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2015-16

ICAR-Central Institute of Temperate Horticulture
Old Air Field, PO-Rangreth, Srinagar-190 007
Jammu and Kashmir (India)

Annual Report

2015-16

भाकृअनुप
ICAR

ICAR-Central Institute of Temperate Horticulture
Old Air Field, PO-Rangreth, Srinagar 190 007, Jammu and Kashmir, India

Published by:
Dr. D.B. Singh
Director

Compiled & Edited by:
Dr. D.B. Singh
Dr. O.C. Sharma
Dr. J.I. Mir
Dr. Anil Sharma
Dr. K.L. Kumawat
Dr. K.M. Rai

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ICAR-Central Institute of Temperate Horticulture
Old Air Field, P.O.-Rangreth-190007, Srinagar (J&K)
Phone: 91-194-2305044, 2305045
E-mail: dircithsgr@icar.org.in

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Fruits of Apple, Peach, Almond and Saffron (Front)
Lettuce, Tomato, Chilli, Tulip and Alstroemeria (Back)

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Executive Summary

The Central Institute of Temperate Horticulture, Srinagar, J&K and its Regional Station, Mukteshwar is continuously carrying out research on temperate horticultural crops to boost the productivity of quality produce. The number of technologies generated at ICAR-CITH is increasing year after year and institute has become a technological hub for temperate horticultural crops. To cater the need of farmers associated with temperate horticultural crops, the research work carried out by institute and its Regional Station are briefly summarized below:

Crop Improvement and Biotechnology

The collection and evaluation of germplasm of horticultural crops is one of the major objective of the institute. The institute has added 140 new germplasm in its field gene bank and its number has reached to 2473 at Srinagar, J&K while Regional Station Mukteshwar is maintaining 365 germplasm of various horticultural crops.

In apple different cultivars were evaluated on various rootstocks like M-9, MM-106 and MM-111 at different planting densities at Srinagar. All the cultivar gave higher productivity on M-9 root stock at 3.0 x 1.5 m spacing without affecting the size of fruit. Similarly the spacing 2.5 x 2.5 m and 2.5 x 4.0 m gave higher productivity on MM-106 & MM-111 rootstock, respectively. In evaluation of 30 apple cultivars at Mukteshwar for various fruit traits Tydeman's Early Worcester, Vance Delicious, Vermont Spur, Mollies Delicious and Skyline Supreme were found promoting for cultivation in Uttarakhand. Four strains of wild apple were also evaluated for various plant, leaf, fruit and chemical traits and can be used as rootstock after standardization of their clonal production. In pear, among 15 European pear and 4 Asian pear cultivar, Hayward (57.13 kg/plant) and CITH-KN-1 (34.10 kg/tree) were found to be highest yielders. The cultivar William Bartlett (235.2 g) and CITH-KN-1 (233.6 g) produced heaviest fruits. In evaluation of 21 cherry selections, CITH-C-02 (18.13 kg/plant) was found highest yielder while among evaluated exotic cherry cultivars Stella gave maximum (22.17 kg/plant) yield. Among 18 plum cultivars, Red Beauty produced heaviest fruits (117.50 g) while Kanto-5 gave maximum yield (35.66 kg/plant). In peach cultivar Red Globe produced heaviest fruits (140.20 g) while maximum yield was recorded in cultivar Fantasia (32.7 kg/plant).

Among 59 apricot collections, Rival produced heaviest fruits (66.51 g) while CITH-AP-1 gave maximum yield (107.8 kg/plant). Fourteen germplasm were early, 41 were mid and 4 were late in maturity. Forty five germplasm were with sweet kernel taste. In almond selections, CITH-Almond-14, CITH-Almond-17 and CITH-Almond-19 were found promising based on the desirable traits while among almond cultivars, Pranyaj was found best from nut yield point of view. Among 127 walnut germplasm, nut weight varied from 6.75g to 22.30g. Twenty two genotypes produced nuts weight more than check cv. Sulaiman (17.5 g). One genotypes PGB-1 produced nuts with papery shell and highest kernel recovery (67.92%). In strawberry, 88 genotypes were evaluated for various physico-chemical traits and fruit weight varied from 3.5 to 12g while ascorbic acid varied from 45 to 86 mg/100g. The cultivar were identified for commercial cultivation based on desirable traits. Among 17 olive cultivars, Cipressino excelled all the cultivars as far as yield efficiency (1.84 kg/cm^2) and oil recovery point of view. Among four female cultivars in Kiwifruit, Hayward excelled all

cultivars as far as fruit size and yield is concerned. The number of fruits/vine played a greater role in fruit size. The Chinese Ber also fruited successfully in Srinagar conditions and can be used as an alternate crop on waste lands.

In vegetable crops 44 germplasm in carrot, 23 in turnip, 5 in radish and 58 in kale were evaluated along with checks at CITH. In carrot SH-C-59 (31.20 t/ha), in summer carrot SH-C-54 (38.88 t/ha), in turnip CITH-T-1 (53.23 t/ha) and in radish JWL (104.40 t/ha) were found promising for in respect of yield.

In flower crops, 20 cultivars of tulip were evaluated for various floral traits and cultivar Alibi gave maximum vase life (13.3 days). The different cultivars were classified on the basis of colour and flowering time. The selection and planting of early mid and late cultivars can enhance the blooming span in tulip. In evaluation of seven cultivars of lilium under polyhouse conditions cultivar Brindsii, Pavia and Brunello were found best for commercial cultivation. In saffron, comparatively low yield was recorded in this year which may be due to fluctuation in temperature. Saffron clone CITH-125 was found highest yielder among 36 clones

In genetic diversity analyses study of strawberry through SSR marker, low level of polymorphism was observed. In micropropagation of cherry and apple clonal rootstock, 5 best hormone combinations were identified. To combine the desirable traits of Ambri in a genotype, 4 cross combinations were made and seeds of crosses were sown. Expression of regulatory genes responsible for biosynthesis of apocartenoids is got up regulated under *in vitro* developed stigma and these are developmentally closely related to natural stigma.

In development of superior varieties and hybrids, many lines were found at par with check in chilli, sweet pepper and brinjal at Srinagar. In Mukteshwar among 14 genotypes, VL-4 was found high yielder in tomato while in capsicum maximum number of fruits (31) was recorded in Selection-3 among 17 genotypes.

Crop Production

Apple

In comparison of three training systems with three cultivars, the espalier system was found best for increasing the productivity in apple. In apple the application of 75% of recommended fertilizers in two splits through fertigation gave maximum yield and fertilizer used efficiency. In intercropping of pea and cauliflower in apple orchard the treatment combination of FYM+ver micompost+biofetlizer+inorganic was found best INM practice in Uttarakhand.

Walnut

In comparison of different training systems, maximum nut efficiency (0.719 nuts/cm^2) was recorded in central leader system. Among different thinning levels 20% thinning, 20% heading back and 10 + 10% thinning + heading back regularly were found best from nut efficiency point of view.

Saffron

In almond-saffron intercropping, highest saffron equivalent yield was recorded in saffron + semi erect type of almond cultivars. The mid rib placement upper to corn in two splits was found best mode of fertilizer application in saffron growing soils without polluting environment.

Vegetables

For raising, the cost effective vegetable seedlings (tomato, capsicum and cucumber) on different growing nutrient media were tried under polyhouse conditions at Uttarakhand. For getting round the year supply of vegetables under polyhouse conditions tomato, capsicum, spinach, fenugreek, coriander, onion and broccoli were tasted in Uttarakhand. In evaluation of chilli genotypes for various compounds, maximum phenolics and ferric reducing power were found highest in Sel-1005/11-1. The maximum capsaicin was recorded in Sel-1052-12015

Floriculture

In evaluation of nine cultivars of Alstroemeria, cultivar Rosita was found best under polyhouse condition while cultivar Alladin and Pluto perform better under open conditions. The polyhouse

conditions were found best for high flower yield and continuous supply of flowers from April to December. The planting of Alstroemeria on raised bed at 45 x 60 cm spacing gave better growth and yield. In comparison of different media for rhizome production, soil + sand + FYM gave better results. The thinning of shoots upto 15% was found best for plant growth without reducing yield.

Composting and nutrient status

In aquatic dissipate management, aquatic dissipate and worm ratio of 15:1 was found best proportion to get utmost benefit in terms of quality, quantity, worm counts and economic returns. The vermi compost prepared from aquatic dissipate was analyzed for 28 elements. To know the soil and leaf nutrient status of apple growing areas of Kashmir were surveyed and deficit areas were identified. In Uttrakhand, the soils of CITH, Regional Station, Mukteshwar, were found deficit in available Zn but sufficient in available Cu, Fe and Mn.

Plant protection

The six districts of J&K were surveyed for sucking pest. The European red mite was found as major sucking pest in apple and almond with 14.28% & 12.5% infestation respectively. In walnut severe infestation was inflicted by *Chromaphis juglandicola* (22.64%), pear psyllid was observed to be most serious pest with 23-33% infestation (23.33%) in pear. For the borers, 8 districts were surveyed and 1508 specimens were collected, out of which 532 belongs to order Coleoptera, 43 under Lepidoptera and 59 under Hymenoptera. Infestations of flat headed borer was high (61.12%) in cherry at Ganderbal. Maximum infestation of shot hole borer (66.50%) was recorded in Shopian. About 84.81% and 64.22% infestation of codling moth was recorded on apple and apricot in Ladakh region.

In fungal foliar diseases of apple, 9 districts were surveyed in Kashmir for alternaria leaf spot and high diseases incidence (46.23%) and intensity (19.51%) was recorded in district Kulgam. In a study of major canker and foliar diseases of apple, it was found that weather parameters strongly influenced the diseases occurrence in apple crop in Nainital district of Uttarakhand. In soil born diseases of apple, wild apple locally called as *paron* was found resistance to white root rot. The edaphic factors strongly influenced the occurrence of white root rot. The soil moisture showed positive relationship with white root rot.

Post Harvest Technology

Two drying modes along with 3 cultivars were used for dehydration of plum into prune. The Italian Plum took less time for dehydration and retained colour, ascorbic acid and carotenoids to maximum with high rehydration ratio. In blending of juices in different ratios, blending of sweet cherry and sour cherry (50% + 50%) was found best while in apricot and plum juices blending, the ratio of 75% + 25% was found best. The cost effective technology for production of pear wine was developed at Uttarakhand.

Extension and other activities

For speedy transfer of various technologies at CITH, Srinagar, an apple day, one scientist farmers interaction meeting, one stakeholders meeting, world soil health day, 4 training programme for officers of line departments, 6 programmes/ visits for students and 31 programmes/ visits were organized for farmers of different districts, five radio/ TV talks and one exhibition was displayed during the year. ICAR-CITH, R S Mukteshwar organized 5 trainings, 12 diagnostic visits, displayed 3 exhibitions and organized 8 farm visits for farmers/ students/ officers. The CITH technologies were demonstrated under TSP and MGMG programmes. A success story of protected cultivation of vegetables in Gurez was also documented in TSP Programme.

Publication

The scientists of CITH published 20 research papers, one book, 11 book chapters, 7 popular articles and 15 extension bulletin/ folders for the benefit of students, researchers, extension functionaries and farmers

2

Introduction

The varied climatic conditions of India are suitable for growing a large number of horticultural crops. The span of supply and availability of these fresh horticultural crops has increased because different regions produce various crops in different seasons. The hilly regions of the country produce some crops which are off season crops for plains. The horticulture has emerged as major enterprise and farmers are getting handsome returns, thus elevating their socioeconomic status. In India the north western and eastern Himalayan states with temperate climate have monopoly in production of temperate fruits, vegetables, ornamentals, medicinal and aromatic plants which have vital role in nutritional and economic security of the region. These crops serve as the backbone of region economy by supporting about 8-10 million people and generating revenue of about ₹ 10000 crores annually.

Among temperate fruits and nuts; apple, pear, peach, plum, kiwifruit, apricot, cherry, almond and walnut are very important while in vegetables, European type of cultivars of cole, bulb and root crops; high value leafy vegetables (lettuce, parsley, celery and Chinese cabbage) asparagus, artichoke, cucumber, capsicum and peas are commercially important. In floriculture, tulip, lilium, alstroemeria, carnation, gladiolus and gerbera are becoming increasingly significant in the recent years. Besides above, a very high value and low volume crops like saffron and kalazeera are exclusively grown in this region which have high commercial value. There is a considerable change in area and production of temperate fruits since 1960 but the increase in the productivity is less. Similar is the situation in temperate vegetables, floriculture and ornamental crops. Among various crops apple and walnut are the major crops of temperate region covering about 75% of the total area and accounting for 65% of temperate fruit production, respectively while rest of the production comes from other fruits like peach, plum, almond, apricot, and cherries etc. which have significance in regions economy. No doubt, there has been manifold increase in area, production and productivity but as compared to average world productivity our position is far behind.

The temperate horticulture is associated with many constraints to get high productivity of quality produce. The adoption of technologies by optimum use of resources is somewhat slow and, temperate horticultural research is still in infancy. The ICAR- CITH is a lone institute having greater role in designing and developing research programmes on various aspects of temperate horticultural crops for achieving economic and nutritional security in the entire Himalayan region. To overcome the production constraints the research on temperate horticultural crops is being carried out both at CITH main campus, Srinagar and at its Regional Station, Mukteshwar (Uttarakhand) with the following mandate and objectives.

Mandate

- Basic, strategic and applied research to enhance sustainable productivity, quality, and utilization of temperate horticultural crops
- Repository of genetic resources and scientific information on temperate horticultural crops
- Transfer of technology, capacity building and impact assessment of technologies
- Coordinate network research and validation of technologies to enhance productivity of temperate fruits

Objectives

- Establishment of field gene bank and management of genetic resources and scientific data base of temperate horticulture crops.
- Genetic improvement of temperate horticultural crops for yield, maturity, quality, resistance to biotic and abiotic stresses through conventional breeding methods and use of 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.

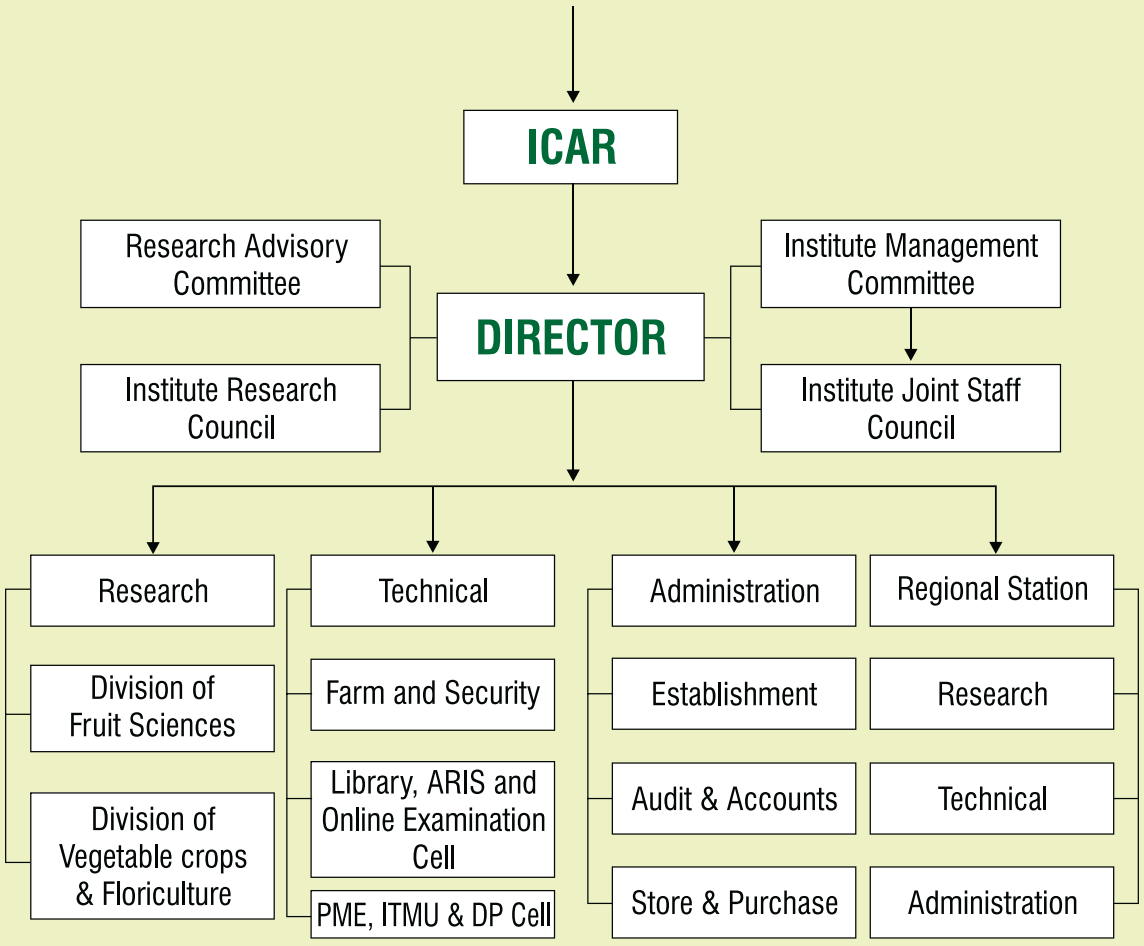
Staff Position (2015-16)

Category	Sanctioned	Filled (as on 31st March, 2016)	Vacant (as on 31st March, 2016)
Scientific	22+1RMP	17	5+1
Administrative	15	13	2
Technical	16	14	2
Supporting	19	11	8
Total	**73**	**55**	**18**

Financial Statement (2015-16)

S. No.	Sub-Head	Plan (In lakhs)	Non-Plan (In lakhs)
1	Establishment Charges	0.00	398.36
2	T.A	6.98	4.00
3	HRD	1.76	0.25
4	Contingency	94.16	203.95
5	Equipment	18.49	2.37
6	I.T	8.16	0.00
7	Works	159.30	0.00
8	Library	0.01	0.00
9	Furniture and Fixture	1.95	0.05
10	Network project	136.64	0.00
11	Pension	0.00	47.18
12	Loans and advances	0.00	1.25
	Total	**427.45**	**657.41**

ORGANOGRAM OF CITH



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Research Achievements

I. Crop Improvement

The productivity of any crop mainly depends upon the cultivar and growing conditions. The breeding of perennial crops is quite difficult due to their heterozygous nature and long juvenile period. The CITH, Srinagar and its regional station Mukteshwar are continuously engaged in identification of superior cultivars/genotypes suitable for commercial cultivation and upliftment of socio-economic status of hilly farmers. The research work carried out on crop improvement during 2015-16 is presented project wise below:

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

The western Himalaya is rich source of diversity for temperate horticultural crops. The institute has made an effort for collection and conservation of germplasm from different region's and sources. The institute is maintaining a good repository of germplasm for evaluation and its use in future. During 2015-16 institute has added 140 new genotype in various crops and the total number has reached up to 2473 (Table 1).

Table 1. Number of germplasm conserved at CITH, Srinagar

S. No	Crop/Group	Germplasm status in 2014-15	Added during 2015-16	Total germplasm in 2016
1	Fruits:	1010	78	1088
	Pome	321	40	361
	Stone	162	32	194
	Nuts	359	00	359
	Others	168	06	174
2	Vegetables	988	62	1050
3	Ornamentals	310	00	310
4	Medicinal & aromatic plants	25	00	25
	Total	2333	140	2473

Fruit Crops

Apple

Evaluation of apple cultivars on different rootstocks under different densities

In apple different cultivars were evaluated on M-9, MM-106 and MM-111 rootstocks. In

one study apple cultivars *viz.* Mollies Delicious, Golden Delicious and Starkrimson were evaluated for yield and fruit traits on M-9 rootstock under 3.0 x 1.5m, 3.0 x 2.0m and 3.0 x 2.5m spacing. Maximum productivity in all the cultivars were observed under 3.0 x 1.5m spacing. Crop density does not show significant effect on fruit size. With increase in spacing marginally yield decreases significantly which may be due to decrease in planting density, since the plants have not acquired the potential age showing yield influence with spacing. Therefore on M-9 rootstock, 3.0 x 1.5m spacing can be recommended for maximum yield (Table 2).

In another trial, apple cultivars (Mollies Delicious, Gala Mast, Cooper-IV, Starkrimson, Golden Delicious and Red Chief) were evaluated for yield and fruit traits on MM-106 clonal rootstock under 2.5 x 2.5m, 2.5 x 3.5m and 3.0 x 3.5m spacings. Maximum numbers of fruits were observed in cultivar Golden Delicious and maximum fruit weight in Cooper-IV under all densities. Maximum yield in all the cultivars was observed under 2.5 x 2.5m spacing (Table 3).

In another experiment apple cultivars (Mollies Delicious, Gala Mast, Jonica, Oregon Spur, Starkrimson and Lal Ambri) were evaluated for yield on MM-111 clonal rootstock under 3.5 x 4.0m, 3.0 x 4.0 and 2.5 x 4.0m spacings. Highest fruit weight was observed in cultivar Jonica under all the densities. Maximum yield (34.71 t/ha) was observed in cultivar Oregon Spur at 2.5x4.0m spacing. Starkrimson gave highest yield (23.7 t/ha) under 3.5 x 4.0m spacing and cultivar Jonica gave highest yield (26.06t/ha) under 3.0x4.0m spacing. Thus on MM-111 yield variation under spacings was observed across the cultivars (Table 4).

Table 2. Performance of some apple cultivars on M-9 rootstock at different planting densities.

Parameter / Genotype	Number of Fruits			Fruit weight (g)			Yield t/ha		
	3.0x1.5	3.0x2.0	3.0x2.5	3.0x1.5	3.0x2.0	3.0x2.5	3.0x1.5	3.0x2.0	3.0x2.5
Mollies Delicious	111	118	121	253	262	243	62.4	51.5	48.9
Golden Delicious	190	175	192	161	169	176	67.9	49.2	45.0
Starkrimson	145	138	135	205	211	207	66.04	48.51	37.25
CD at 5%	*2.04*	*2.45*	*2.63*	*2.25*	*4.07*	*5.22*	*0.38*	*0.45*	*0.34*

Pear

In pear out of total 43 genotypes established at CITH, Srinagar, 15 European and 4 Asian pear genotypes were evaluated for various fruit traits. In European pear, maximum yield (57.13 kg/tree)

Table 3. Performance of some apple cultivars on MM-106 clonal rootstock at different planting densities.

