities do not reach up to the mark for the consumer's acceptance. Alternatively, when these fruits are harvested at a late ripe stage, they rapidly spoils and their shelf life become significantly low along with difficulties in transport. Determination of optimum ripening stage of apple fruits before harvesting would greatly help to find the optimal harvesting time, to device postharvest handling strategies, and to predict the shelf life time frame when these fruits should be marketed and consumed. Current harvesting practice of apple mainly relies on visual screening based on fruit colour change (green to red), which is often not very reliable. The sensor-based technology can predict ripening and selected nutritional values for apple. It is low cost, it can sense multiple parameters and most importantly it can be visualized with a existing android phone using app.</p> 
<p>Technology-II</p>	<p>Multiplex PCR for simultaneous and rapid detection of four viruses (ApMV, ApNMV, ASGV and ASPV) in apple</p>
<p>Contributors</p>	<p>Lead: Sajad Un Nabi Associated: J. I. Mir, W. H. Raja, Madhu G. S., O. C. Sharma, M. K. Verma and V. K. Baranwal</p>

<p>About the technology</p>	<p>Apple is of perennial nature hence accumulates viral population throughout its life cycle, results in grave economic losses. Mixed infections and ubiquitous presence of viruses in field are common in apple; hence development of reliable, robust, highly sensitive and economical multiplexing diagnostic procedure is the need of the hour. The multiplex (m)-PCR and m-RT-PCR are the most potential routine diagnostic assays used for concurrent detection of viruses or sub viral agents present in mixed infection in fruit crops in a single tube. Apple crop is also infected with many viruses especially apple mosaic virus (ApMV), apple necrotic mosaic virus(ApNMV), apple stem pitting virus (ASPV) and apple stem grooving virus(ASGV) either individually or in mixed infection. The present technology is cost effective, rapid and accurate m-RT-PCR for four viruses ApNMV, ApMV, ASPV, and ASGV present in apple. The technology will benefit the nursery growers, quarantine stations, research organizations across the globe for rapid indexing of 4 viruses simultaneously in germplasm which not only saves time but also the resources. This technology will play an important role in recently devised project by Govt. of India on clean plant programme as ultimate aim of the programme is supply of virus free clean plants to farmers</p>
<p>Technology-III</p>	<p>Kharif onion: A new crop for Kashmir.</p>
<p>Contributors</p>	<p>Lead: Geetika Malik Associates: J. I. Mir, O. C. Sharma, D. B. Singh, M. K. Verma</p>
<p>About the technology</p>	<p>The technology is essentially an offseason cultivation technology of onion, which is presently non-existent in Kashmir despite being a tradition in most of the other states of the country. This technology will provide a new crop to Kashmir valley for cultivation. It will reduce dependence on onion imports and stabilize onion prices during slack period, provide additional source of income and diversify the color of onion as well as crops produced in Kashmir. Presently, the vegetable growers cultivate yellow onions and the recent trend has shifted towards red and white varieties for their greater pungency, storability and amenability to processing. This technology will provide opportunity for white bulb onion cultivation as well as work as baseline to introduce more varieties of different colors, as the technology further develops and refines.</p>

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