Parameter / Genotype	Number of Fruits			Fruit weight (g)			Yield (t/ha)		
	2.5x2.5	2.5x3.5	3.0x3.5	2.5x2.5	2.5x3.5	3.0x3.5	2.5x2.5	2.5x3.5	3.0x3.5
Mollies Delicious	100	105	103	202	216	207	32.2	25.95	18.00
Gala Mast	180	150	204	150	154	181	43.2	26.30	35.15
Cooper -1V	145	169	120	228	229	245	52.9	44.20	23.90
Starkrimson	150	190	195	202	205	191	48.48	44.80	30.39
Golden Delicious	212	285	265	175	171	155	59.36	55.60	46.90
Red Chief	210	260	190	195	192	195	65.52	57.01	30.23
CD at 5%	***2.39***	***2.84***	***3.62***	***3.42***	***3.79***	***3.12***	***1.88***	***2.91***	***1.80***

Table 4. Performance of apple cultivars on MM-111 clonal rootstock at different planting spacing

Parameter / Genotype	Number of Fruits			Fruit weight (g)			Yield t/ha		
	3.5x4.0	3.0 x 4.0	2.5x4.0	3.5x4.0	3.0x4. 0	2.5x 4.0	3.5x4.0	3.0x4.0	2.5x4.0
Mollies Delicious	106	69	84	191	292	215	16.7	14.4	18.06
Gala Mast	60	67	50	197	176	152	8.43	9.82	7.6
Jonica	109	96	76	271	326	308	21.0	26.06	23.40
Oregon spur	65	105	163	190	236	213	8.81	20.64	34.71
Starkrimson	135	84	105	246	232	211	23.7	16.23	22.15
Lal Ambri	82	60	65	275	325	232	16.1	16.24	15.08
CD at 5%	*6.97*	*6.69*	*5.41*	*9.15*	*7.91*	*7.49*	*3.49*	*2.13*	*2.31*

were harvested from cultivar Hayward. Maximum fruit weight (235.2 g) and fruit diameter (77.78 mm) were recorded in cultivars William Bartlett. Among Asian pear, maximum fruit yield (34.10 kg/tree), fruit weight (233.6 g), fruit length (82.21 mm) and fruit diameter (76.99 mm) were recorded in selection CITH KN-1. Whereas, maximum TSS (14.03°B) was recorded in Japanese pear (Table 5).

Table 5. Fruit traits and maturity time of different pear cultivars.

Cultivars/ Selection	Date of maturity	Pedicle length (mm)	Fruit length (mm)	Fruit Dia. (mm)	TSS (°B)	Acidity %	Firmness
European Pear							
Starkrimson	4th August	20.69	81.90	70.28	10.40	0.4	76.28
Max Red Bartlett	28th July	23.69	84.05	71.86	11.26	0.2	83.6
Red Bartlett	2nd July	25.22	84.70	77.03	10.60	0.6	80.7
Smart	2nd August	33.50	64.15	63.55	12.33	0.9	65.76
Santyabraskaya	Ist August	34.6	79.33	62.98	11.70	0.6	52.1
William Bartlett	Ist August	28.02	81.63	77.78	12.56	0.6	83.3
Gent Drouard	12th August	25.88	72.24	68.11	9.80	1.0	82.1
Red Anjou	12th August	29.5	48.26	40.38	13.97	0.6	68.58
Doyenne Burrah	15th August	22.17	85.05	66.89	9.70	0.9	75.85
Besri-de-Amanalis	27th August	22.24	82.44	72.05	11.66	0.6	78.0
Fertility	27th August	27.58	87.49	65.22	12.10	0.73	79.6
King Pear	29th August	34.68	106.71	67.8	10.80	0.7	82.96
Hayward	26th August	18.07	82.22	74.32	13.53	0.86	73.03
Flemish Beauty	28th August	18.07	61.54	66.85	9.53	0.86	75.1
Devol	3rd Sept.	30.93	29.68	35.65	20.8	2.3	58.53
CD at 5%	--	7.08	8.89	8.33	0.74	0.1	4.91
Asian Pear							
CITH-KN	2nd Sept.	59.43	82.21	76.99	11.10	0.5	69.10
Kashmiri Nakh	18th .Sept.	50.06	51.76	51.57	9.40	0.5	68.16

Cultivars/ Selection	Date of maturity	Pedicle length (mm)	Fruit length (mm)	Fruit Dia. (mm)	TSS (°B)	Acidity %	Firmness
Badshahnakh	13th Sept.	30.04	54.77	59.87	12.13	0.9	88.16
Japanese pear	1st Oct.	29.97	56.06	69.85	14.03	0.8	91.12
CD at 5%	--	*15.68*	*3.89*	*4.09*	*0.33*	*0.28*	*6.17*

Cherry

In evaluation of 21 cherry selections (Table 6), maximum fruit weight was recorded in CITH C-19 (8.75 g) followed by CITH C-18 (8.65 g) and CITH C-7 (8.42 g) and minimum in CITH C-8 (5.33 g) followed by CITH C-6 (5.36 g). Maximum pulp: stone ratio was found in CITH-C-07 (18.39) and minimum in CITH C-09 (11.30). Maturity index was maximum in CITH C-07 (20.48) and minimum in CITH C-11A (8.38). Maximum yield/plant was recorded in CITH C-02 (18.13 kg) and minimum in CITH C-19 (3.90 kg).

Table 6. Yield and Physico-chemical characteristics of some cherry selections

Selections	Fruit weight (g)	Fruit length (mm)	Fruit dia. (mm)	Pulp stone ratio	Firm-ness (index)	Color				Maturity index (TSS/TA)	Yield Plant^{-1} (kg)
						L	a	b	tint		
CITH C-1	6.92	23.37	23.27	17.76	24.36	27.43	12.00	6.50	-87.21	13.62	17.80
CITH C-2	7.13	22.93	22.71	12.94	41.31	20.10	10.03	3.13	-117.08	18.51	18.13
CITH C-3	5.83	21.41	21.13	12.73	21.83	15.43	7.89	1.13	-113.13	17.11	13.06
CITH C-4	6.47	22.33	21.92	16.02	16.63	12.97	7.62	0.92	-128.07	18.25	6.03
CITH C-5	5.94	23.72	23.28	11.59	30.73	14.66	4.20	0.38	-146.08	17.15	13.76
CITH C-6	5.36	21.11	20.96	12.39	39.39	14.22	2.96	0.98	-123.40	17.83	16.86
CITH C-7	8.42	25.68	25.26	18.39	22.39	20.42	8.93	1.86	-66.17	20.48	13.16
CITH C-8	5.33	21.33	21.30	10.96	38.45	15.26	4.23	0.72	-102.06	16.20	16.06
CITH C-9	6.09	22.03	21.63	11.30	18.26	25.76	6.53	1.71	-130.31	16.72	16.16
CITH C-10	6.46	22.67	22.37	12.24	25.43	33.73	30.21	10.03	-134.74	9.26	8.73
CITH C-11A	6.55	22.81	23.35	13.99	22.00	32.77	31.25	12.42	-124.65	8.38	9.83
CITH C-11B	6.09	22.59	22.08	14.40	20.23	21.02	17.00	3.90	-91.53	8.54	7.76
CITH C-12	6.69	23.68	24.01	11.83	22.88	22.24	17.84	10.13	-125.27	10.68	8.53
CITH C-13	7.19	24.60	24.97	12.34	22.01	19.73	17.87	8.43	-112.47	10.74	9.20
CITH C-14	6.30	22.84	23.15	11.88	22.51	23.15	18.36	10.15	-112.09	10.25	9.50
CITH C-15A	7.62	25.04	24.54	15.75	22.03	24.37	18.66	8.45	-111.22	10.34	5.80
CITH C-15B	7.72	23.93	24.70	13.67	21.63	25.05	19.15	8.67	-115.96	11.48	7.16
CITH C-16	8.07	24.77	25.52	16.68	21.03	19.05	16.21	3.33	-92.84	10.19	4.23
CITH C-17	6.46	21.91	23.37	16.65	17.88	20.38	17.09	3.64	-90.92	9.56	6.70
CITH C-18	8.65	25.02	25.78	17.65	23.06	19.03	6.13	0.84	-30.49	9.09	4.80
CITH C-19	8.75	25.17	25.51	17.52	20.87	21.63	21.02	6.71	-116.92	9.15	3.90
CD at 5%	0.66	1.20	1.13	1.90	3.08	2.53	2.47	1.21	17.55	1.95	1.60

In evaluation of 8 cherry cultivars (Table 7), maximum fruit weight (9.91 g) and pulp stone ratio (20.87) were recorded in Lapins and these parameter were minimum (2.37 g) and (6.25) in Awal No. (Guigne Pourpera Prece). Maximum maturity index and yield/plant were recorded in Lambert (10.47) and Stella (22.17 kg) while these parameters were minimum (5.63 and 6.90 kg) in Awal No. (Guigne Pourpera Prece) and Mishri (Bigarreau Noir Grossa), respectively.

Table 7. Physico-chemical characteristics of some cherry cultivars

Cultivars	Fruit weight (g)	Fruit lenght (mm)	Fruit dia. (mm)	Pulp stone ratio	Firm-ness (index)	Color				Maturity index (TSS/ TA)	Yield Plant^{-1} (kg)
						L	a	b	tint		
Stella	6.41	23.08	24.78	14.08	21.43	25.87	25.63	10.75	-132.01	6.70	22.17
Bing	7.22	22.08	21.20	17.19	20.73	27.26	39.66	18.42	-201.23	8.93	13.80
Van	6.45	22.41	23.03	13.57	21.10	23.39	20.23	6.69	-104.62	9.43	7.20
Lapins	9.91	25.69	26.87	20.87	18.07	24.22	21.27	6.67	-123.61	10.35	14.20
Mishri	4.62	22.47	20.14	11.98	25.37	26.97	31.03	24.56	-148.32	7.95	21.13
Sweet Heart	7.72	19.34	19.56	16.51	20.13	18.75	13.65	4.01	-49.73	10.08	6.90
Awal No.	2.37	15.48	14.42	6.25	22.37	30.04	38.63	20.34	-194.08	5.63	9.57
Lambert	6.52	23.94	24.87	10.43	27.36	32.64	40.32	18.16	-175.13	10.47	9.00
CD at 5%	***0.73***	***3.45***	***2.35***	***1.92***	***3.14***	***9.52***	***8.57***	***4.31***	***25.21***	***0.78***	***2.94***

CITH - C-08 | CITH - C-02 | Stella | CITH-C-11A

Fruiting in some promising cherry selections and cultivars

Plum

In evaluation of 18 plum cultivars in respect of physico-chemical parameters, maximum fruit weight was recorded in Red Beauty (117.50 g) and minimum in Krassivica Plum (12.30 g). The firmness (relative index) was maximum in Black Amber (76.75) and minimum in Kubio Plum (19.75). Maximum yield/plant (35.66 kg) was recorded in Kanto-5.

Fruiting in promising plum cultivar

Peach and Nectarine

In evaluation of peach cultivars (Fig. 1), maximum fruit weight was recorded in Red

Globe (140.20 g) and minimum in Fantasia (45.7 g) but yield/plant was highest in Fantasia (32.7 kg) and lowest in Vance Marble (7.4 kg). In case of chemical traits maximum TSS was recorded in Snow Queen (14.50 ^{0}B) and minimum in July Elberta (6.70 ^{0}B). The maximum firmness (Index) was recorded in Fantasia (58.63 RI) and minimum in Nimla (6.7 RI)

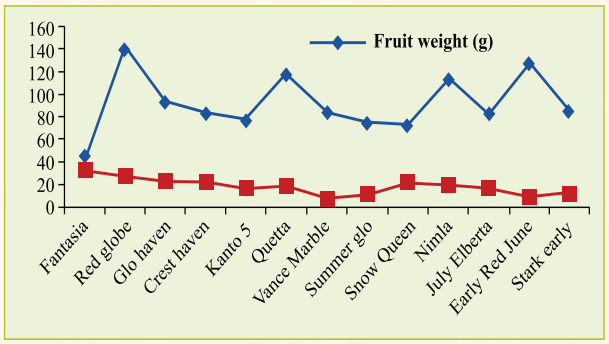


Fig. 1. Yield/plant and fruit weight in some cultivars of peach and nectarines

AP-1 (107.8 kg/ tree) followed by Harcot (75.1 kg/ tree) and CITH-AP-2 (63.9 kg/tree). The highest fruit weight was recorded in Rival (66.51g) followed Harcot (58.58g), and Communis Holly (56.07g).

Fruit bearing branches of CITH-Apricot-1

Red Globe

Glo Haven

Kanto-5

Fantasia

Fruiting in some peach and nectarine cultivars

Apricot

In apricot, a total of 59 exotic and indigenous collections/cultivars were evaluated for yield and quality traits (Table 8). The fruit, stone and kernel weight ranged from 16.7- 66.51 g, 1.82-3.90 g and 0.69-1.32 g, respectively. Highest TSS was recorded in CITH-AP-33 (24.60 °B). Apricot genotypes were classified on the basis of kernel taste into two group *viz*., sweet kernel and bitter kernel. Among 59 genotypes, 45 have sweet kernel while 14 genotypes produced fruit with bitter kernel. On the basis of harvest date, apricot genotypes/cultivars were classified into three maturity groups i.e., early, mid and late maturing. Highest fruit yield (Fig. 2) was recorded in CITH-

Table 8. Range for different traits in apricot germplasm at CITH

Characters	Range
Fruit characters	
Fruit weight	16.70g (CITH-AP-30)-66.51g (Rival)
Stone weight	1.82g (CITH-AP-28)-3.90g (CITH-AP-9)
Kernel weight	0.69g (Turkey)-1.32g (CITH-AP-25)
TSS	8.43 °B (PAS-3)-24.60°B (CITH-AP-33)
Titrable acidity	0.24% (CITH-AP-27)-1.74% (PAS-3)
TSS/Acidity ratio	4.83(PAS-3)-68.53 (CITH-AP-14)

Characters	Range
Kernel taste	
Sweet Kernel type	CITH-AP-1, 2, 3, 4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 23, 24, 26, 28, 30, 32, 33, 34, 35, 36, 37, Harcot, Balcota, Erani, Chinese, Australian, Tokpopa, Heartly, Afghani, Sateni, Yerevani, Communis Holy, Nari, PAS-1, PAS-2, PAS-3, PAS-4
Bitter kernel type	CITH-AP-6, 7, 20, 22, 25, 27, 31, Rival, Tilton, Communis, Turkey, Fairmedcester, Viva Gold, New Castle
Harvesting time	
Early (Last week of June to first week of July)	CITH-AP-1, 2, 3, 4, 6, 7, 10, Harcot, Balcota, Erani, PAS-2, New Castle, Heartly and Turkey.
Mid (Second to third week of July)	CITH-AP-5, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27, 28, 30, 32, 33, 34, 35, 36, 37, PAS-1, PAS-3, PAS-4, Chinese, Rival, Tilton, Tokpopa, Afghani, Communis Holy, Sateni, Yerevani, Australian, Nari, Viva Gold and Fairmedcester.
Late (Last week of July)	CITH-AP-24, 26, 31 and Communis

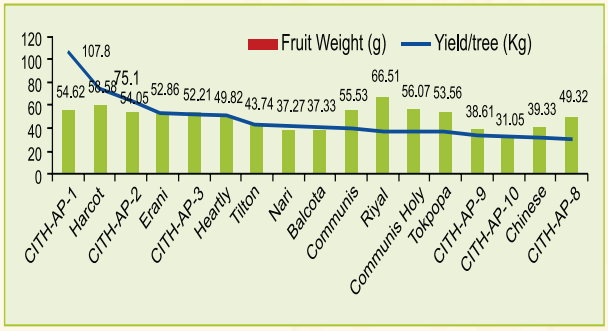


Fig. 2. Yield and fruit weight of promising apricot genotype/ cultivars.

Almond

In almond, 22 selections were evaluated for various traits (Fig. 3). The CITH-Almond-9, CITH-Almond-19, CITH-Almond-21, CITH-Almond-22 and CITH-Almond-23 were found semi-hard with good kernel recovery. However, in respect of yield/tree CITH-Almond-14, CITH-Almond-17 and CITH-Almond-9 were found promising. In evaluation of 9 cultivars of almond Pranyaj was found promising in respect of fruit weight and yield/tree whereas maximum kernel recovery, A grade kernel and least gummosis infestation were recorded in Waris followed by Non-Pareil (Fig. 4&5).

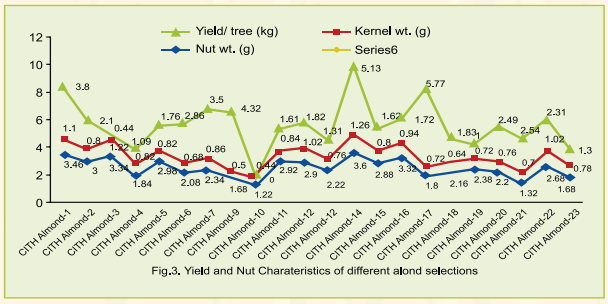


Fig. 3. Yield and Nut Charateristics of different alond selections

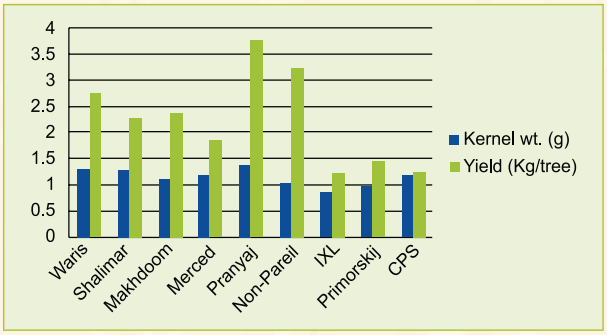


Fig. 4. Kernel weight and yield/plant of different almond cultivars

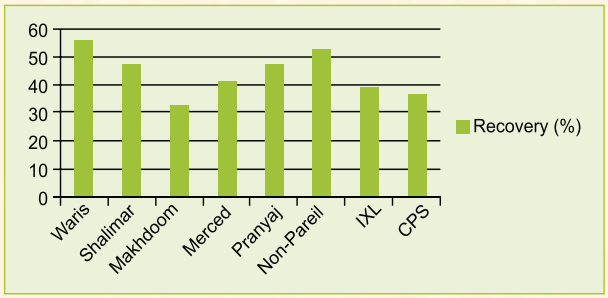


Fig. 5. Kernel recovery (%) in different almond cultivar

Fruiting in almond cv. Waris

Shalimar | Makhdoom | Pranyaj | Primorskij

Merced | California Paper Shell | IXL | Non Pariel

Fruiting in different almond cultivars

Walnut

In walnut, 127 exotic and indigenous collections were evaluated for nut and kernel traits along with check. In evaluated genotype, nut weight varied from 22.30 g (CITH-W-100) to 6.75 g (Serr) while kernel weight varied from 10.63 (CITH-W-100) to 3.6 g (Serr). PGB-1 genotype has highest kernel recovery (67.92%) and it has papery shell (Table 9).

Among the evaluated genotype, 22 genotypes showed higher nut weight than check variety Sulaiman (17.5g) while 23 genotypes showed higher kernel weight than check variety Hamdan (8.57g) and are suitable for commercial cultivation after further evaluation (Table 10).

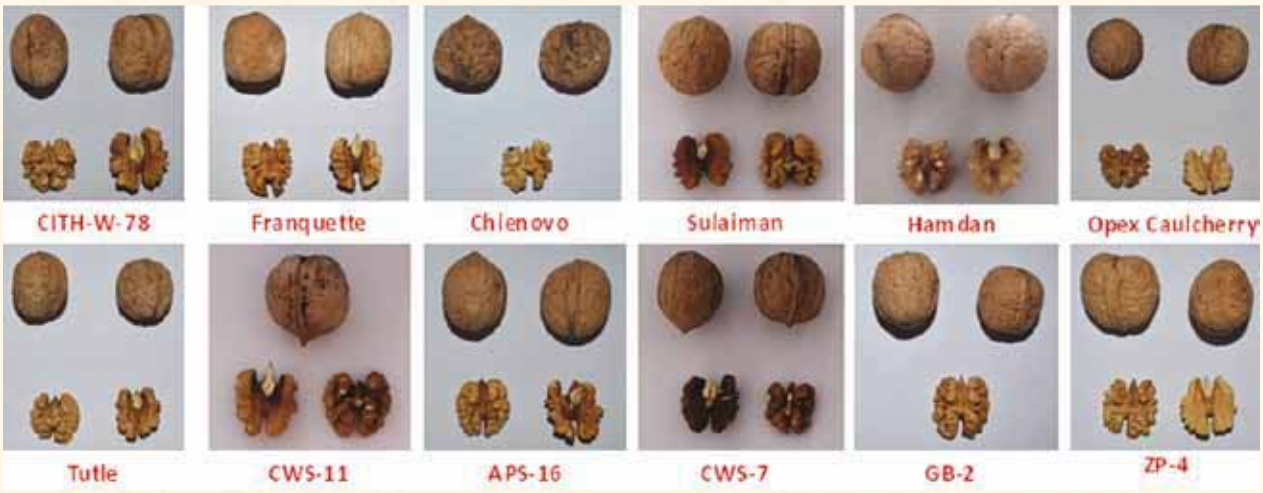
Table 9. Variation for different nut and kernel characters in evaluated walnut genotype

Characters	Range	Mean	SD	COV (%)
Nut Weight (g)	6.8-22.3	14.4	3.3	23.1
Nut Length (mm)	29.2-52.0	39.9	4.9	12.3
Nut diameter (mm)	25.5-40.6	33.2	3.1	9.3
Nut Thickness (mm)	27.5-41.7	34.7	3.4	9.8
Shell thickness (mm)	1.1-2.6	1.8	0.3	16.5
Packing tissue thickness (mm)	0.1-0.8	0.2	0..1	48.7
Kernel wt. (g)	3.6-10.6	7.0	1.6	22.1
Kernel recovery (%)	34.0-67.9	49.3	5.3	10.8

Table 10. Nut and kernel characteristics of some promising walnut genotypes/varieties

Genotype	Nut Weight (g)	Nut Length (mm)	Nut Dia. (g)	Nut thickness (mm)	Shell thickness (mm)	Packing Tissue Thickness (mm)	Kernel Wt (g)	Kernel Recovery (%)
CITH-W-1	21.00	47.83	38.60	41.47	2.37	0.18	10.50	50.17
CITH-W-3	17.20	41.90	36.40	38.27	1.60	0.24	9.03	52.70
CITH-W-5	20.10	46.47	37.70	40.17	1.50	0.15	8.83	43.83
CITH-W-6	21.07	42.93	40.67	40.67	2.43	0.18	9.07	43.00
CITH-W-7	20.87	49.13	37.53	39.53	2.37	0.25	9.93	48.37
CITH-W-10	18.33	44.17	36.83	37.60	2.07	0.20	7.10	38.77
CITH-W-12	19.47	47.90	36.60	39.47	1.97	0.19	8.30	42.53
CITH-W-13	18.77	41.17	38.07	38.20	2.00	0.24	8.73	46.47

Genotype	Nut Weight (g)	Nut Length (mm)	Nut Dia. (g)	Nut thickness (mm)	Shell thickness (mm)	Packing Tissue Thickness (mm)	Kernel Wt (g)	Kernel Recovery (%)
CITH-W-14	18.37	40.27	36.67	37.13	2.07	0.19	8.77	47.80
CITH-W-19	17.93	43.23	36.73	36.67	2.17	0.21	9.00	50.73
CITH-W-20	18.67	48.47	34.20	38.50	1.90	0.16	9.43	50.67
CITH-W-26	18.33	43.07	37.00	37.13	1.90	0.18	9.03	49.50
CITH-W-39	18.47	35.87	35.43	37.27	2.13	0.20	9.77	54.87
CITH-W-61	21.27	47.00	37.97	36.77	2.43	0.31	9.00	42.37
CITH-W-78	17.90	42.63	36.60	39.67	1.87	0.16	8.90	49.67
CITH-W-79	19.23	44.50	34.00	40.97	2.30	0.16	7.73	40.30
CITH-W-100	22.30	49.47	38.73	41.23	2.33	0.17	10.60	47.53
CITH-W-87	19.00	49.17	37.00	40.37	1.80	0.30	10.27	54.70
CITH-W-88	19.57	46.73	33.70	37.30	2.20	0.30	8.93	45.83
CITH-W-89	17.67	43.97	36.47	36.20	2.13	0.26	7.33	41.47
CITH-W-90	17.77	41.13	32.93	36.23	2.57	0.21	8.33	46.77
CITH-W-91	18.57	39.33	32.83	37.30	2.47	0.27	6.77	36.67
Opex Caulchery	9.90	36.87	29.50	31.23	1.77	0.27	5.00	50.23
Sulaiman	17.40	39.93	37.40	40.77	2.40	0.19	8.50	49.10
Hamdan	15.97	44.27	34.07	35.40	1.67	0.14	8.23	51.37
Tutle	9.70	32.73	28.50	29.80	1.27	0.19	5.27	54.60
Chienovo	15.30	42.13	34.33	33.40	1.90	0.41	7.33	48.00
C.D. at 5%	2.56	2.83	2.21	2.17	0.29	0.11	1.95	NS



Nut and kernel of promising walnut genotype along with check cultivar

Strawberry

In strawberry 88 genotypes were evaluated for different fruit quality traits like ascorbic acid content, TSS, fruit weight, acidity etc. Ascorbic acid (mg/100g) ranged from 45-86 and genotypes like Katrian Sweet, Winter Dawn, North West, IC-111-14, IC-319153, Elasta, Senga Sengana, EC-439591, Sweet Heart, Pajaro, NR-Round, Sheet Master, IC-319132, IC-319135, EC-262589, Katrain Sweet, Red Coat, Hybrid-2, EC-362601 showed higher ascorbic acid (>70mg/100g). Fruit weight ranges from 3.5-12 g and genotypes like Howard, Red Coat, Kalling Long, Dana, Kimberly, Tilamok, Mastadom, Nabilla, Sweet Heart, Phenomenon, Red Coat, Hybrid-2, CH-111-12 and CH-40 showed fruit weight >10g. TSS ranges from 6-12° Brix with IC-319128, IC-319129, IC-319143, IC-111-14, Fairfax, Selection-1, CH-10, Merchant, Tilamok, Banglora, IC-318195, Lucende, Hybrid-2, EC-362601 showing >10°B TSS. Titrable acidity ranged from 0.11-0.36.

Olive

In olive, 17 cultivars flowered and fruited during 2015. The variation was observed for various traits like fruit weight, fruit length, fruit diameter, pulp weight and TSS. Maximum fruit weight and pulp weight (4.08 and 3.12 g) were recorded in cultivar Zaituna while Pendolino produced smallest fruits having weight of 1.70 g. The TSS varied from 10.30 (Carignola) to 20.23 (Belice). The minimum seed weight (0.52g) was recorded in cultivar Morolio and Pendolino. The longest fruits (21.43 mm) were recorded in Coratina. Based on yield efficiency the cultivars, Cipressino (1.84 kg/cm^2),Coratina (0.152 kg/cm$^{2)}$, Belice (0.147 kg/cm^2), Picholine (0.091 kg/cm^2), Pendolino (0.071 kg/cm^2) and Biancolilla (0.054 kg/cm^2) were found suitable for Kashmir conditions from yield point of view (Fig. 6). The oil percentage ranged from 9.75 to 31.25 per cent. The cultivars Cipressino (31.25%), Ottobratica (24.0%), Leccino (22.68%), Toffia (21.54%), Tonda Iblea (20.75%), Cornicobra (19.37%) and Pendolino (18.75%) were found superior with respect to oil yield.

Among seventeen cultivars the earliest initiation of flowering (20th May) was recorded in cultivar Coratina and Messenese, while cultivar Cipressino was last to initiate flowering (8th June). The peak flowering period was observed from 1st June to 24th June. The cultivar Ottobratica was found last to end the flowering (3rd July). Sixteen cultivars were observed for self, open and control

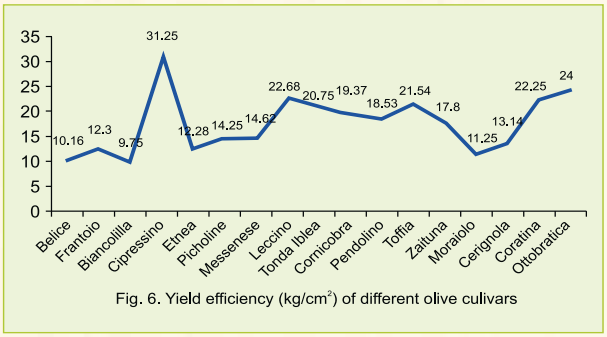


Fig. 6. Yield efficiency (kg/cm^2) of different olive culivars

Fruiting in different olive cultivars

pollination. In self pollination of sixteen cultivars fruit set varied from 1.70% to 47.05%. In open pollination the fruit set varied from 9.57% to 34.19%.

Kiwifruit

Among seven cultivars, six flowered during 2015 and most of the male and female cultivars initiated flowering between 20 to 22nd May. Among five female cultivars, 4 fruited and the number of fruits/vine were obtained as 34, 24, 20 and 15 in cultivars Hayward, Abbot, Monty and Allison, respectively. The fruit size also varied within the cultivar and found negatively correlated with number of fruits/vine in all the cultivars. Cultivar Hayward, Monty, Abbot and Allison showed respective average fruit weight of 54.45g, 45.11g, 39.66g and 31.0g and average fruit length/ fruit diameter as 54.25/39.39mm, 52.54/36.90mm, 51.01/35.76mm and 43.61/33.97mm. The fruit weight of 103g was also recorded in cultivar Hayward.

Fruiting in kiwifruit cv. Hayward

Chinese ber

To know the suitability of Chinese ber under Kashmir condition, one introduced genotype of

Flowering in Chinese ber

the ber was evaluated for fruit characters. Good fruiting was observed under Kashmir conditions. The fruits were harvested during second week of September. The fruit weight varied from 1.4 to 3.8g with average weight of 2.73g. Similarly fruit length and diameter varied from 14.04 to 21.06 mm and 10.63 to 17.21mm with an average of 17.99 and 14.31 mm, respectively. The TSS ranged from 12.6 to 15.5 ^{0}B with an average of 14.05^{o}B.

Mukteshwar

The germplasm collection, conservation, evaluation and characterization is also going on at CITH-RS, Mukteshwar. The evaluation of different cultivars of horticultural crops had led to recommendation of many promising types of cultivars for Uttarakhand. The Regional Station is maintaining 65 cultivars of apple, 4 in pear, 5 in plum, 10 in peach, 2 in cherry, 4 in Kiwifruit, 4 in hazelnut and 6 in apricot. Besides this in vegetable crops, 45 lines/varieties of tomato including cherry tomato, 40 of capsicum, 12 of peas, 5 of french bean, 5 each in garlic, onion and lettuce, 2 each in broccoli, cucumber and pumpkin were maintained at the station for research purpose. In flowers crops, 60 lines in gerbera, 5 in alstroemaria, 5 in carnation, 10 in gladiolus, 10 in rose, 5 in dahlia, 5 in chrysanthemum were maintained. Besides, 50 types of other ornamental plant species were also collected and maintained for production of planting material and research purposes.

Evaluation of apple cultivars for various traits at Uttarakhand

Thirty apple cultivars having different maturity period were evaluated for various traits at Mukteshwar. The perusal of data regarding the physico-chemical characteristics of different apple cultivars differed significantly and depicted in Table 11. The highest fruit length (69.29 mm), fruit diameter (80.55 mm) and fruit weight (209. 19 g) were recorded in Tydeman's Early Worcester while, smallest fruits were produced by Early Shanburry. The maximum (11.73 Ib/inch^2) and minimum (4.86 Ib/inch^2) fruit firmness was recorded in Red Gold and Prima, respectively. The maximum T.S.S. was recorded in Skyline Supreme (14.30 °B) while the minimum T.S.S. was recorded in Early Shanburry (9.16°B). On the basis of present findings, the Tydeman's Early Worcester, Vance Delicious, Vermont Spur, Mollies Delicious and Skyline Supreme has been found superior with respect to most of the physico-chemical characteristics.

Promising cultivars of apple growing at Uttarakhand

Table 11. Fruit characteristics of different apple cultivars in Uttarakhand

Cultivars	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit firmness (Ib/inch2)	T.S.S (°B)
Early Season					
Summer Red	57.25	65.93	118.18	7.73	10.20
Fanny	54.60	67.90	127.35	10.73	11.83
Early Shanburry	38.67	47.37	39.64	5.76	9.16
Gloster	54.26	66.02	108.08	8.80	10.66
Tydeman's Early Worcester	69.29	80.55	209.19	9.26	12.46
Schlomit	60.70	73.13	124.85	9.20	13.66
Chaubattia Anupam	49.99	60.22	77.26	7.73	12.06
Maayan	55.62	70.70	137.51	11.53	11.40
Chaubattia Princess	52.42	63.39	110.52	9.43	11.03
Mollies Delicious	62.21	76.35	163.88	5.70	12.06
Prima	53.98	67.10	123.69	4.86	10.00
Mid Season					
Starkrimson	62.16	70.10	145.70	7.22	11.86
Gala Mast	56.73	66.32	120.33	5.86	9.80
Liberty	48.80	64.10	100.06	6.63	12.16
Vance Delicious	69.05	66.21	140.66	8.66	14.23

Cultivars	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit firmness (Ib/inch2)	T.S.S (°B)
Gold Spur	52.60	60.28	88.20	6.26	10.13
Red Delicious	58.64	66.48	131.80	8.86	13.33
Bright-N- Early	59.56	72.16	159.33	7.10	11.83
Stark Spur	63.40	68.13	136.66	8.00	11.76
Rich-a-Red	60.07	68.32	133.60	8.53	13.83
Cooper-IV	54.90	68.48	120.17	8.93	10.86
Skyline Supreme	67.08	74.25	181.25	7.36	14.30
Oregon Spur	62.50	65.79	113.60	8.26	12.10
Red Chief	67.29	74.47	167.20	7.13	12.93
Late Season					
Golden Delicious	62.08	64.15	124.73	9.73	13.10
Firdous	53.24	66.52	119.50	5.76	13.86
Red Gold	44.05	56.98	75.58	11.73	10.80
Hardy Spur	59.61	70.39	146.98	7.80	12.20
Vermont Spur	67.00	76.06	190.53	7.70	12.56
C.D. at 5%	***5.92***	***6.38***	***34.13***	***2.11***	***2.00***

Phenotypic variability in wild apple (*Malus baccata*) at Kumaon hills of Uttarakhand

In another study five collections of wild apple locally known as *paron* were evaluated and data is presented in Table. 12. Based on physical and bio-chemical studies, all five types of *Paron* were found significantly different from each other. The highest leaf area was recorded in the Collection-4 (Letibunga) *i.e.* 64.69 cm^2 while highest fruit weight was recorded in the Collection-5 (Galla-Lodh) *i.e.* 28.15g. The maximum fruit T.S.S. was recorded in the Collection-1 (Sargakhet) 17.2^{0}B while carotene content of fruits were found highest in the Collection-1 (Sargakhet) *i.e.* 1758.02 µg/100g. The highest total antioxidant activity was recorded in the Collection-5 (Galla-Lodh) *i.e.* 32.65 mMTE/L. From this study, it can be inferred that the collected valuable material can be used as rootstock and may be evaluated for its clonal propagation behavior. After that its graft compatibility with commercial cultivar and its effect on various traits can be studied in future.

Fruits and leaves of different wild apple collections: From the left, Collection-1 (Sargakhet), Collection-2 (Jadapani), Collection-3 (Satbunga), Collection-4 (Letibunga) and Collection-5 (Galla-Lodh)

Table 12. Leaf, fruit and seed characteristics of five collection of *Paron* (Wild apple)

	Leaf				Fruit											Seed			
Collections	**Length (cm)**	**Width (cm)**	**Petiole length (cm)**	**Leaf area (cm^2)**	**Length (mm)**	**Width (mm)**	**Peduncle length (cm)**	**Weight (g)**	**T.S.S. (0B)**	**Acidity (%)**	**Ascorbic acid (mg/100g)**	**Reducing sugars (%)**	**Total sugars (%)**	**Carotene content (µg/100g)**	**Total anti-oxidant activity (mMTE/L)**	**Length (mm)**	**Width (mm)**	**Weight of 100 seeds (g)**	**Number of seeds/ fruit**
Collection-1 (Sargakhet)	6.10	3.30	2.64	49.79	14.82	15.82	2.06	2.06	17.20	1.98	18.88	2.86	5.79	1,758.02	22.25	4.66	2.61	1.26	5.20
Collection-2 (Jadapani)	6.34	3.58	2.54	48.64	8.68	9.09	3.78	0.45	12.23	1.81	15.34	1.85	2.83	84.08	10.05	4.59	2.09	1.18	5.40
Collection-3 (Satbunga)	6.96	4.38	2.66	60.68	16.07	18.98	3.36	3.41	14.00	2.45	12.98	1.34	2.84	431.98	21.49	5.83	2.77	2.05	6.20
Collection-4 (Letibunga)	7.54	4.90	2.18	64.69	29.67	28.88	2.84	13.59	11.87	2.08	17.70	2.91	5.47	198.25	32.33	6.52	3.50	2.72	2.40
Collection-5 (Galla-Lodh)	6.48	4.42	2.34	54.59	31.53	38.45	3.02	28.15	15.20	1.24	7.08	6.41	8.94	190.54	32.65	7.32	4.06	3.18	3.20
CD at 5%	***0.60***	***0.51***	***N/A***	***5.69***	***1.52***	***1.10***	***0.48***	***1.83***	***0.57***	***0.10***	***1.03***	***0.16***	***0.24***	***21.58***	***1.27***	***0.47***	***0.26***	***0.037***	***1.36***

Vegetable Crops

Carrot

Forty four collections of carrot were evaluated for yield and related attributes; root yield (t/ha), root length (cm), root diameter (cm), core diameter (cm), average root weight (kg) etc. The yield of the germplasm ranged from14.83 to 31.20 t/ha, root length from 14.40 to 19.20 cm, root diameter from 2.17 to 2.95 cm, core diameter from 0.50 to 0.84 cm and average root weight from 0.045 to 0.094 kg. Significant differences were observed for all traits. The root yield of promising varieties is presented in Fig. 7.

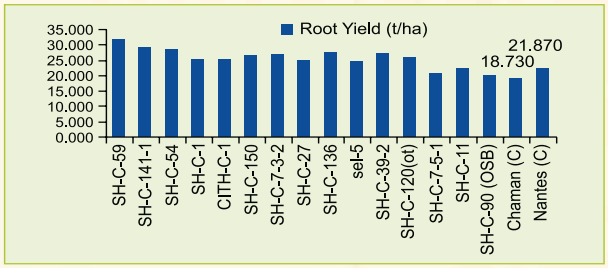


Fig. 7. Root yield of top 15 promising genotypes of carrot

Summer carrot

Forty four carrot genotypes were evaluated for various valuable traits. The root yield ranged from 10.54 to 38.88 t/ha, root length from 11.35 to 17.06 cm, root diameter from 2.46 to 3.99 cm and average root weight from 0.032 to 0.117 kg. Significant differences were observed among genotypes for all traits except core diameter. The root yield of promising varieties is presented in Fig. 8.

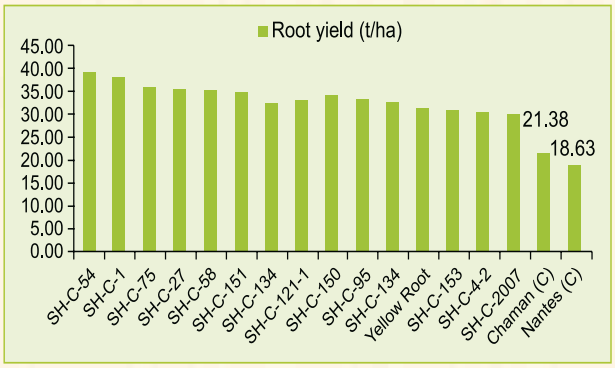


Fig. 8. Root yield of top 15 promising carrot genotypes in summer

Turnip

Twenty three genotypes of turnip were evaluated along with one check Nigeen (25.97 t/ha). There were statistically significant differences among genotypes for all traits. The root yield ranged from 20.33 to 53.23 t/ha, root equatorial diameter from 5.41 to 9.09 cm and root polar diameter from 3.95 to 9.43 cm. Three new selections were also made based on root color and shape. The root yield of promising varieties is presented in Fig. 9.

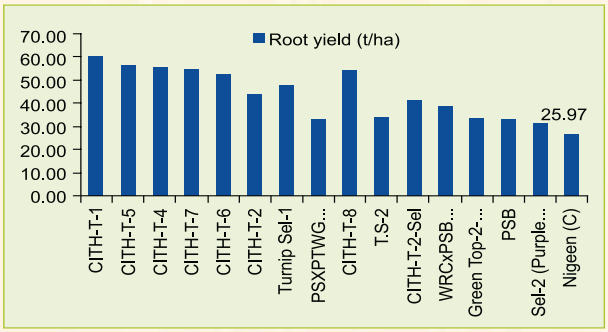


Fig. 9. Root yield of top 15 genotypes in turnip

Roots of carrot genotype SH-C-54

Some selections in turnip

Radish

Five genotypes were evaluated with variety check Japanese White Long (104.40 t/ha) for yield and related traits. Significant differences were observed among germplasm for all traits. However, none of the genotypes could surpass check for root yield. The root yield ranged from 29.13 to 51.53 t/ha, root polar diameter ranged from 5.71 to 9.55 cm and root equatorial diameter ranged from 6.11 to 8.29 cm. Two new selections were also made based on root shape, size and color. The root yield of different varieties is presented in Fig. 10.

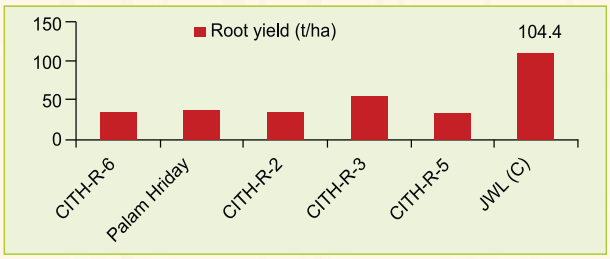


Fig. 10. Root yield of different radish genotypes

Some new round selection of radish

Kale

Fifty eight genotypes of kale were evaluated with check var. Khanyari (44.44 t/ha). The leaf yield ranged from 18.70 to 174.44 t/ha, number of leaves per plant from 12.67 to 78.67, leaf length from 16.33 cm to 35.00 cm and leaf width from 8.33 to 34.33 cm. The leaf yield of promising varieties is presented in Fig. 11.

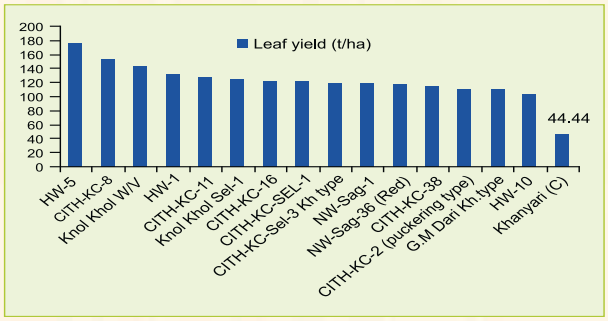


Fig. 11. Leaf yied (t/ha) of top 15 kale genotypes

Flower crops

Tulip

Twenty cultivars of tulip were planted on 22nd December, 2014 at CITH, Srinagar and evaluated for various traits. Most of cultivars germinated during February, 2015 except Texas Gold in which germination took place in March. Minimum days for planting to germination and germination to flowering were recorded as 51 and 98 days in the cultivar Pleasure and Apeldoorn Elite while these parameters were maximum (78 & 119 days) in cultivar Texas Gold. Significant differences were recorded in all growth and floral traits among different cultivars except leaf width. Maximum plant height (53.90 cm) and spike girth (11.30 mm) were recorded in cultivars All the Jazz and Canasta, respectively. Maximum flower length (99.41 mm) and flower diameter (122.70 mm) were recorded in Texas Gold. A great extent of variation was also observed for colour (L, a, b and tint). Maximum vase life (13.3 days) and *in situ* flowering (19 days) were recorded in cultivar Alibi. Among 20 cultivars, 4 were white (Pleasure, White Marvel, Best Seller and Francoise), 3 were yellow (Day Dream, Texas Gold and Ballade Gold), 2 were pink (All the Jazz and Mistress), 1 orange (Apeldoorn Elite), 2 purple (Abegail and Alibi), 1 marron (Pallada) and 7 red (Alladin, Judith Lester, Miranda, Canasta, Ben Van Zentein, Strawberry Ice and Rosy Delight). Among different cultivars 8 were early (98-105 days), 11 were mid (106-110 days) and 1 was late in flowering (119 days) from sowing. Hence by selecting early, mid and late flowering cultivars and their planting can enhance the bloomimg period and long span of flowering can be achieved.

Lilium

Seven cultivars of lilium were planted at CITH, Srinagar under polyhouse condition in February, 2015 and were evaluated for various plant, leaf and flower traits. The maximum plant height (115.33 cm) was recorded in cultivar Royal Trinity while maximum spike girth (18.27 mm) was recorded

View of flowering in different cultivars of tulip

in cultivar Brunello. The minimum days (73.67) were taken from flowering by the cultivar Brindsii while cultivar Mero Star took maximum (120) days to initiate the flowering. The cultivar Mero Star produced biggest flowers having diameter of 21.43 cm. The maximum vase life was recorded in cultivar Brindsii followed by Pavia and Brunello. Similarly, *In situ* flowering life was also recorded more in cultivars Pavia, Brindsii, Litouwen and Brunello. So based on various parameters cultivar Pavia, Brindsii, Litouwen, Brunello and Royal Trinity were found more suitable for Kashmir conditions

DNA finger printing of temperate horticultural crops

Genetic diversity analysis in strawberry germplasm through SSR markers

Eighty eight strawberry germplasm lines were used for molecular characterization through 26 pairs of SSR markers. Polymorphic information content and marker index varied from 0.027 to 0.327 and band informativeness varies from 1.589 to 1.973. Dendrogram analysis revealed low level of polymorphism across the genotypes and most of the genotypes were clustered together due to low level of variability (Fig. 12).

View of flowering in different cultivars of lilium

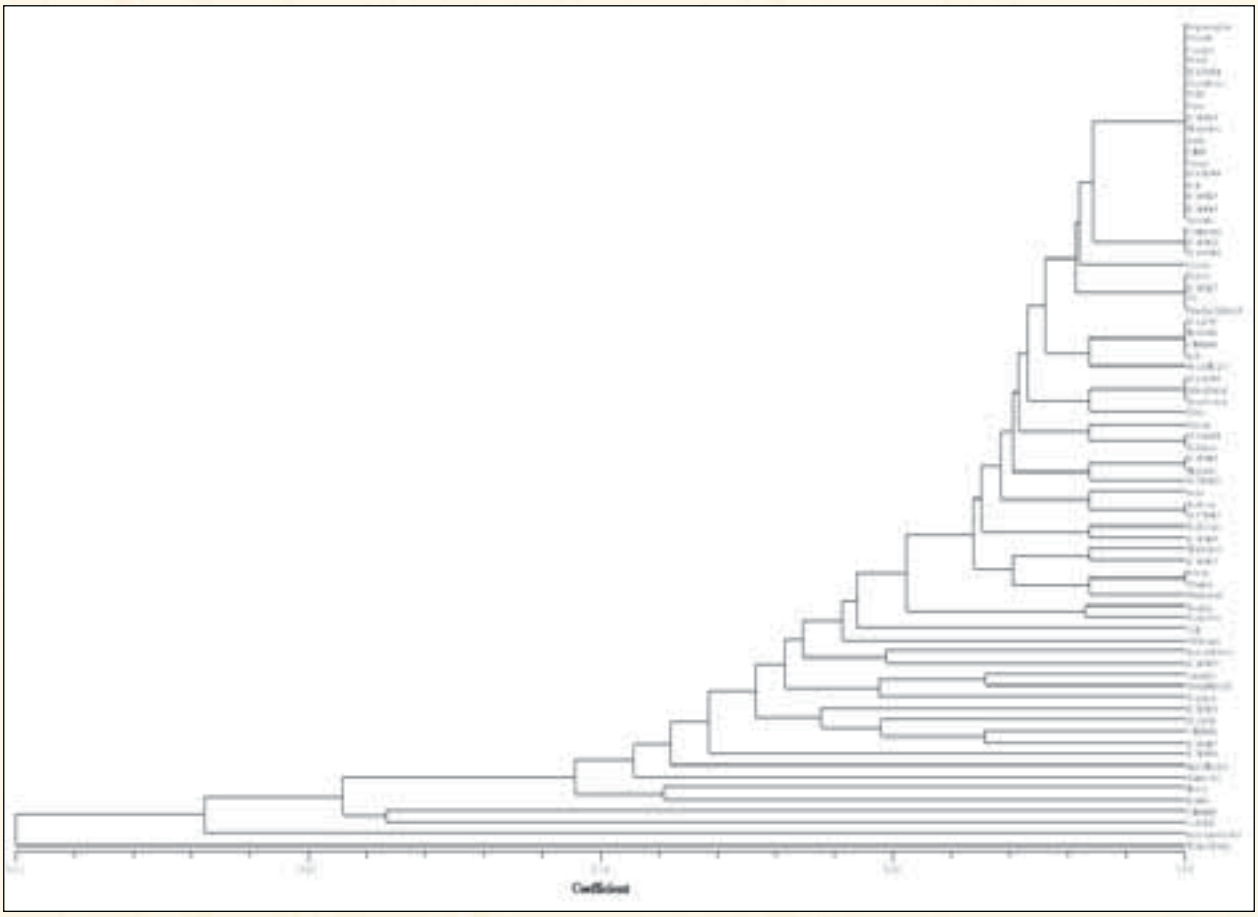


Fig. 12. UPGMA dendrogram showing clustering pattern of strawberry genotypes.

Standardization of micro-propagation protocols for cherry and apple

Shoot and root multiplication studies in cherry and apple clonal root stocks under *In-vitro* conditions

During 2015-16 different phytohormone combinations were tried to optimize the best hormone combinations for shoot proliferation and root proliferation for all apple clonal root stocks and five best combinations were identified and are recommended (Table 13&14).

Table 13. Five best phytohormone combinations recommended for apple shoot proliferation

Treatments	No. of shoots	Shoot Length(cm)
2.0 mg/L BAP+0.5 mg/L kinetin	33.333	15.000
2.0 mg/L BAP+0.5 mg/L GA_3	50.000	20.333
3.0 mg/L BAP+0.5 mg/L GA_3	68.667	15.000
3.0 mg/L BAP+0.2 mg/L GA_3	40.000	15.000
3.0 mg/L BAP+1 mg/L GA_3	32.000	17.500
CD at5%	4.90	1.51

Table 14. Five best phytohormone combinations recommended for apple root proliferation

IAA(µM)	AC (mg/L)	GA_3 (mg/L)	PG (mg/L)	Initiation of rooting (days)	Avg length of roots(cm)	Total root no
2	100	0.4	25	20	12	60
2	200	0.2	15	15	17	79
2	200	0.2	20	6	23	85
2	200	0.2	25	18	13.5	68
2.5	100	0.4	15	27	9	62

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

Hybridization for development of superior hybrids in apple

During the year 2015 four cross combinations using Ambri as one parent were carried out to transfer the traits like scab resistance from Shireen, fruit color from Oregon Spur, earliness from Mollies Delicious and fruit size from Granny Smith. All the crosses showed significant fruit set and the seeds were sown for germination. Hybrid plants raised from last year's (2009-2014) crosses were evaluated and screened for scab, powdery mildew and aphid infection/infestation. At present sixty three hybrids representing crosses of Ambri, Golden Delicious, Prima, Red Delicious, Royal Delicious, Top Red, Mollies Delicious, Granny Smith, Oregon Spur, Silver Spur, *M. floribunda*, Well Spur etc established in the hybrid block. These hybrids are being top worked on MM 106/ M-9 clonal root stocks to obtain early fruiting for further evaluation. Hybrids top worked on MM-106 rootstock were evaluated for fruit quality traits and five hybrids Red Delicious x Mollies Delicious, Starkrimson x Gold Spur, Golden Delicious x Cooper-IV, Red Delicious x Gala Mast and Golden Delicious x Red Fuji were identified distinct from parents and with superior quality. These hybrids have been planted for establishment and large scale multiplication in CITH field gene bank.

National Saffron Mission for revival of saffron industry in J&K

In-vitro stigma development in saffron (*Crocus sativus*) with active apocarotenoid biosynthesis

Stigma like structures and stigma has been produced under *in-vitro* conditions using ovary as explant with different phytohormone combinations on G-5 media. For development of stigma like structures under *In-vitro* conditions, ovaries were cultured on media supplemented with different combinations of phytohormones. Stigma-like structures and stigma appeared on cultured ovaries. Stigma like structures having highest potential for apocarotenoid biosynthesis was observed on G-5 media supplemented with 27µM NAA & 44.4 µM BA. Direct stigma have apocarotenoids at par with natural stigma obtained on G-5 media supplemented with 0.5 mgL^{-1} BAP, 0.1 mgL^{-1} NAA & 0.5 mgL^{-1} 2,4-D using half ovary as an explant. Present study is the first report on development of apocarotenoid rich SLS with very high frequency of SLS development and development of direct stigma under *In-vitro* conditions with low frequency. HPLC analysis showed that SLS contains about 10 mg/g crocin and 0.09 mg/g of safranal content whereas direct stigma developed under *In-vitro* conditions contain about 30 mg/g crocin and 0.12 mg/g safranal (Fig. 13). Real Time PCR analysis revealed that apocarotenoid biosynthetic gene expression throughout the development of SLS and stigma under *In-vitro* conditions. The relative quantification through real time PCR for

expression of apocarotenoid genes like *CsZCD* and *CsLYC* revealed that there is increase in expression from callus to stigma development. Expression of the regulatory genes responsible for biosynthesis of apocarotenoids *viz.* crocin, picrocrocin and safranal is getting upregulated in *in-vitro* developed stigma in saffron hence revealing that these are developmentally closely related to natural stigma.

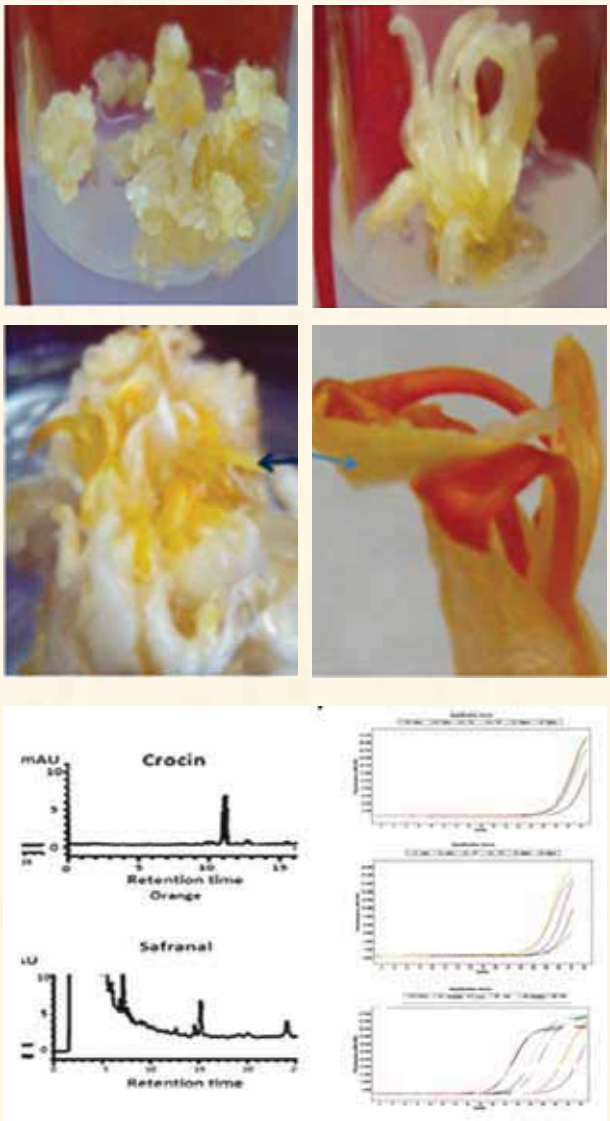


Fig. 13. Apocarotenoid estimation and gene expression in stigma like structure in saffron

Breeding for development of superior varieties / hybrids in Solanaceous crops

This study was carried out at Srinagar and Mukteshwar. In Srinagar, advanced varietal trials were conducted for evaluating promising lines of different solanaceous crops. Seven, four and five genotypes in chilli, brinjal and sweet pepper were evaluated, respectively. In chilli, the red ripe fruit yield ranged from 11.91 t/ha to 24.14 t/ha including the check SH-HP-1154 at 17.16 t/ha. There are significant differences for yield among genotypes but none could surpass check. However all of them were at par with the check (Fig. 14). In sweet pepper, the fruit yield of promising lines of sweet pepper ranged from 36.13 t/ha to 60.03 t/ha. The highest one was that of check Nishat-1. None of the lines could surpass check (Fig. 15). However, only SH-SP-3-1 was at par with it and all others were inferior in performance. In brinjal, the fruit yield of promising brinjal genotypes ranged from 52.54 t/ha to 105.67 t/ha. The check Local Round yielded 88.96 t/ha (Fig. 16).

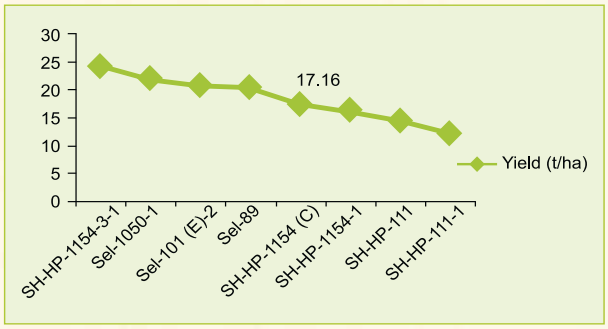


Fig. 14. Yield of promising genotypes of chilli

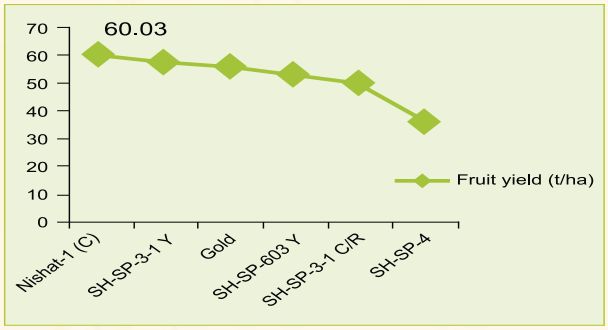


Fig. 15. Yield of promising genotypes of sweet pepper

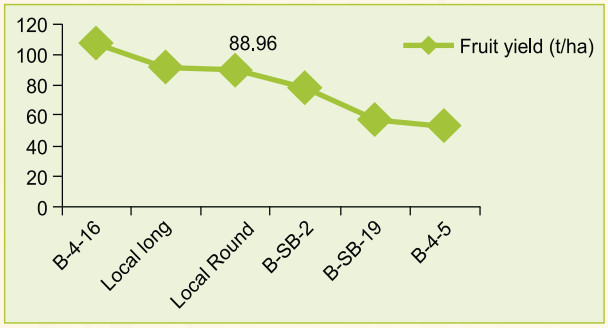


Fig. 16. Yield of promising genotypes of Brinjal

Some promising genotype of chilli

Some promising genotype of brinjal

In addition to promising lines, 50, 40 and 71 genotypes of chilli, brinjal and sweet pepper were also evaluated under initial evaluation trials. The red ripe fruit yield in chilli ranged from 11.91 t/ha to 24.14 t/ha, fruit yield in brinjal and sweet pepper ranged from 52.54 t/ha to 105.67 t/ha and 36.13 t/ha to 60.03 t/ha, respectively.

In Mukteshwar, fourteen genotypes of tomato were selected for breeding to develop new varieties and germplasm. Most of lines exhibited significant differences for various growth, yield and quality parameters. Among the genotypes and hybrid/varieties, maximum total number of fruits/plant (167.50) was observed in CITH-RS-CT-4. However, maximum average fruit weight (85.00 g) was observed in Shalimar and lowest (6.57g)in CITH-RS-CT-2 (Red). Maximum average fruit yield per plant (5.78 kg) was recorded in VL-4 and lowest (0.17 kg) in CITH RS-CT-2 (Red). The highest polar and equatorial diameter of 67.60 mm and 62.15 mm were recorded in Roma and FT-5, respectively. TSS of 8.50 °Brix was recorded in genotype CITH-RS-CT-5.

In capsicum, seventeen genotypes were evaluated for growth, yield and quality parameters. Most of lines exhibited significant differences for various growth, yield and quality parameters. Among the genotypes and hybrid/varieties, maximum plant height (62.00 cm) was recorded in Selection-1and lowest (26.93 cm) in Sel-12. Total number of fruits/plant (31.00) were recorded in Selection-3. However, maximum average fruit yield per plant (1.87 kg) was recorded in California Wonder. Maximum number of branch per plant (7.66) were recorded in Selection-1. The branch length was highest (52.59 cm) in Selection-9.

Fruiting in tomato and capsicum at Mukteshwwar

Studies on improvement of saffron

Thirty six elite clones established at CITH, farm were evaluated for various traits and on the basis of yield traits ten best genotypes were indentified. Very low saffron yield (kg/ha)was noticed in this year due to fluctuation in temperature during flowering. These clones include CITH-125 (1.26), CITH-124 (1.12), CITH-123(1.01), CITH-122 (0.99), CITH-12 (0.92), CITH-121 (0.90), CITH-107 (0.88), CITH-120 (0.86), CITH-117 (0.83) and CITH-104 (0.79).

II. Crop production

The non availability of quality material is the major constraint in temperate fruit production. The institute is producing quality planting material of elite cultivars of fruit crops and supplying to the stakeholders throughout the country. The planting material produced during 2015-16 is presented in Table 15. Total 80,100 grafted plants, 12,450 budded plants, 25,000 runners and 5.5 quintal vegetable seed were produced.

Table 15. Planting material of different crops produced at CITH during 2015-16

Method	Crop	No. of plants
Grafting	Apple (on seedling RS)	30, 000
	Apple on clonal root stock	19,000
	Peach	3,500
	Apricot	2,500
	Almond	1,500
	Cherry	3,900
	Pear	2,700
	Walnut	17,000
	Total	**80,100**
Budding	Almond	6,650
	Peach	2,800
	Apricot	1,870
	Cherry	1,130
Total		**12,450**
Runners	Strawberry	25,000
Seed	Vegetable seed	5.5 quintals

Energy harvest through plant architectural engineering for increasing source and sink relationship in apple

In apple 3 cultivars (Coe Red Fuji, Granny Smith and Spartan on M-9 rootstock) with three training system (espalier, cordon and vertical axis) were compared to recommend best training system and cultivar for increasing source and sink relationship through plant arthitectural engineering and results are presented in Table 16. Among cultivars, maximum fruit weight was observed in Granny Smith and yield efficiency (0.69) was observed in Coe Red Fuji. Among training systems maximum weight and yield efficiency was observed in espalier training system. The interaction showed that cultivar Granny Smith gave highest fruit weight under Espalier system while maximum yield per tree was observed in cultivar Coe Red Fuji on Espalier system. Maximum yield efficiency was observed in variety Spartan on espalier training system. Therefore espalier training system is the best training system for all the varieties under study to increase productivity with quality produce.

Table 16. Performance of apple varieties on different training system in apple

Treatments	TCSA (cm2)	Fruit wt (g)	Yield (kg/tree)	YE (kg/cm2)
Cultivars				
Coe Red Fuji (V1)	46.33	181.55	32.11	0.69
Granny Smith (V2)	40.45	210.11	25.65	0.63
Spartan (V3)	36.99	189.43	24.55	0.66
CD at 5%	*3.88*	*6.77*	*5.21*	*NS*
Training system				
Espalier (T1)	50.31	200.12	36.36	0.72
Vertical axis (T2)	40.12	188.64	27.83	0.69
Cordon (T3)	36.40	181.28	24.19	0.66
CD at 5%	*5.22*	*7.33*	*6.11*	*0.12*
Interaction				
V1T1	48.00	185.22	32.16	0.67
V1T2	40.34	176.23	21.12	0.52
V1T3	41.12	170.36	23.13	0.56
V2T1	45.12	210.55	28.17	0.62
V2T2	38.11	200.12	17.17	0.45
V2T3	28.15	198.20	15.56	0.55
V3T1	42.12	192.21	30.12	0.72
V3T2	31.12	165.23	17.24	0.55
V3T3	32.33	174.22	14.54	0.45
CD at 5%	*6.55*	*8.99*	*6.44*	0.44

Influence of light intensity on different quality parameters in apple under different training systems was also recorded and presented in Table 17. Maximum photon flux density (237 $\mu molm^{-2}s^{-1}$) was observed across the canopy of Spartan with minimum leaf area index (0.30) and among training systems maximum PPFD (221 $\mu molm^{-2}s^{-1}$) was observed in espalier system with minimum LAI (0.21). All the cultivar showed maximum PPFD values under espalier system and gave better quality fruits as revealed by higher TSS and color quality parameters. Leaf area index was inversely proportional to PPFD values.

Table 17. Influence of light intensity on different quality parameters in apple

Cultivars/ Training system	Light parameters			LAI	Color parameters				TSS °B
	PPFD µmolm^{-2}s^{-1}	PPFD (%)	DLI (Mol/ m^{2}day)	LAI	L	a	b	Tint	
Cultivars									
Coe Red Fuji (V1)	172	29.6	8.60	0.33	54.78	10.3	22.2	-59.11	14.10
Granny Smith (V2)	192	38.4	9.67	0.38	71.14	-10.02	32.98	10.00	10.20
Spartan (V3)	237	45.5	11.9	0.30	51.66	24.60	20.34	-88.44	12.50
CD (5%)	***6.2***	***3.1***	***1.1***	***0.03***	***1.23***	***1.10***	***2.33***	***4.56***	***1.11***
Training system									
Vertical axis (T1)	196	22.2	9.87	0.46	42.18	8.70	24.7	-30.11	12.55
Espalier (T2)	221	36.8	11.12	0.21	65.20	6.30	34.65	-20.55	16.24
Cordon (T3)	200	25.7	10.08	0.22	55.24	14.8	22.50	-33.25	13.25
CD (5%)	***5.4***	***3.4***	***1.1***	***0.04***	***1.22***	***1.68***	***2.00***	***4.55***	***1.12***
Interaction									
V1T1	179.9	20.54	9.07	0.42	50.12	11.20	2012	-58.88	13.20
V1T2	194	23.31	9.78	0.28	65.12	8.80	26.23	-59.76	15.40
V1T3	172.6	20.02	8.7	0.28	56.13	10.32	22.34	-58.21	14.20
V2T1	183.13	22.07	9.23	0.54	65.24	-10.22	30.99	10.50	9.55
V2T2	198.6	24.11	10.01	0.32	78.12	-10.31	34.88	10.75	11.10
V2T3	180.75	21.12	9.11	0.34	71.11	-10.00	32.60	9.20	10.30
V3T1	207.7	27.00	10.47	0.45	50.36	23.10	21.14	-86.27	11.20
V3T2	**227**	29.89	11.4	0.32	54.46	26.20	20.00	-90.24	13.80
V3T3	200.9	24.21	10.13	0.34	51.34	24.33	20.22	-87.46	12.20
CD (5%)	***4.33***	***1.11***	***1.11***	***0.03***	***0.22***	***2.11***	***0.88***	***3.22***	***0.66***

Effect of various training and pruning systems in Persian walnut

Among four training system, maximum nut efficiency (0.719 nuts/cm^2) was recorded in Central leader system while branching density was recorded more (6.5/m) in Multi leader system. Maximum nut weight (14.95 g) and kernel percentage (55.34%) was recorded in Open Centre system of training. In different levels of thinning, significant differences were recorded in nut efficiency over control. Maximum nut efficiency (1.56 nuts/cm^2) was recorded at 20% closely followed by 10% thinning regularly (1.465 nuts/cm^2). Maximum branching density (5.3/m) was produced by 30% regular thinning. Maximum nut weight (14.76 g) was recorded at 20% thinning regularly while kernel percentage was more (54.38%) at 30% thinning in alternate years. Maximum nut efficiency (0.7 313 nuts/ cm^2) was recorded at 20% heading back regularly. The branching density was more (6.6/m) at 30% heading back on alternate years. Heaviest nuts (17.11 g) were produced by 10% heading back at alternate years. The maximum kernel percentage (52.86%) was recorded at 30% heading back in

alternate years. In combined effect of thinning + heading back, maximum nut efficiency (0.941 nuts/cm^2) was recorded at 10 + 10% thinning + heading back. The highest branching density was recorded at 30 + 30% thinning + heading back in alternate years. The thinning + heading back at 10 + 10% in alternate years gave maximum nut size of (13.54g). The maximum kernel percentage was recorded at 30 + 30% thinning + heading back in alternate years.

Enhancing alstroemeria production involving different growing conditions

Two growing condition and nine cultivars were compared for various growth parameters and returns in alstroemeria. The polyhouse conditions were found best for continuous supply of cut flowers from April to December. In open conditions flowering was observed from May to October. Cultivar Rosita excel all cultivars as far as flower production (58.8 flowers/plant) is concerned while under open condition cultivar, Alladin and Pluto gave yield of (32.3 flowers/plant). The cultivar Tiara gave maximum vase life (26.45 days) followed by Rosita (24.83 days).

Among various planting distances and methods, planting of Alstroemeria at 45 x 60 cm distance on raised bed gave maximum flower yield (40.64/plant) and rhizome weight (1656g/plant). Hence raised bed planting at a distance of 45 x 60 cm can be recommended. For planting material production, different growing media were tried including FYM, cocopeat, perlite and vermiculite. So media containing soil + sand + FYM gave maximum rhizome weight (1945g/plant) followed by media containing soil+vermiculite (1615g/plant). The thinning of shoots upto 15% was found better without reducing the flower yield in alstroemeria after third year. The thinning levels varies from cultivar to cultivar. The rhizome weight increased with the increase in level of thinning. The repeated occurrence of a new disorder (rossetting) was also observed in few plants in few cultivars during spring and early winters.

Development of almond based saffron inter cropping system

In almond based saffron intercropping, poor yield was recorded in saffron due to rains and fluctuation in temperature in this year. Maximum saffron yield (0.832 kg/ha) was recorded in saffron sole, followed by saffron + erect type of almond cultivar (0.745 kg), saffron + semi erect almond cultivar (0.683 kg/ha) and saffron + dropping type of almond cultivar (0.513 kg/ha). Maximum almond yield (12.49 q/ha) and saffron equivalent yield (1.932 kg/ha) was recorded in saffron + semi erect type of almond cultivar.

Aquatic Dissipate/waste management through vermitechnology

Vermicompost from aquatic waste was prepared and was analyzed for twenty eight elements including macro and micro nutrients as well as heavy metals. Vermicompost prepared from aquatic dissipate/waste was analyzed for carbon nitrogen ratio and proportion of aquatic dissipate to vermiculture to get utmost economic returns through quality vermicompost preparation was standardized (Fig. 17). It was observed that lowest C:N ratio (15.94) was in vermicompost where the ratio of dissipate to worm was 15:1 (*i.e.* 7.5 kg aquatic dissipate + 0.5 kg earthworm). It was further observed that amount of vermicompost prepared was highest in treatment where AD to worm ratio was 18:1 but it was at par with the

Flowering in alstroemeria cultivar Rosita

treatment, where the ratio was 15:1 (Fig. 18). Elevation in earthworm count and weight as influenced by different quantities of aquatic waste was also assessed. It was observed that earth worm count and weight increased in treatment where the proportion of aquatic dissipates to worms was 15:1(Table 18). Experiment was repeated for three years and it was concluded that AD:W ratio of 15:1 is the best proportion to get utmost benefit in terms of quantity, quality, worm count and economic returns from aquatic waste.

Table 18. Vermiculture weight and worm count as influenced by worm dissipate proportion

Treatment	Vermiculture weight (kg)	Worm Count
	2015-16	2015-16
No AD, +W	0.84	358
2 kg AD, +W	2.81	568
3 kg AD, + W	2.66	571
4 kg AD, +W	3.42	856
5 kg AD, + W	3.54	812
7.5 kg AD, + W	3.75	938
9.0 kg AD, + W	3.74	942
CD at 5%	***0.15***	***25***

Initial Weight = 0.5 kg
Initial Count = 300
AD: Aquatic dissipate; W: Earthworm

Divulging the adept mode of fertilizer application to optimize saffron yield.

Different modes of fertilizer application were followed to fertilize saffron. Effect of these modes on saffron yield was revealed. Fertilizer application through different modes revealed that maximum yield was in treatment where fertilizer was applied through mid rib placement upper to corms in two splits. The significant impact on corm multiplication was also noticed in the same treatment. Different modes of followed fertilizer application were broad casting, band placement and foliar fertigation. It was further noticed that saffron yield (Table 19) in CS1 (corm size < 10g) ranged between 0.41 to 0.57 kg ha^{-1} with highest yield in mid rib placement upper to corm; where as in CS2 (corm size > 10g), the yield ranged between 0.95 to 1.28 kg ha^{-1} with highest being in mid rib with parallel placement. On studying the corm multiplication rate of three years it was noticed that corm multiplication elevated by 75 and 90% in CS1 and CS2 (Fig. 19). Besides column studies were also done to reveal the pollution potential of the identified best mode of fertilizer application (Fig. 20). It was observed that when nitrogenous fertilizer was applied through different splits in midrib placement upper to corms, the method in which two splits were followed was having least pollution potential. Finally it can be concluded that midrib placement upper to corms in two

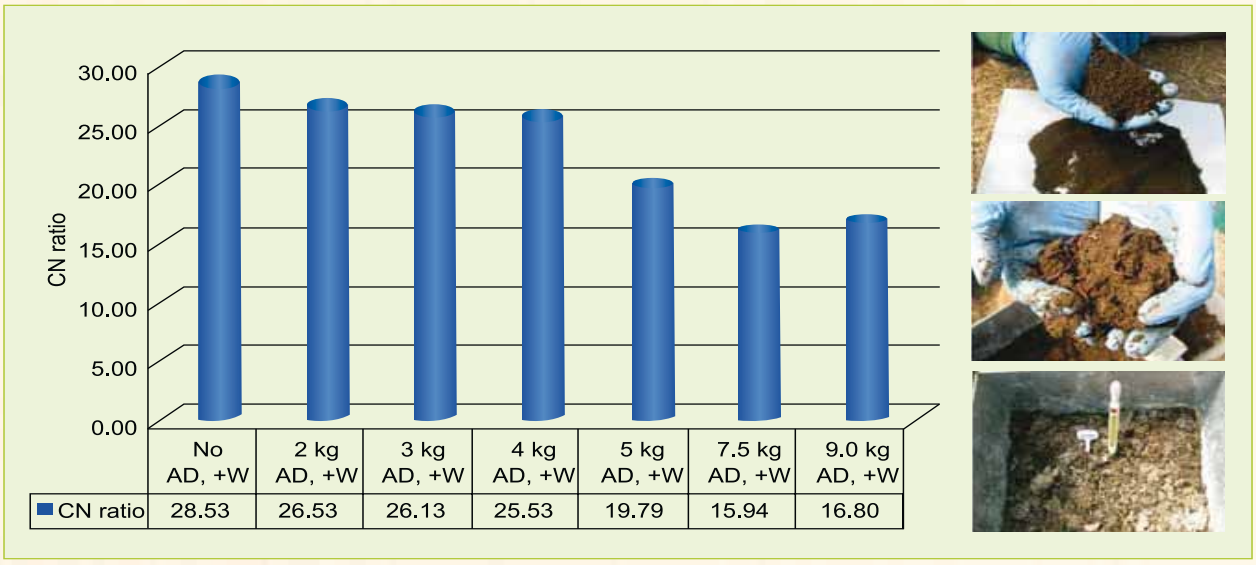


Fig. 17. CN ratio of vermicompost prepared as influenced by worm-dissipates proportion. (AD: Aquatic dissipate; W: Earthworm)

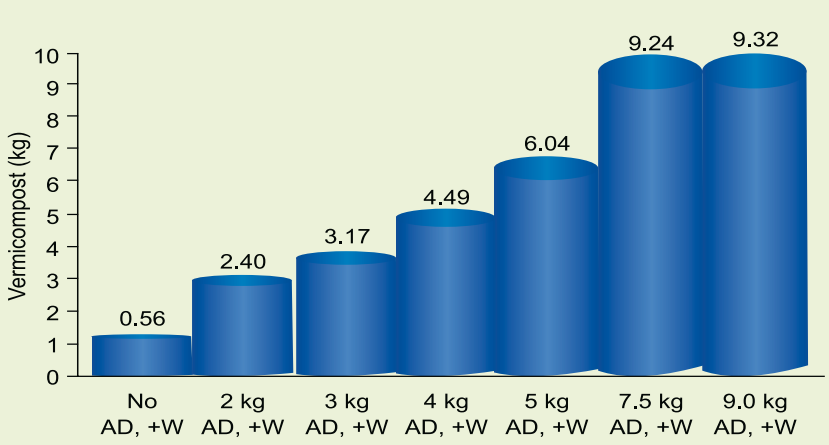


Fig. 18. Vermicompost as influenced by worm-dissipate proportion. (AD: Aquatic dissipate; W: Earthworm)

splits is the best mode of fertilizer application in saffron growing soils to get utmost returns without polluting the environment

Table 19. Saffron yield (kg ha^{-1}) as influenced by different modes of fertilizer application

Treatments	CS1	CS2
	2015-16	2015-16
C	0.41	0.95
B	0.47	1.10
BPSSP	0.48	1.15
BPSSU	0.56	1.21
MRPP	0.59	1.31
MRPU	0.62	1.39
FA	0.57	1.28
CD at 5%	0.02	0.07

C: Control; B: Broadcasting; BPSSP: Band placement Single sided and parallel
BPSSU: Band placement Single sided and up; MRPP: Mid rib placement parallel
MRPU: Mid rib placement up; FA: Foliar application
CS1: Corm size = 5-7g; CS2: Corm size =8-10 gC: Control

Fertigation: An efficient soil management stratagem for escalating nutrient and water use efficiency.

Effect of various fertigation treatments on fruit yield of apple was studied. Highest fruit yield of 28.78 kg tree^{-1} (Fig. 21) was noticed in fertigation treatment where 75% of the recommended fertilizer was applied in two splits followed by

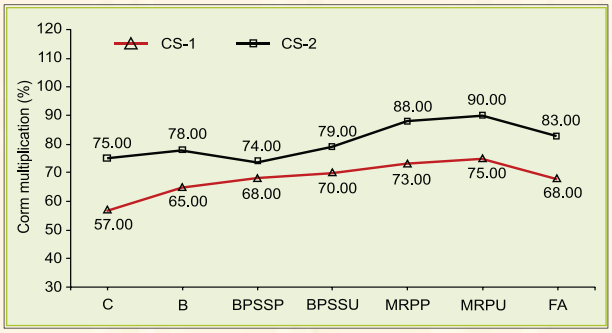
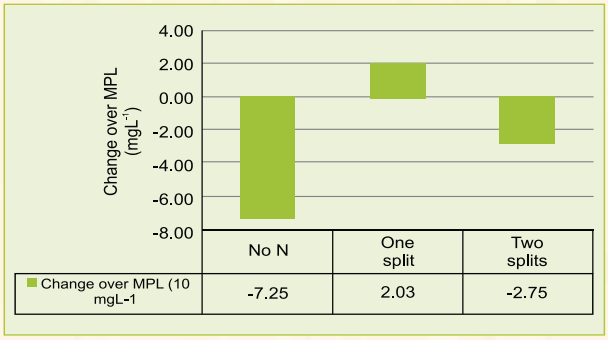


Fig. 19. Per cent corm elevation as influenced by fertilizer application through different modes



Maximum permissible limit (MPL) of Nitrate in ground water = 10 mg L-1

Fig. 20. Polluting potential of nitrogenous fertilizer application in different splits through midrib placement upper to corms in saffron growing soils.

recommended fertilizer in two splits (27.85 kg Tree^{-1}). Fertilizer use efficiency as well as water use efficiency as influenced by various fertigation treatments was also studied. It was observed that 75% of the recommended fertilizer application through fertigation is the best way to fertilize apple crop to get maximum yield as well as FUE

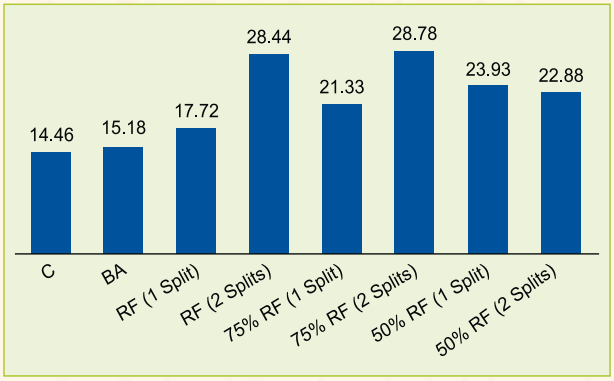


Fig. 21. Apple fruit yield (t/ha) as influenced by fertigation treatments
C: Control ; BA: Basal application; RF: Recommended fertilizer (through fertigation)

Micronutrient management in horticultural crops for enhancement of yield, nutrient content and quality

Micronutrient status of surface as well as sub-surface soils of apple growing areas of Kashmir was studied. It was revealed that soils were sufficient in copper and iron but were deficit in manganese and zinc (Fig. 22).

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

In this experiment apple orchard was intercropped with pea and cauliflower along with four different treatment combinations comprising FYM + Inorganic (recommended dose), FYM + Vermi-compost + Inorganic, FYM + Vermi-compost + Bio-fertilizers + Inorganic and FYM + Inorganic (half of the recommended doses). In both the intercrops treatment comprising FYM + Vermi-compost + Bio-fertilizer + Inorganic registered highest average yield per tree as compared to other treatments (Table 20). This treatment also significantly improved the fruit qualities like TSS. In intercrops recorded data, the treatment comprising of FYM + Vermi-compost + Biofertilizer + Inorganics was found best in both pea and cauliflower intercrops in apple orchard exhibiting highest growth and yield followed by FYM + Vermi-compost + Inorganics treatment (Table 21).

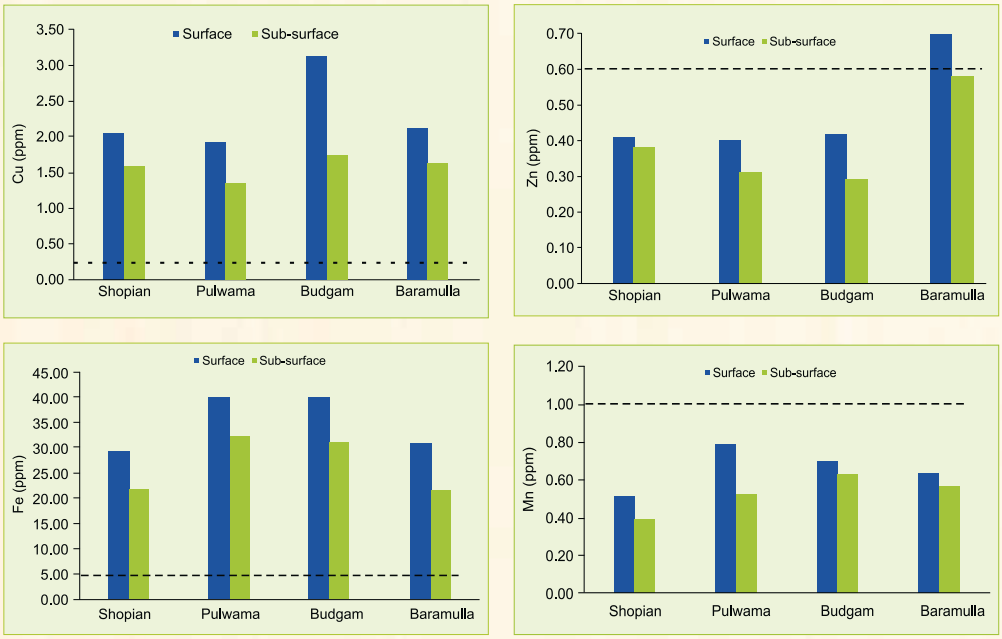


Fig. 22. Micronutrient status of apple growing soils of Kashmir

Intercropping with cauliflower var. Snow Crown and pea var. VL-7 under apple orchard

Table 20. Effect of INM and intercrops on fruit quality and yield of apple

Treatments	Intercrop- cauliflower						Intercrop-pea					
	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit firmness (Ib/ inch^2)	Fruit TSS (^{0}B)	Yield (kg/ tree)	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit firmness (Ib/inch^2)	Fruit TSS (^{0}B)	Yield (kg/ tree)
Apple sole	54.97	64.61	130.70	9.03	10.28	29.14	59.43	66.76	132.68	10.14	13.91	31.18
FYM + Inorganic (Recommended)	57.18	66.58	139.25	10.46	10.76	28.75	58.65	66.69	131.62	9.45	13.67	30.85
FYM + Vermicompost + Inorganic	58.91	67.71	147.50	11.37	11.83	33.25	62.70	67.73	135.04	9.84	14.17	35.98
FYM + Vermicompost + biofertilizer + Inorganic	61.94	69.23	156.75	12.40	12.44	36.30	65.72	72.13	150.51	11.08	14.59	39.07
FYM + Inorganic (half of the recommended doses)	54.80	66.81	128.33	9.49	9.87	28.58	57.70	64.58	126.26	8.94	12.20	30.58
CD at 5%	**3.97**	**3.31**	**14.05**	**1.30**	**1.05**	**1.68**	**3.97**	**5.68**	**25.22**	**2.15**	**1.36**	**1.12**

Table 21. Effect of INM on growth and yield of intercrops under apple orchard

Treatment	Cauliflower					Pea			
	Plant height (cm)	No. of leaves/plant	Curd diameter (cm)	Curd weight (g)	Yield (q/ha)	Plant height (cm)	No. of branches/ plant	Pod length (cm)	Yield (q/ha)
FYM + Inorganic (Recommended)	42.50	15.46	16.09	400.66	156.66	77.36	10.99	8.79	44.74
FYM + Vermicompost + Inorganic	42.90	16.33	17.11	505.66	196.66	74.19	11.63	8.97	51.50
FYM + Vermicompost + Biofertilizer + Inorganic	43.88	17.46	19.14	524.66	282.21	78.71	12.47	9.68	61.72
FYM + Inorganic (half of the recommended doses)	41.38	15.13	15.22	329.66	124.44	69.9	9.44	7.63	34.72
C D at 5%	**3.02**	**2.12**	**1.84**	**28.66**	**13.90**	**0.72**	**0.45**	**0.57**	**1.09**

Standardization of growing/nutrients media for cost effective production of quality vegetable seedlings under protected conditions

Different growth medium *viz.*, vermicompost, farm yard manure, forest litter were analyzed for their nutrient status and microbial growth.

Table 22. Total microbial population in different substrate

Medium	Bacteria (cfu)10^6		Fungi (cfu)10^4		Actinomycetes (cfu)10^5	
	4th Day	7th Day	4th Day	7th Day	4th Day	7th Day
FYM	*20.66*	*31.66*	*53.33*	*70*	*25*	*42.66*
Vermicompost	*18.66*	*32.33*	*48.33*	*61.66*	*29.66*	*44*
Soil	*15.33*	*30.33*	*50*	*61.66*	*28*	*38.66*
Forest litter	*18.66*	*31.33*	*33.33*	*54.66*	*26.66*	*40.33*

Vegetable nursery production with different growing media

In general, FYM possessed more organic matter (66.28%) and organic carbon (38.45%) as compared to other nutrient medium followed by vermicompost (40.96%) and forest litter (23.76%) respctively.

The maximum fungi and actinomycetes count was observed at 7th day of inoculation in FYM media *i.e.* 70 x 10^4 and 42.66 x 10^5, respectively. However, the maximum bacterial count (32.33 x 10^6) was recorded at 7th day of inoculation in vermicompost medium (Table 22).

Seeds of targeted vegetable crops *viz.*, tomato cv. VL-4, capsicum cv. California Wonder, cucumber cv. Local were sown in pro trays and poly bags containing various media combinatios (sole soil, FYM, vermicompost, forest litter and their combinations *viz.*, soil + FYM (1:1), soil+vermicompost (1:1), soil+forest litter (1:1), FYM+vermicompost (1:1), FYM+forest litter (1:1), soil+FYM+vermicompost (1:1:1), FYM+vermicompost+forest litter (1:1:1) and soil+FYM+vermicompost+forest litter (1:1:1:1).

Crop diversification technology for round the year vegetable crops under protected conditions in mid and high hills of Uttarakhand

To see the possibility of round the year production of major vegetables, different genotypes/varieties were tried to screen varieties for particular season. In tomato thirty two genotypes and varieties of tomato were evaluated for their growth, yield and quality parameters. Most of lines exhibited significant differences for various growth, yield and quality parameters. Among the genotypes and hybrid varieties maximum total number of fruits/plant (69.83) were recorded in Hawat-4 and minimum (17.66) in HDT-1927. However, maximum average fruit weight 138.33 g in DVRT-1 and lowest (10.66 g) in genotype 6907. Average fruit yield per plant ranged from 0.17 kg (CITH RS CT-2) to 5.078 kg (VL-4). The highest polar and equatorial diameter was recorded in Shahenshah (57.92 mm) and HDT-1927 (61.43 mm). Maximum TSS (8.30 °B) was recorded in genotype 6907.

In capsicum, seven genotypes were evaluated for growth, yield and quality parameters. Most of lines exhibited significant differences for various growth, yield and quality parameters. Among the genotypes and hybrid varieties, maximum plant height (104.21 cm) was recorded in Spanic Paprika and lowest (41.57 cm) in Sweet Joy. The highest number of fruits/plant (30.71) were produced by SP-643-3. However, maximum average fruit yield per plant (3.11 kg) was recorded in SP-643-3. The variation in maximum number of branch per plant (7.83) was recorded in GPC-1. The maximum branch length (79.16 cm) was recorded in SP-650.

Fourteen varieties/hybrids of tomato (VL-4, Marglobe, Roma, Sioux, DVRT-1, S-I, S-II, Pant T-1, Pusa Sheetal, Pusa Sadabahr, SH-TH-1, SH-TH-2, Manisha, Himsona) and 21 capsicum (California Wonder, Yello Wonder, Solan Bharpur, Nishat-1, SH-SP-461, CITH-Sel-2, 4 & 5; SP-643-3, Sel-2, 3, 4 & 5; UHF-1, Pusa Deepti, Yamuna, Indira, Orbelle, Bombay, VLSM-3, Lucky Star) were planted at farmers field.

Characterization of Soil and Nutritional Survey in Apple and Peach Growing Areas of Uttarakhand

To assess the nutrient status of soils of CITH, RS Mukteshwar farm, sample were collected and analyzed for micro nutrient status. The soil of this station is found to be deficient in available Zn. The available Zn level decreased with the increase in soil depth. In majority, there were no significant differences among available Zn levels between same soil depths of different soil profiles within a particular block. The available Cu levels in all of the investigated soil depths were found to be well above the critical limit of 0.2 mg kg^{-1} soil. Hence, the soil of this station is said to be sufficient in terms of available Cu. However, like Zn, Cu levels also decreased with the increase in soil depth.The available Fe levels in all of the investigated soil depths were found to be well above the critical limit of 4.5 mg kg^{-1} soil. Hence, the soil of this station is said to be sufficient in terms of available Fe for sustainable plant growth. Like other micronutrients, Fe levels also decreased with the increase in soil depth. In majority, there were no significant differences among available Fe levels between same soil depths of different soil profiles within a particular block. Like other micronutrients, Mn levels also decreased with the increase in soil depth. The available Mn levels in all of the investigated soil depths were found to be well above the critical limit of 2.0 mg kg^{-1} soil. Hence, the soil of this station is said to be sufficient in terms of available Mn for sustainable plant growth.

A view of tomato and capsicum crop at Mukteshwar

III. Crop protection

Study of bio-ecology and management of aphid and mite pests in temperate fruits

The population density and life cycle of the European red mite, *Panonychus ulmi*, small walnut aphids and peach stem aphid *Pterochloroides persicae* were studied. Twenty one species of predatory coccinellids were collected, identified and documented on different sucking pests. The natural enemies of *Panonychus ulmi* includes Coccinellids *Adalia tetraspilota, Calvia punctate*, *Priscibrumus uropygialis*, *Hippodomia variegata*, *Stethorus aptus*, *Coccinella septumpunctata*, *Oenopia conglobata*, *Halyzia sanscita*, *Serangium montazerii* and anthocorid bug. Predatory potential of five dominant coccinellids were studied. Among these, *Stethorus aptus* and *Calvia punctata* fed 48.34 and 49.34 mites/day, respectively. Among the miticide evaluated against ERM, Fenzaquine (0.002%) was found effective, followed by Fenpyrioximate (0.005%). The peach stem aphid species *Pterochloroides persicae* was found infesting almond, peach and plum. Overwintering eggs start emerging on 2nd week of March, single generation last for about 31-68 days, 15-56 nymph produced per female and over-wintering eggs were laid from 2nd week of November to late December. For the management of peach stem aphid on almond, NSKE @ 5% was found effective for its management. An experiment was also conducted for management of peach leaf curl disease. Among the various treatments, fungicides captan (0.05%) was found effective against leaf curl disease followed by haxoconazole (0.05%) at bud swell stage. Walnut aphid, *Callaphis juglandis* population density were also recorded on weekly interval at CITH. The pest population reached at peak i.e. 56.54 aphids/ leaf during first week of July. The Coccinellids predators were found effective to reduce the walnut aphid population naturally, which includes *Calvia punctata*, *Harmonia eucharis*, *Priscibrumus uropygialis*, *Coccinella septumpunctata*, *Adalia tetraspilota* and *Oenopia conglobata*. Among these, *Harmonia eucharis* was most abundant species and was present in six different colour morphs.

Outreach programme on Management of sucking pests in horticultural crops

Sucking pests of temperate fruit crops in Jammu and Kashmir

Survey, collection and documentation of sucking pest complex have been carried out in different orchards in six districts of Jammu and Kashmir. The collected specimens were properly labelled along with GPS data and stored. Some of specimens species identity have been confirmed by sending specimens to various institutes. The major pest species of temperate fruit crops observed for their incidence and severity include; *Quadraspidiotus perniciosus, Eriosoma lanigerum, Panonychus ulmi, Tetranychus urticae, Cacopsylla pyri* and *Eriophyes erineus*. Preliminary analysis reveal that in apple (14.28%) and almond (12.5%), *Panonychus ulmi* was the most severe sucking pest species followed by *Quadraspidiotus perniciosus* in apple (12.28%) and *Tetranychus urticae* in almond (9.25%). In case of Walnut most severe damage is inflicted by *Chromaphis juglandicola* (22.64%) followed by *Eriophyes erineus* (13.23%). Pear psyllid, *Cacopsylla pyri* was observed the most serious pest of the pear (23.33%). Field identification guide for major sucking pests of temperate horticultural crops was also prepared. Biology of pear psyllid *Caopsylla pyri* on pear, two spotted mite *Tetranychus urticae* on almond and coccinellid predator *Adalia tetraspilota* on *Aphis pomi* were studied.

For screening and evaluation of effective and safe pesticides**,** trials were carried out to screen the effective and safe chemicals (botanicals + dehydrating agents + oils) against peach stem aphid, *Pterochloroides persicae* and walnut aphid, *Chromaphis juglandicola* at various concentrations. In case of *Chromaphis juglandicola* 14 combinations were tried, among which NSKE (7.5ml) + Rosemary (0.1 ml) + Soybean oil (10 ml) with soap solution (10ml) / litre of water was found most effective. Among the 15 chemical combinations evaluated against *Pterochloroides persicae,* combination of rosemary oil (0.03 ml) + lavender oil (0.03 ml) + soybean oil + soap (10ml)/litre of water proved most

efficient. The overwinter stages of sucking pests of temperate horticultual crops were also surveyed and documated.

Woolly apple aphid (*Eriosoma lanigerum*)

San Jose Scale (*Quadraspidiotus perniciosus*)

European red mite (*Panonychus ulmi*)

Pear psyllid (*Caopsylla pyri*)

Consortium research platform on borers

Borers of temperate fruits in Jammu and Kashmir

Survey and collection were carried out from 133 localities falling in eight districts namely Srinagar, Ganderbal, Baramulla, Shopian, Pulwama, Budgam, Kargil and Leh during 2015. Total 1508 specimens were collected and out of these 532 specimens belong to the order Coleoptera, 43 specimens under Lepidoptera and 59 under Hymenoptera. For identification, borer specimens and their natural enemies were sent to NBAII and other institutions. Photographs of different life stages (egg, larva, pupa and adult) of different borers along with damage symptoms were also captured. Preliminary data reveals that, infestation of flat headed borer (FHB) was severe in cherry at Ganderbal (61.12%) followed by Budgam (13.04%) and Baramulla (8.48%) districts. In case of shot hole borer (SHB), 66.50% infestation was observed in district Shopian, followed by Ganderbal (23%). As far as apple stem borer concerned, very sever infestation was recorded in Shopian (11.03%) and Baramulla (6.32%). However in Ladakh region, codling moth (*Cydia pomonella*) exhibiting a total of 84.81% and 64.22% fruit damage in apple and apricot, respectively. Biological studies of shot hole borer on almond and plum, flat headed borer on cherry has been undertaken under laboratory as well as in field condition. In addition to this, studies on walnut fruit borer, brinjal shoot and fruit borer, and pomegranate fruit borer were initiated. In case of natural enemies concerned, parasitoids of borer infesting on cherry, grapes, pomegranate and apple were critically observed. Parasitoids after depositing their eggs into the borer eggs and larvae were collected and reared in laboratory till adult emergence. Different monitoring techniques *viz*., light traps, ethanol or methanol trap, log wood traps were utilized for the collection and monitoring of different types of borers. Management strategies *viz*., sealer-cum-healer (organic and inorganic), and chemical pesticides include drenching with Chloropyriphos (3ml/L) + Carbendazim (1g/L) and Imidachlorpid (1ml/L) + Carbendazim (1g/L) were carried out in cherry and almond after fruit harvest during last year.

Aeolesthes sp.

Sphenoptera sp.

Scolytidae

Codling moth (*Cydia pomonella*) damage in apple

Codling moth (*Cydia pomonella*) damage in apricot

Walnut Moth (*Garella ruficirra*) damage

ORP on Fungal Foliar Diseases

Incidence and intensity of alternaria leaf spot (*Alternaria mali*) of apple at various districts

The survey was conducted in nine districts of Kashmir and 5 locations were selected from each district. Highest disease incidence (46.23%) and intensity (19.51%) were recorded in district Kulgam followed by district Budgam with 32.78 & 12.28% incidence and intensity respectively. Lowest disease incidence and intensity (10.38 & 4.04%) were recorded in district Srinagar (Table 23). The hyphae were light brown to brown, septate, straight, branched, and their average width ranged from 7.20 µm (Delicious at Potkha, Baramulla) to 8.89 µm (Golden Delicious at Badoora, Anantnag). The highest (39.31 µm) and the lowest (19.87 µm) inter septal distance was recorded in (Gala Mast at Zanipora, Shopian) and (Delicious at Potkha, Baramulla), respectively. The conidia were brown to dark brown, muriform in shape, sometimes formed in catenation, with 0 - 7 transverse and 0-4 longitudinal septa and their average length ranged from 22.54 µm (Golden Delicious at Badoora, Anantnag) to 28.08 µm (Gala Mast at Zanipora, Shopian). However, the highest (19.82 µm) and the lowest (13.33 µm) average conidial width was recorded in Golden Delicious at Badoora, Anantnag and Delicious at Kokarnag, Anantnag, respectively. The conidial beak was brown, short, aseptate, and its average length ranged from 7.25 µm (Grany Smith at Pombay, Kulgam) to 10.46 µm (Delicious at Zoram, Shopian). The conidiophores were light brown, short, cylindrical, with average length ranging from 13.12 µm (Delicious at Potkha, Baramulla) to 21.37 µm (Delicious at Kokarnag, Anantnag). The highest radial mycelia growth of 5.09 was attained from isolate (Grany Smith at Pombay, Kulgam), and the lowest of 2.80 was recorded in (Golden Delicious at Badoora, Anantnag) after seven days of inoculation (Table 24).

Table 23. District wise incidence and intensity of alternaria leaf spot

District	Mean disease incidence (%)	Mean disease intensity (%)
Anantnag	23.42	9.74
Baramulla	17.53	7.12
Budgam	32.78	12.28
Kulgam	46.23	19.51
Ganderbal	11.95	4.32
Pulwama	16.44	6.97
Shopain	20.09	8.65
Srinagar	10 38	4.04
Kupwara	18.68	7.63

Table 24. Variability in the hyphae, conidia and conidiophores of *Alternaria mali* isolates

(Length in microns)

Isolate	Hyphal width	Inter septal distance	Conidial length	Conidial width	Conidial beak	Conidiophore length	Radial mycelia growth (cm) after 7 days
DelKA	8.12	34.52	25.85	13.33	7.80	21.37	2.90
DelKB	8.87	22.98	25.06	16.50	9.49	14.73	3.65
DelPBZ	7.20	19.87	24.41	14.39	10.00	13.12	3.33
DelZS	7.88	27.42	23.88	16.12	10.46	17.52	5.05
GMS	6.92	39.31	28.08	14.67	9.74	18.08	4.81
GdBA	8.89	32.89	22.54	19.82	10.29	14.93	2.80
GSPK	7.90	30.16	26.43	15.12	7.25	16.52	5.09

Development of Spray Schedule against Major Canker and Foliar Diseases of Apple in Uttarakhand

Influence of weather parameters on major canker and foliar diseases in apple

Epidemiological studies

The effect of different weather parameters on development of major canker, foliar and fruit diseases of apple was studied and a definite relationship was observed between major diseases of apple and the prevailing temperature, relative humidity and rainfall pattern. Observation on the severity of apple diseases was made from the month of 1st January, 2015 to 30th September. For an instance as per the history of powdery mildew disease appearance in the Uttarakhand and other apple growing areas of India, it appears on the terminal ends of apple trees in the month of March, however in this year only it appeared in the month of May. Overall severity of major canker and foliar diseases of apple kept on increasing till the leaf fall occurs. However, it was recorded highest during the months of July and August when average relative humidity was found maximum i.e. 91-93 per cent. During the period under report, major canker and foliar diseases of apple progressed rapidly during the month of July where, monthly average minimum temperature of 15^{0}C, maximum temperature of 20.60^{0}C, relative humidity of 93% and rainfall of 280.80 mm was recorded.

Correlation studies

Correlation studies revealed a positive correlation between severity of major cankers and foliar diseases of apple and abiotic factors *viz*., average minimum and maximum temperature, relative humidity and rainfall (Table 25). Relative humidity showed significant effect on the severity of major canker and foliar diseases of apple during the period under report. Papery bark canker and Alternaria leaf spot diseases exhibited highly significant correlation (r=0.819 and r=0.835 respectively) with average relative humidity, whereas, stem black canker, smoky blight canker, Marssonina blight and powdery mildew diseases exhibited significant correlation (r=0.731, r=0.762, r=0.794 and r=0.794 respectively) with average relative humidity. Major canker and foliar diseases of apple also showed strong relationship with average minimum temperature. Papery bark canker, smoky blight canker and powdery mildew diseases exhibited highly significant correlation (r=0.803, r=0.820 and r=0.839 respectively) with average minimum temperature, whereas *Alternaria* leaf spot disease showed significant correlation (r=0.702) with average minimum temperature.

Multiple regression equations

The coefficient of multiple determination (R^2) was calculated (Table 26) as 0.767- 0.917 for major canker and foliar diseases of apple which signifies that 76.70 – 91.70 per cent variation in per cent

severity of major canker and foliar diseases dependent on weather parameters included in these studies. From this study it can be concluded that weather parameters are strongly influenced the disease occurrence on apple crop in Nainital district of Uttarakhand.

Table 25. Simple correlation between weather parameters and severity of major canker and foliar diseases of apple in Nainital district of Uttrakhand

Parameter	Simple correlation coefficient					
	Canker diseases			Foliar diseases		
	Papery bark	Stem black	Smoky blight	Marssonina blight	Alternaria leaf spot	Powdery mildew
Minimum temperature (^{0}C)	0.803**	0.555	0.820**	0.615	0.702*	0.839**
Maximum temperature (^{0}C)	0.606	0.369	0.663	0.413	0.479	0.648
Relative humidity (%)	0.819**	0.731*	0.762*	0.794*	0.835**	0.794*
Rainfall (mm)	0.287	0.127	0.238	0.227	0.298	0.328

Where; *- Correlation is significant, **- Correlation is highly significant

Table 26. Multiple regression equation indicating relationship among weather parameters and severity of major canker and foliar diseases of apple in Nainital district of Uttrakhand

Regression equations	R^2
Y_1 (PB) = -9.23 + 2.82 X_1(Tmi) – 1.56 X_2 (Tma) + 0.46 X_3 (RH) - 0.07 X_4 (Rn)	91.70
Y_2 (SB) = -19.18 + 0.091 X_1 (Tmi) + 0.049 X_2 (Tma)+ 0.385 X_3 (RH) - 0.04 X_4 (Rn)	76.70
Y_3 (SmB) = -23.17 + 1.257 X_1 (Tmi) – 0.129 X_2 (Tma) + 0.465 X_3 (RH) + 0.055 X_4 (Rn)	88.40
Y_4 (MB) = -69.33 + 1.449 X_1 (Tmi) – 0.60 X_2 (Tma) + 1.499 X_3 (RH) - 0.147 X_4 (Rn)	80.30
Y_5 (ALS) = -26.04 + 2.93 X_1 (Tmi) – 1.82 X_2 (Tma) + 0.85 X_3 (RH) - 0.099 X_4 (Rn)	85.90
Y_6 (PM) = 15.93 + 4.80 X_1(Tmi) – 3.04 X_2 (Tma) + 0.226 X_3 (RH) + 0.068 X_4 (Rn)	89.80

Where;

Y1 (PB)	:	Per cent disease severity of papery bark canker
Y2 (SB)	:	Per cent disease severity of stem black
Y3 (SmB)	:	Per cent disease severity of smoky blight
Y4 (MB)	:	Per cent disease severity of Marssonina blight
Y5 (ALS)	:	Per cent disease severity of Alternaria leaf spot
Y6(PM)	:	Per cent disease severity of powdery mildew
X1 (Tmi)	:	Minimum temperature (^{o}C)
X2 (Tma)	:	Maximum temperature (^{o}C)
X3 (RH)	:	Relative humidity (%)
X4 (Rn)	:	Rainfall (mm)
R2	:	Coefficient of multiple determination

Management of Major Soil Born Diseases of Apple

Evaluation of apple rootstocks against *Dematophora necatrix*

It is evident from the data (Table 27) that all the rootstocks showed appearance of disease. *Paron* showed resistant (R) reaction to the test pathogen with 4.37 per cent disease severity. MM 111 and M 9 root stocks showed moderately resistant reaction against white root rot disease of apple with 17.33 and 15.42 per cent disease severity. MM 106 showed susceptible disease reaction against the disease, while *Malus baccata* from Kashmir showed highly susceptible disease reaction against white root rot exhibiting 68.67 per cent disease severity under field conditions. From this study, it can be concluded that in the second trial of rootstocks evaluation, *Malus baccata* var. *himalaica* (*Paron*) again screened out as resistant against *Dematophora necatrix* causing white root rot of apple.

White root rot disease symptoms occur on the underground parts of the trees and effects are also manifested on the above ground parts at the later stage of infection. To study the disease expression on the host test rootstocks were grafted with CITH Lodh Apple 1 and planted in naturally infested soil in apple nursery. Test rootstocks were assessed for rate of wilting, bronzing and inward cupping of leaves and defoliation at fifteen days intervals. Data on per cent wilting revealed that except *Paron* all the rootstocks showed wilting at all the times of observation. Observations on bronzing and inward cupping of leaves and defoliation showed that except *Paron* all the rootstocks showed this types of symptoms at all the times of observation; however *Paron* expressed this types of symptoms only after 60 days of inoculation. Here, important point is that *Paron* did not show wilting and it showed least mean bronzing and inward cupping of leaves (3.83%) and defoliation (3.06%) as compared to all the test rootstocks.

Effect of edaphic factors on disease development

For this purpose seedlings of *Malus baccata* from Kashmir were grafted with CITH Lodh Apple-1 and planted in naturally infested soil in apple nursery. It is evident that per cent mortality of grafted plants of apple occurred first in the month of July and thereafter, it increased in month of August. However, from the month of September, a sharp decline in per cent mortality of grafted plants of apple was observed due to change in soil environmental conditions. It was also observed that there was a definite relationship between per cent mortality of apple by *Dematophora necatrix viz.* soil temperature and soil moisture. During the period under report, mortality of apple plants progressed rapidly during the month of July where, monthly average soil temperature of 19.5^{0}C, and soil moisture of 2.38 g/kg soil was recorded. From this study it can be concluded that edaphic factors strongly influenced the occurrence of white root rot in apple crop (Fig. 23).

Correlation studies

The simple correlation coefficients were calculated from the data to find out the relationship between per cent mortality of apple plants by white root rot of apple and edaphic factors *viz.*, soil temperature and soil moisture. It is evident from correlation matrix that both the factors were positively correlated with per cent mortality of apple plants. Soil moisture showed strong relationship (r=0.416) with white root rot of apple as compared to soil temperature (r=0.332).

Multiple regression equation

The multiple regression equation showed that 1 degree increase in soil temperature (STm) caused 0.203 per cent increase in per cent mortality of apple plants by white root rot of apple. The equation further signifies that 1 g/kg soil increase in soil moisture (Sm) caused 2.195 per cent increase in the per cent mortality of apple plants. The coefficient of multiple determination (R^2) was calculated as 0.4645 for per cent mortality of apple plants by white root rot of apple which signifies that 46.45 per cent variation in per cent mortality of apple plants dependent on edaphic factors included in these studies. It is apparent from the value of R^2 that besides the mentioned two edaphic factors other parameters of diseases development like pathogen virulence,

host susceptibility etc are also playing vital role in causing mortality of apple plants.

Table 27. Disease reaction of different apple rootstocks against white root rot disease of apple under field conditions

Rootstocks	Disease severity (%)*	Disease reaction**
MM 106	60.27 (49.25)	Susceptible
MM 111	17.33 (24.57)	Moderately resistant
M 9	15.42 (13.66)	Moderately resistant
Paron (*Malus baccata var. Himalaica*)	4.37 (12.05)	Resistant
Malus baccata from Kashmir	68.67 (55.22)	Highly susceptible
CD at 5%	1.92 (1.03)	-

* Figures in the parentheses are arcsine transformed values; **-Where; Resistant (0-5%), Moderately resistant (6-20%), Moderately susceptible (21-40%), Susceptible (41-60%) and Highly susceptible (>60%)

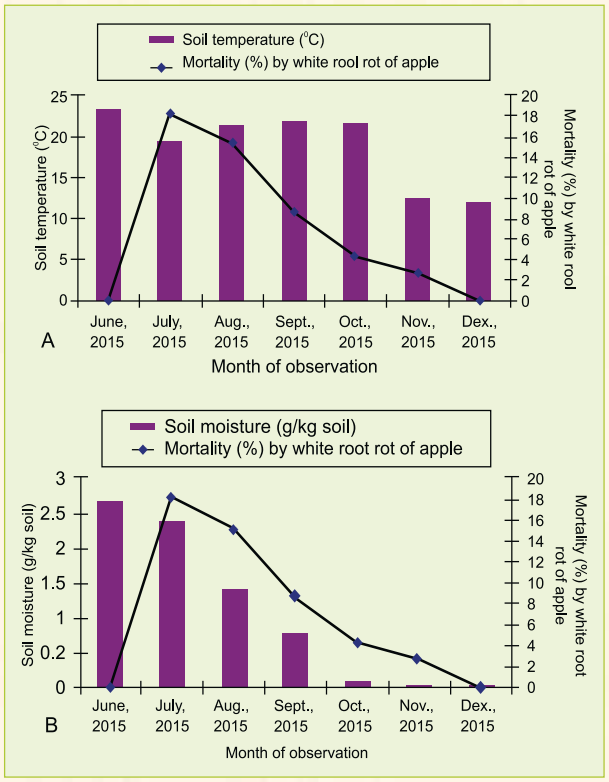


Fig. 23. Effect of different edaphic factors *viz.*, soil temperature (A) and soil moisture (B) on mortality of apple plants caused by white root rot of apple.

IV. Post Harvest Technology

Studies on dried prunes in relation to cultivars and drying technology

Prunes are plum cultivars, mostly *Prunus domestica* sold as fresh or dried. Prunes are dryied by cleaning with water sprays, dipping in cold and hot water followed by dehydration. The effect of cultivars and drying technology in prune was investigated. Three cultivars i.e. Grand Duke, President Plum and Italian Plum (pitted material) were taken for drying for prune purpose. Two drying modes were taken for investigation i.e. Osmo dehydration followed by dehydration in cabinet dryer at 60°C and direct cabinet drying at 60°C. Among the cultivars and osmo dehydration Italian Plum took minimum time for dehydration by osmosis *i.e.* 3 hrs where as Garand Duke took 3 hrs and 30 minutes and President Plum took 4 hrs (Fig. 24). Over all dehydration by means of osmo dehydration followed by cabinet drying at 60°C, minimum time (Fig. 25) was taken by Italian Plum (13 hrs). After 180 days of storage at low temperature (4°C) maximum colour, vit. C and carotene retention was recorded in Italian Plum when osmo dehydrated. Over all study reveals

Osmo dehydrated Italian Plum

that Italian Plum took less time for dehydration and retained colour, ascorbic acid, carotenoids to the maximum and also showed relatively higher rehydration ratio (RHR). The organoleptic evaluation further confirms the results.

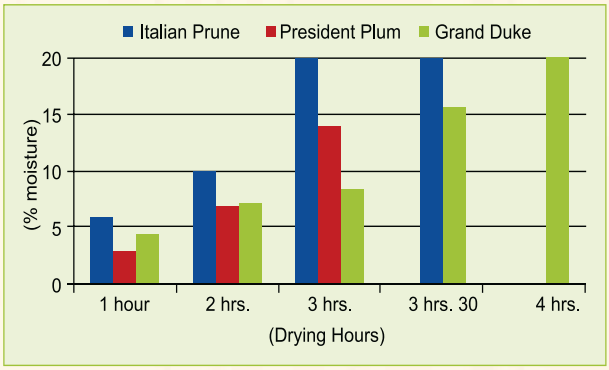


Fig. 24. Reduction in moisture during osmo dehydration of plum cultivars processed for prunes

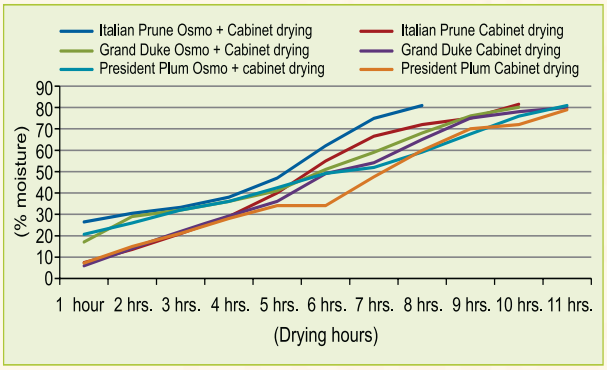


Fig. 25. Reduction in moisture during osmo dehydration + cabinet drying of plum cultivars processed for prunes in different hours

Standardization of technology for blending of temperate stone fruit juices

Taste of some kind of fruit juices depends upon variety, cultivation environmental factors in which it is grown. Due to lack of cold storage facilities and awareness among the growers about its processing, large quantities of these fruits goes waste/spoiled before reaching the consumers. Hence, the study was carried out to blend the juices in different proportion to get best combination with market acceptability. Therefore, it is important to standardize the blending ratio of these fruit juices with due importance for taste, quality composition and acceptance.

Standardization of blending of Sweet and Sour cherry juices preserved with sodium benzoate and stored at refrigeration temperature

Three blending ratio i.e., 25% sweet cherry + 75% sour cherry, 50% sweet cherry + 50% sour cherry, 75% sweet cherry + 25% sour cherry with 100% each of sweet and sour cherry with and without treatment of 0.1% Sodium benzoate and stored at 4±2°C were taken for investigation. After six months of storage study it was found that Blend of 50% Sweet cherry + 50% sour cherry treated with sodium benzoate retained desirable colour i.e. brightness, redness and freshness to maximum when compared with other blending combinations. This blend was also found superior in retaining ascorbic acid, desirable blend of acidity and TSS (Fig. 26, 27 & 28). Organoleptic evaluation further confirms the results.

Sweet cherry

Sour cherry

Blend juices of sweet cherry and sour cherry

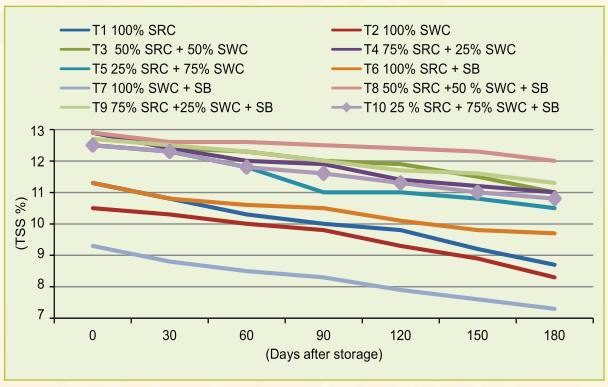


Fig. 26. Reduction of TSS during storage

* SRC= Sour Cherry * SWC= Sweet Cherry
* SB= Sodium Benzoate

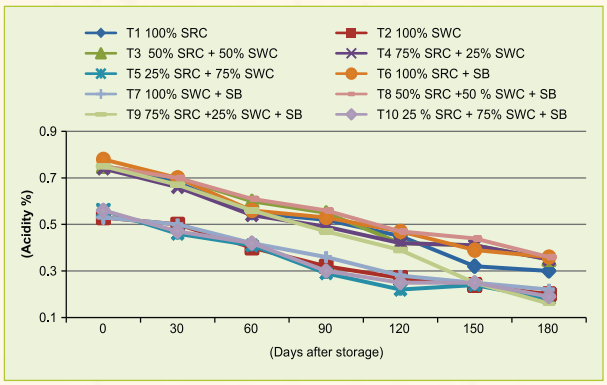


Fig. 27. Reduction of acidity during storage

* SRC= Sour Cherry * SWC= Sweet Cherry
* SB= Sodium Benzoate

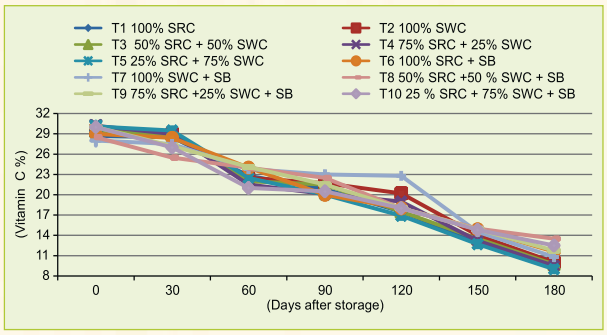


Fig. 28. Reduction in ascorbic acid during storage

* SRC= Sour Cherry * SWC= Sweet Cherry
* SB= Sodium Benzoate

Standardization of blending of apricot and plum juices preserved with sodium benzoate at refrigeration temperature

Three blending ratio i.e., 25% apricot + 75% plum, 50% apricot + 50% plum, 75% apricot + 25% plum with 100% each of apricot and plum juice with and without treatment of 0.1% sodium benzoate stored at 4±2°C was taken for investigation. Before storage study different blends were analysed for quality attributes (Table 28). After six months of storage study it was found that Blend of 75% apricot + 25% plum treated with sodium benzoate retained maximum desirable colour i.e brightness, redness and freshness when compared with other blending combinations. This blend was also found superior in retaining vit. C (ascorbic acid), desirable blend of acidity and TSS

(Fig 29, 30&31) when stored up to 180 days. Organoleptic evaluation further confirms the results

Plum cv. President plum

Apricot genotype CITH-AP-3

Blend juices of Apricot and Plum

Table 28. Chemical composition of apricot and plum blend juices

Treatment		TSS (°B)	Acidity (%)	Ascorbic acid (mg/100g)	pH	L*	a*	b*
T1	100% AJ	9.0	0.42	12.0	4.3	41.01	32.5	48.23
T2	100% PJ	4.6	0.56	22.5	4.7	35.17	49.63	42.15
T3	50% AJ + 50% PJ	9.3	0.56	15.0	5.0	33.95	41.32	44.57
T4	75% AJ + 25% PJ	9.3	0.50	16.5	5.3	42.19	35.01	50.16
T5	25% AJ + 75% PJ	6.9	0.58	14.6	4.7	37.16	37.59	33.59
T6	100% AJ + SB	8.6	0.36	14.0	5.2	41.1	32.5	48.00
T7	100% PJ + SB	9.0	0.42	22.0	4.9	35.2	40.0	42.0
T8	50% AJ+50% PJ + SB	9.3	0.57	20.0	4.9	33.5	38.0	43.0
T9	75% AJ +25% PJ + SB	9.3	0.50	22.1	4.8	42.2	36.0	43.5
T10	25% AJ + 75% PJ + SB	6.9	0.57	22.1	4.9	32.10	34.0	42.5

* AJ = Apricot juice
* PJ = Plum Juice
* SB = Sodium Benzoate

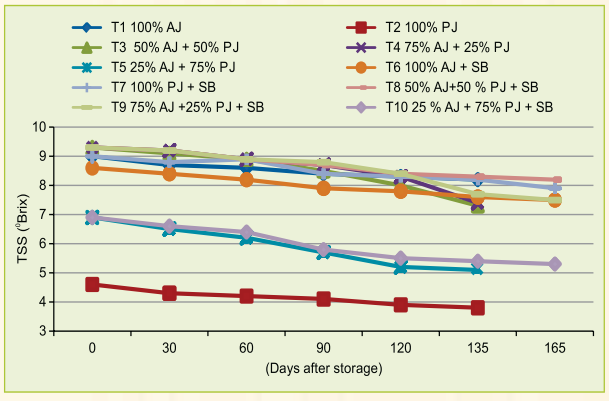


Fig. 29. TSS of different juices during storage

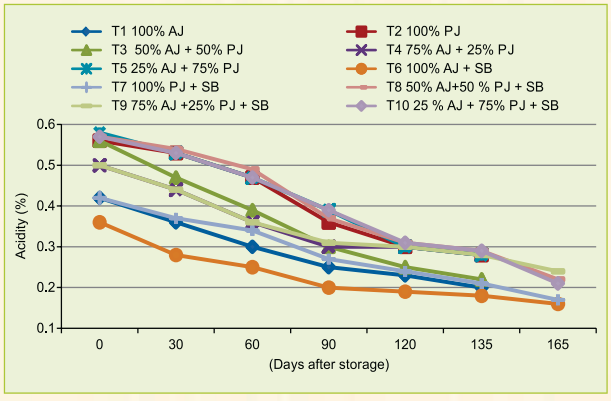


Fig. 30. Acidity of different juices during storage

* AJ = Apricot juice
* PJ = Plum Juice
* SB = Sodium Benzoate

* AJ = Apricot juice
* PJ = Plum Juice
* SB = Sodium Benzoate

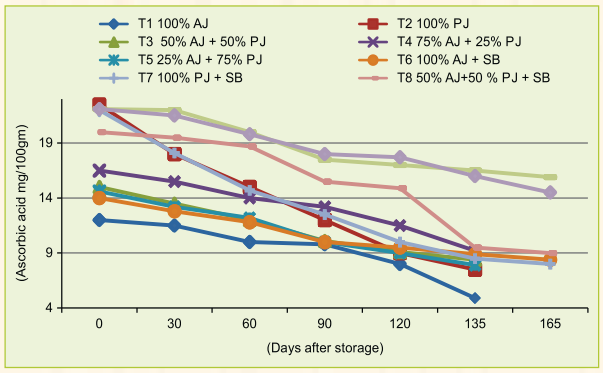


Fig. 31. Ascorbic Acid of different juices during storage

* AJ = Apricot juice
* PJ = Plum Juice
* SB = Sodium Benzoate

Assessment of Kashmir chili for commercial traits

Chilli (*Capsicum anum* L.) has its unique place in the world diet in its dried form (as a spice) as well as green form. The Kashmir chili reserves its brand in national and international market for its colour, flavor and aroma. So to screen out best genotypes, present investigation were carried out.

Estimation of total phenolic content and ferric reducing antioxidant power of chilli selections.

A total of thirty chilli genotypes were evaluated for phenolic compounds. The total phenolic content varies from 7.67 GAE mg/g of dried sample in genotype SH-SP-1154-4-4 to 55 GAE mg/g in genotype SEL-1005/11-1 (Table 29). Ferric reducing power was found highest (13.93 µM of ferrous equivalent Fe (II) per gram sample) in genotype SEL-1005/11-1 and lowest (3.45) in genotype SH-HP-111-5. Total phenolic content was positively correlated with FRAP (r=0.747).

Table 29. Biochemical evaluation of chilli genotypes with respect to total phenols and FRAP

S. No	VARIETIES	Total Phenols (GAE mg/g)	FRAP (µM of ferrous equivalent Fe (II) per gram sample)
1	CITH- HP-114/13	24.33	9.83
2	SEL-910-1	13.67	6.94
3	SEL-1005-1-1	11.33	5.52
4	SH-HP-111-5	8.44	3.45
5	SEL-836-1-2-1	21.50	6.74
6	SH-HP-1154-9-1	26.00	7.60
7	SEL-914/15	8.83	3.63
8	SEL-1016-2	15.67	5.98
9	SH-HP-1154/13	26.17	9.08
10	CITH-HP-80/13	13.17	7.01
11	CITH-HP-38/13	21.83	7.40
12	SH-HP-1154-8-2	24.67	7.29
13	SH-HP-1154-1-1	8.50	4.06
14	SEL-82-02	21.50	6.90
15	CITH-HP-29/13	9.00	5.92
16	SH-HP-1154-3	39.17	13.02
17	SH-SP-1154-4-4	7.67	9.98
18	CITH-HP-60/13	15.33	8.87
19	SEL-1005/11-1	55.00	13.93
20	CITH-HP-31/13	14.33	9.08
21	AL-5	9.50	6.34
22	AL-10/12	24.67	10.69
23	SEL-1011-2	8.33	6.57

24	SEL-836-1-2-2	17.00	6.16
25	CITH-HP-17/3	11.67	6.18
26	SH-HP-1154-1-03	8.33	4.10
27	SEL-89-1	18.50	6.53
28	CITH-HP-101/13	25.67	7.51
29	SEL-1052-1-2015	21.17	6.53
30	SEL-2012-2	8.84	8.68
CD at 5%		2.11	1.16

Biochemical evaluation of chilli samples for estimation of capsaicin content

Twelve chilli genotypes were evaluated for capsacin content (Table 30 & Fig.32). Maximum capsaicin concentration (634 ppm) was found in chilli genotype SEL-1052-12015 followed by CITH-HP-82/13 (583 ppm) and SH-HP-1154-1-03 (542 ppm)

Table 30. Capsaicin content in different chilli samples estimated through RP-HPLC analysis

S.NO	Sample Name	Conc. (ppm)
1	CITH-HP-31/13	169
2.	AL-5	241
3.	AL-10/12	247
4.	Sel-1011-2	193
5.	Sel-836-1-2-2	368
6.	CITH-HP- 17/13	390
7.	SH-HP-1154-1-03	542
8.	SEL-89-1	202
9.	CITH-HP-101/13	220
10.	SEL-1052-12015	634
11.	CITH-HP-82/13	583
12.	SH-HP-1154-5-1	508
CD at 5%		--

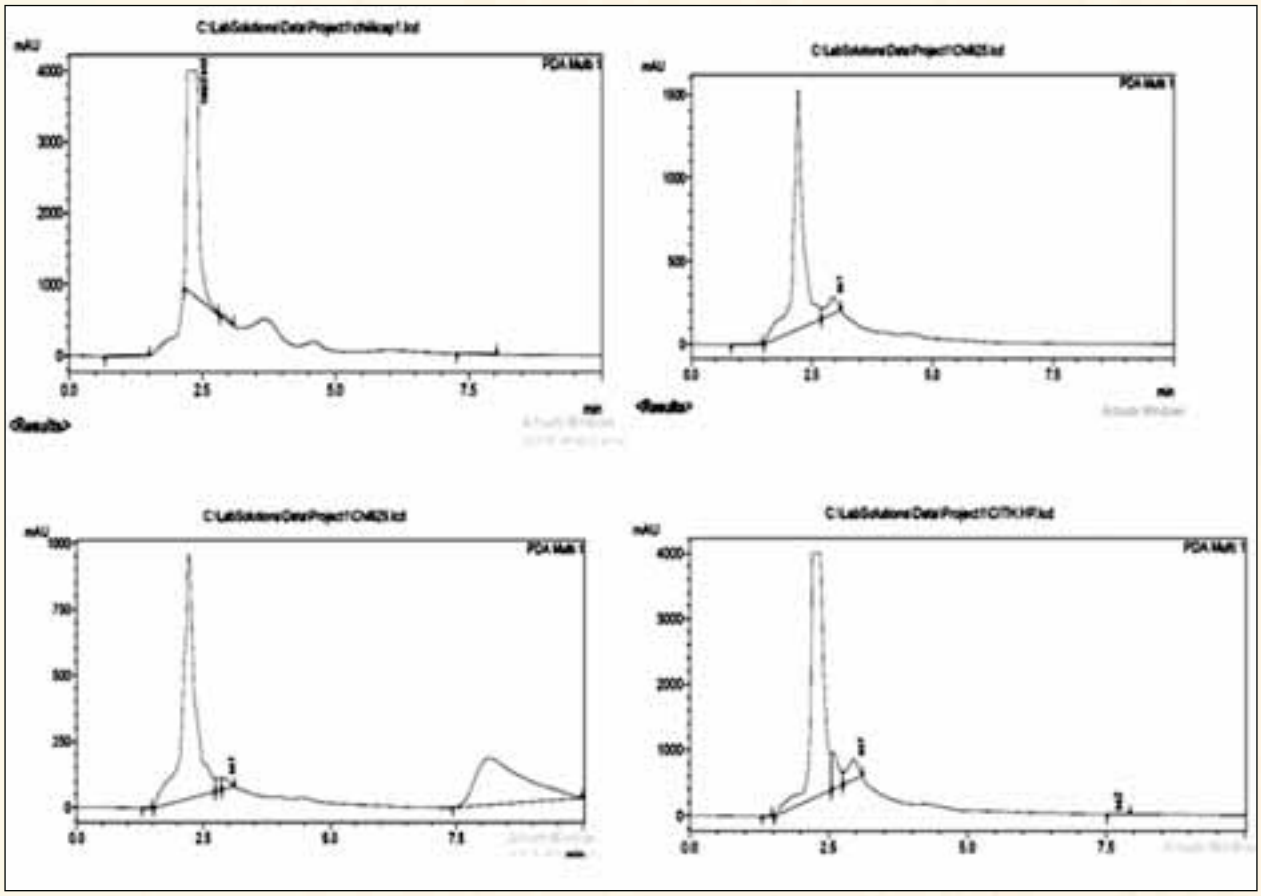


Fig.32. HPLC Chromatogram showing capsaicin peaks in different chilli samples

Preparation and evaluation of fruit wine from different cultivars of pear grown in Uttarakhand.

Three cultivars of pear *viz*. *Jagner*, Sand pear and *Kakria* were used for wine preparation wine preparation studies. The physico-chemical characters of different cultivars of pear revealed a significant difference indicating a genetic variability among the cultivars. It was found that the fermentation rate was comparatively higher in the treatments having lower TSS and it decreased with the increase in the TSS. The physico-chemical parameters of pear and ginger wine from three cultivars having different TSS at 0 and 6 months, depicting a significant difference amongst various treatments. As per the initial TSS the variation in the final TSS of the wines was recorded which indicated that after a certain level of alcohol production, the activity of the yeast seizes. Corresponding to the TSS the alcohol (%) also varied in different treatments and it was noticed that about 50% of the TSS utilized for alcohol production. During storage there was a reduction in the TSS and alcohol which may be attributed due to sedimentation and volatility. The acidity (%) and volatile acidity (%AA) was found to increase in all the treatments with increase in TSS as well as storage period which may be due to more alcohol production.The pH of the products was found in corroboration with the acidity. The reducing and total sugars (%) were non-detectable in all the treatments immediately after preparation and 6 months storage indicating that the same have been utilized for alcohol production. Further, ascorbic acid (mg/100g) in various treatments of pear ginger wine was retained better having higher alcohol (%) in the final product. The total phenols (mg/L), aldehydes (mg/L), esters (mg/L) and total antioxidants (mMTE/L) were found to increase with increase in the TSS and alcohol production and also retained better after 6 months of storage which indicated that the alcohol plays a significant role in the production and retention of these constituents in the wines. The prepared pear ginger wines of different treatments were evaluated for sensory quality attributes at different intervals of storage and it was found that the pear ginger wine from sand pear having TSS of 22°B with 2.5% ginger had an edge over other treatments immediately after preparation and after 6 months storage. The products were found safe at ambient conditions after 6 months storage. From the cost of production of the prepared products it was found that it is quite reasonable (₹ 70.40/650 ml bottle) with good profit margin comparable with low alcoholic beverages available in the market. The cost may further be reduced if the production is on commercial scale by any processing unit in the production areas.

4

Meetings and Events

National Conference on Temperate Fruits and Nuts

ICAR-Central Institute of Temperate Horticulture, Srinagar and Horticulture Society of India, New Delhi jointly organized a "**National Conference on Temperate Fruits and Nuts- A Way Forward for Enhancing Productivity and Quality"** from 6 to 9th Nov., 2015 at ICAR-CITH, Old Air Field, Rangreth, Srinagar. Jenab Ab. Rehman Veeri, Minister of Horticulture, Haj and Auqaf, J&K State, Jenab Syed M.A. Bukhari, Minister of Public Works, Floriculture, Parks and Gardens, J&K State, Dr. Asgar Samoon, Divisional Commissioner, Kashmir Division Dr. N.K. Krishna Kumar, DDG (HS), ICAR and other dignitaries inaugurated the conference. During the conference about 400 participants comprising of scientists, students, research scholars, teachers, nursery men, progressive farmers etc. participated. On 9th Nov., 2015 stakeholders meeting was organized at ICAR-CITH, Srinagar in which about 400 farmers, nurserymen, industrialists, scientists, students and other stakeholders participated.

Inaugural function and audience in National Conference

12th Institute Research Council Meeting

Institute Research Council Meeting was held on 29 - 30th March, 2016 at CITH, Srinagar under chairmanship of Dr. D.B. Singh, Director (Acting), CITH, Srinagar. All the scientists of CITH, and IGFRI, RRS, Srinagar as well as RA's/ SRF's participated in the meeting. Project-wise presentations were made by respective PI's and results/ outcomes along with the activities to be taken up in next year were presented and discussed in details. Chairman gave critical inputs on experimentation for obtaining realistic and reproducible results. New Institute projects were also proposed and some were approved by the house.

Director (Acting) and scientists discussing the outcomes of projects during 12th IRC meeting

QRT meeting

Third Quinquennial Review Team meeting was held from 7 to 10th Sept., 2015 at ICAR-CITH, Srinagar. The meeting was chaired by Dr S.D. Shikhamany, Chairman QRT and other members of QRT to review for the period 2009-2014. The chairman and members visited the research fields, labs and interacted with scientists and other staff members. The work was discussed in detail and various suggestions were given by the chairman and other committee members. QRT members and scientist of CITH, Srinagar organized stakeholders meet on 9th Sept., 2015 in which various problems faced by the farmers were discussed and the road map for management of these problems was discussed.

QRT members discussing the outcomes and taking the stack holders view during QRT meeting

IMC meeting

12th Institute Management Committee meeting was held on 14th Dec., 2015 under the chairmanship of Dr. Desh Beer Singh, Acting Director, CITH, Srinagar. The committee discussed and approved all the agenda items including the recommendations of QRT for further consideration and approval of the Competent Authority.

IMC members discussing various issues during IMC meeting

Hindi Week

Hindi week was observed by ICAR-Central Institute of Temperate Horticulture, Srinagar and its Regional Station, Mukteshwar from 14 to 21st Sept., 2015 for compliance of official language policy. Institute organized an essay writing and poster drawing competition for students, staff members and their children.

Hindi week function celebration at CITH Srinagar

Vigilance week

ICAR-Central Institute of Temperate Horticulture and its Regional Station, Mukteshwar observed vigilance Awareness week from 26 to 31st Oct., 2015. The theme for the vigilance Awareness week, 2015 was "Preventive vigilance – a tool of good governance." Director ICAR-CITH emphasizes the role of preventive vigilance on the efficiency and objectivity in governance for eradication of corruption from public life.

Rastriya Ekta Diwas

ICAR-Central Institute of Temperate Horticulture and its Regional Station, Mukteshwar observed "Rashtriya Ekta Diwas (National Unity Day) on 31st Oct., 2015. This occasion provides an opportunity to re-affirm the inherent strength and resilience of our nation to withstand the actual and potential threats to the unity, integrity and security of our country. A Pledge taking ceremony was held on 30th Oct., 2015. All the Staff members participated in the Pledge-taking ceremony

Cleanliness Campaign

A cleanliness drive was organized from 28th Sep. to 31st Oct., 2015 under Swachh Bharat Mission in institute campus in which staff members were sensitized about cleanliness.

CITH staff cleaning the campus during Cleanliness Campaign

ICAR Inter Institutional North Zone Staff Sports meet

ICAR-CITH, Srinagar participated in ICAR Inter Institutional North Zone Staff Sports meet organized at ICAR-IISWC, Dehradun from 18 to 21st April, 2015. During the event Ajaz Ahmad Wani, Technician won the gold medal in carom.

Interzonal sports meet

CITH team and Mr. Wani receiving the Gold Medal during ICAR, Inter institutional North Zone Staff Sports Meet

ICAR-CITH, Srinagar participated in ICAR Inter Zonal Sport Tournament from 8 to 12th Feb., 2016 held at Central Arid Zone Research Institute, Jodhpur. Mr. Ajaz Ahmad Wani, Technician a gold medalist in inter-institutional sports meet participated along with Dr. Javid Iqbal Mir, Scientist who was the Chief De-Mission during the event.

5

Extension and Other Programmes

Extension Activities

The continuous efforts made in research by ICAR- CITH to overcome the problems faced by farmers have won the trust of farmers. The number of stakeholders of CITH is continuously increasing throughout the country. The Central Institute of Temperate Horticulture, Srinagar and its Regional station are putting continuous efforts to make the farmers/ officers of line departments aware of various new technologies generated in temperate horticultural crops for improving productivity and quality. The Institute has organized number of programs for human resource development. For the quick adoption of technologies CITH is continuously organizing vocational trainings, model training courses, crop days, on campus and off campus trainings as well as demonstrations, gosthis, farm visits, diagnostic visits, supply of quality planting material, publication in local language, participation in farmer fairs, radio talk, TV shows and display of exhibits on various occasions/ farmers fair etc. The details of various programmes organized at CITH during the year are presented below:

Jenab Abdul Rehman Bhat (Veeri), Hon'ble minister for Horticulture and Haj & Auqaf, J&K addressing the audience during apple day

Apple Day

Central Institute of Temperate Horticulture, Old Air Field, Rangreth, Srinagar organized Apple Day on 23rd September, 2015. Jenab Abdul Rehman Bhat (Veeri), Hon'ble minister for Horticulture and Haj & Auqaf, J&K State was the Chief Guest on the occasion who inaugurated the function. Shri P.K. Sharma, (Director Horticulture Kashmir), Shri A.K. Sharma (Director, Horticulture, Jammu) and S.L. Hangloo (Director, Horticulture Planning and Marketing) also gave their remarks on various schemes and developmental activities in apple. Chief Guest, Jenab Abdul Rehman Bhat (Veeri) gave emphasis on High Density Plantation and its importance for enhancing the livelihood of farmers. He highlighted various programmes and policies initiated in horticulture especially the Mission on apple HDP. An interactive meeting of scientists, development department officials and farmers was also held where Prof. Nazeer Ahmed, Director, CITH gave detailed presentation on present scenario and technological interventions requirements for enhancing the productivity and quality of apple. During the meeting farmers also raised several queries which were suitably answered by the scientists of CITH who assured

all technical and material support for HDP promotion in the State. About 300 farmers participated in the event.

Farmer-scientist interaction meeting

ICAR-Central Institute of Temperate Horticulture, Srinagar organized farmer's interaction meeting with Bayer Experts and scientists of CITH on 26th May, 2015 at CITH, Srinagar. Farmers particularly apple growers from district Shopian, Kulgam, Ananatnag, Pulwama etc participated in the event. During the interaction session Mr. Fabien Martil, Consultant, Eco Fruit Council, France gave detailed overview on apple scab and wooly apple aphid. Farmers raised queries regarding the problems they are facing in apple and valuable suggestions for their remedy were given by Mr. Fabien, CITH Scientists and Experts from Bayer. Farmers were enlightened about the judicious use of fungicides against scab and pesticides against wooly aphid.

Discussion during Farmers - Scientist Interaction Meeting

Stakeholders meet on temperate fruits and nuts

ICAR-Central Institute of Temperate Horticulture, Srinagar organized stake holders meet on temperate fruit and nut crops on 20th June, 2015 at ICAR-CITH, Srinagar. Dr. N.K. Krishna Kumar, Hon'ble Deputy Director General (Horticultural Science), Indian Council of Agricultural Research, New Delhi, Dr. A.A. Sofi, Former Director, ICAR-CITH, Dr. F.A. Zaki, Dean Horticulture, SKUAST (K), Dr. F.A. Banday, HOD, Fruit Science SKUAST (K), officers from State Horticulture Departments, research scientists, fruit growers, nursery men, representatives from fruit growers associations, packaging, CA storage and processing units, participated in the event. Dr N.K. Krishna Kumar, Hon'ble DDG, Hort. Science, apprised the audience on the importance of temperate horticulture and impressed the participants for adopting latest technologies and varieties developed by CITH for improving the productivity. He emphasized on tremendous scope of temperate horticulture particularly in J & K for improving livelihood and economy of the farmers.

Discussion during Stakeholders meet

World Soil Health Day

World soil health day was celebrated on 5th Dec., 2015 at ICAR-CITH, Srinagar in which soil health cards were distributed among the farmers and farmer scientist interaction meeting was held on soil health and management.

Dr. D.B. Singh, Director (Acting), distributing Soil Health Card during World Soil Health Day

Training programmes for Department Personnel

ICAR-CITH Srinagar organized four training programmes of 2 to 3 days duration for the officials of line departments during the year. The details of training programmes conducting are presented in Table 31.

Table 31. Training Programmes Organized at CITH, Srinagar during 2015-16

Sr. No	Training Programme	Duration	Trainee	Coordinator
1	Training, pruning and nursery production in temperate fruit crops	27 to 29th Nov., 2015	Officials from Deptt of Horticulture, Poonch	O C Sharma
2	Training, pruning and nursery production in temperate fruit crops	9 to 10th Dec., 2015	Officials from Deptt of Horticulture, Ramban (J&K)	O C Sharma
3	Propagation of walnut under low cost polyhouse	18 to 20th Feb., 2016	Officials from Uttarakhand Forest Department (Uttarakhand)	K L Kumawat, Mudasir Magray
4	Walnut budding and grafting	15 to 17th Feb., 2016	Gardeners from Horticulture Department Jammu (J&K)	J I Mir & Shoaib Kirmani

Dr. D.B. Singh giving tips of walnut propagation for Uttarakhand Officers

Student's trainings/visits

Besides the officials and farmers trainings CITH, Srinagar also organized trainings/visits to the students on various lab techniques and instruments. The number of student groups who visited CITH during the year is presented in Table 32.

Table 32. Training programmes/ visits organized for students at CITH, Srinagar during 2015-16

No.	Date	Organization	No of students	Organizer
1	24-26/8/2015	Students of S P College, Srinagar (J&K)	40	J I Mir
2	20/5/2015	School children from Air Force Station Rangreth (J&K)	97	Megna Rashid
3	21/5/15	School children from Air Force Station Rangreth (J&K)	77	Megna Rashid
4	21/7/2015	Students of BSc III, Agriculture SKUAST-J (J&K)	35	K L Kumawat & Lal Chand
5	3/9/2015	Students of BSc. and MSc.Hort from SKUAST-K, Srinagar (J&K)	36	J I Mir & Shoaib Kirmani
6	15/9/2015	Students from Govt. Higher Secondary School, Ukhdar, Ramban (J&K)	15	J I Mir

Farmers visits

The ICAR-CITH has become attention centre of technologies in temperate horticultural crops for farmers/line departments. Different departments used to bring the farmers for one day training at CITH to make farmers aware of various technologies. Thirty one groups of farmers visited ICAR-CITH, Srinagar during the year. The list of various groups who visited CITH is presented in Table 33.

Table 33. List of farmers group who visited CITH during 2015-16

Sr. No.	Date	District	No of farmers	Organizer
1	16.4.2015	Gandharbal	70	O C Sharma
2	12.5.2015	Budgam	33	O C Sharma & K L Kumawat
3	25.7.2015	Poonch	20	Shoaib Kirmani & Mudasir Magray
4	27.8.2015	Poonch	30	Shoaib Kirmani
5	2.9. 2015	Kupwara and Baramulla	25	Geetika Malik & Shoib Kirmani
6	9.9. 2015	Rajouri	30	Shoaib Kirmani & Mudasir Magray
7	10.9. 2015	Rajouri	35	J I Mir & Shoib Kirmani
8	15.9. 2015	Ramban	36	Shoaib Kirmani & Mudasir Magray
9	17.9. 2015	Bandipora	13	Waseem Hassan Raja & Mudasir Magrey
10	17.9. 2015	Bandipora	25	Waseem Hassan Raja & Mudasir Magrey
11	18.9.2015	Kishtwar	20	O C Sharma & G Mahideran
12	19.9.2015	Kathua	10	Geetika Malik, K M Rai & Waseem Hassan Raja
13	30.9. 2015	Srinagar	60	Shoaib Kirmani & Mudasir Magray
14	30.9. 2015	Shopian	9	Shoaib Kirmani & Mudasir Magray

Sr. No.	Date	District	No of farmers	Organizer
15	1.10. 2015	Kupwara	27	O C Sharma & Geetika Malik
16	14.10. 2015	Baramulla	50	Geetika Malik & Shoaib Kirmani
17	2.11. 2015	Leh	13	K M Rai & Mudasir Magray
18	16.11.2015	Kupwara	21	Shoaib Kirmani & Mudasir Magray
19	26.11. 2015	Baramulla	50	Shoaib Kirmani & Mudasir Magray
20	26.11. 2015	Baramulla	50	Shoaib Kirmani & Mudasir Magray
21	8.12. 2015	Budgam	68	Geetika Malik & Shoaib Kirmani
22	17.12.2015	Budgam	41	Geetika Malik, O C Sharma & S K Raina
23	21.1.2016	Reasi	30	O C Sharma & J I Mir
24	1.2.2016	Ranban	45	O C Sharma & J I Mir
25	14.3.2016	Different districts of Kashmir	60	O C Sharma & S K Raina
26	14.3.2016	Anantnag	45	Shoaib Kirmani & Mudasir Magray
27	15.3.2016	Budgam	50	K L Kumawat, Lal Chand & K M Rai
28	16.3.2016	Budgam	22	O C Sharma & K L Kumawat
29	22.3.2016	Budgam	53	O C Sharma, K M Rai & Mudasir Magrey
30	22.3.2016	Budgam	55	Wasim Hassan Raja, Shoaib Kirmani & Mudasir Magray
31	25.3.2016	Budgam	50	Wasim Hassan Raja, Shoaib Kirmani & Mudasir Magray


Field and lab visit of students from SKUAST –J, Jammu


Students from S P College, Srinagar learning the lab techniques

Students of SKUAS K, Shalimar learning about protected cultivation

Farmer groups from different districts learning about various technologies during their visit/training at CITH, Srinagar

Exhibitions and talks

The Scientist of CITH, Srinagar delivered 5 TV talks (J.I. Mir-2, K.L. Kumawat-2, Geetika Malik-1) on various aspects of temperate horticultural crops and displayed exhibition in *Technology Exhibition cum Seed Mela* organized by SKUAST- K at Shalimar, Srinagar on 6 to 7th March, 2016. Dr D.B. Singh, J.I. Mir, O.C. Sharma and Lal Chand participated in this Mela.

Mera Gaon Mera Gaurav (MGMG)

ICAR-Central Institute of Temperate Horticulture, Srinagar identified one village "Hatigam" for MGMG in district Anantnag, Jammu and Kashmir in which maximum farmer families are engaged with horticulture. One awareness camp about MGMG was organized on 2nd March, 2016 by Dr Javid Iqbal Mir, Scientist, CITH, Srinagar in which farmers were made aware about the scheme and its benefits. On the same day about 44 farmer families were benefitted by provided quality planting material of apple and other temperate horticultural crops.

Awareness camp about MGMG at Hatigam, Ananatnag

Distribution of planting material under MGMG at Hatigam, Ananatnag

Tribal Sub Plan Scheme

Under tribal sub plan scheme planting material and farm inputs were provided to tribal farmers of Gurez, Ganderbal, Poonch, Udhampur, Rajouri etc. Different training programmes and awareness camps were organized in tribal regions of these districts about HDP, PPV&FRA, canopy management systems etc. In addition demonstration on protected cultivation of vegetables, nursery raising etc were given to tribal farmers.

Fertilizer distribution among tribal farmers of Gurez, Bandipora

Performance of walnut plants raised under TSP at Gurez, Bandipora

Planting material distribution under TSP at Babanagri, Ganderbal

Protected and off season vegetable production in polyhouses constructed under TSP programme at Gurez

Training on HDP under TSP Programme

Planting material distribution cum training programme at Mongri area of District Udhampur (under Tribal Sub-Plan)

Trainings organized at Mukteshwar

To speed the transfer of technologies in Uttarakhand, Regional station Mukteshwar organized 5 training camps for farmers on various aspects, conducted 12 diagnostic visits and 3 exhibitions on various farmers fair. During the year, 8 group of farmers/ students/ officials of line departments visited the station. Fifteen demonstrations were laid out on four vegetable crops. Twenty one lectures were delivered in various programmes organized by different agencies

Dr. Raj Narayan demostrating the protected vegetable production

Different programmes/visits organized at Mukteswar

Success story on protected cultivation of vegetables at Gurez

Gurez in the local Shina language, is a valley located in the high Himalayas, about 86 kilometres from Bandipore and 123 kilometres from Srinagar in northern Kashmir and southern Gilgit-Baltistan. At about 8,000 feet (2,400 m) above sea level, the valley is surrounded by snow-capped mountains. Dawar is the central township in the area. The population of the area is estimated to be about 30,000, and is scattered among fifteen villages. Due to heavy snowfall in winter, the valley remains cut off for six months of the year. Keeping in view the need for protected and offseason cultivation of vegetables which can be utilized in the winter period during which Gurez road remains completely closed, ICAR-Central Institute of Temperate Horticulture, Srinagar constructed polyhouses at four different locations under TSP Scheme. During the winter period these polyhouses were used for vegetable production and raising of nursery seedlings. The low cost polyhouses were made with PVC pipes covered with UV stabilized polythene sheets. Well decomposed and sieved farmyard manure in combination of FYM: sand: soil in ratio of 2:1:1 by volume was recommended as growing media for nursery raising and the same performed very well. Four locations *viz.* Dawar, Markote, Wanpora and Mastan were selected for construction of low cost polyhouses and at all the four locations performance with respect to nursery raising and offseason vegetable production was significantly very good. Vegetables like kale, tomato, cucumber, bottle gourd, pumpkin, brinjil etc were successfully raised under protected conditions at Gurez. Since Gurez remains under snow cover till late May-June and therefore nursery raising and transplanting of vegetable seedlings is done in late summer which delays the cropping season. Therefore utilization of low cost polyhouses for nursery raising under protected cultivation will save time and increase the duration of vegetable availability in the region.

Team Members:

(Scientific: Dr. Javid Iqbal Mir, Scientist, Prof. Nazeer Ahmed, Former Director, Dr. D.B. Singh, Director/Acting, Dr. Om Chand Sharma, Senior Scientist, Dr. Anil Sharma, Senior Scientist, Dr. Wasim Raja, Scientist ; Technical & Supporting: Mr. Ishtiyaq Ahmad Sheikh, Mr. Mehraj Ud Din Bhat, Mr. Ghulam Nabi Bhat)

Low cost polyhouse at Mastan, Gurez

Vegetable production under LCP at Markote, Gurez

Vegetable production under LCP at Dawar, Gurez

Vegetable production under LCP at Wanpora, Gurez

6

Trainings and Capacity Building

Trainings attended by scientific staff

Dr. Desh Beer Singh, Director (Acting)

- Visited Central Asian Countries (Uzbekistan, Kazakhstan, Kyrgyzstan and Tajikistan w.e.f. 14 to 28th Sept., 2015 for discussion of potential for collaboration research between Central Asian Scientific Institutions and ICAR on diversity of temperate fruit trees.

Dr. Raj Narayan, Principal Scientist (Hort. Science)

- Attended Refresher course on 'Agricultural Research Management at ICAR-NAARM, Hyderabad w.e.f. 13 to 25th July, 2015

Dr Anil Sharma, Sr Scientist (Soil Science)

- Attended 3 days training workshop on Competency development for HRD Nodal Officers of ICAR at NAARM, Hyderabad w.e.f. 10 to12th Feb., 2016.

Dr. Anil Kumar, Scientist (Plant Pathology)

- Attended a short course on Geoinformatics in natural resource management and climate change mitigation held at ICAR-Indian Institute of Soil Science, Bhopal w.e.f. 20 to 29th Nov., 2015.

Shri Sovan Debnath, Scientist (Soil Science)

- Attended a short course on Geoinformatics in natural resource management and climate change mitigation held at ICAR-Indian Institute of Soil Science, Bhopal w.e.f. 20 to 29th Nov., 2015.

Dr. Wasim Hassan Raja, Scientist (Fruit Science)

- Successfully completed three months professional attachment training in Division of Fruit Science, SKUAST-K w.e.f. 19th Nov, 2015 to 29th Feb., 2016.

Shri Lal Chand, Scientist (Fruit Science)

- Successfully completed three months Professional Attachment Training at Division of Fruits and Horticultural Technology, ICAR-IARI, New Delhi w.e.f. 1st Dec., 2015 to 1st March, 2016

Dr. K. M. Rai, Scientist (Fruit Science)

- Successfully completed three months professional attachment training at ICAR-CISH, Lucknow w.e.f. 1st Dec., 2015 to 29th Fab., 2016

Trainings attended by Administrative Staff

- Sh. Akhil Thukral, AAO attended training on Vigilance—Role of Enquiry / presenting officers held at ISTM, New Delhi w.e.f. 14 to 18th Sept., 2015
- Sh. Ramesh, AAO, attended a training programme on Public Procurement w.e.f. 1 7 to 22nd Aug., 2015 at NIFM, Faridabad
- Tariq Ahmad Mir, Jr. Stenographer attended a training progaramme on MS power Point at ISTM, New Delhi w.e.f 30th Nov. to 2nd Dec., 2015
- Sh. Akhil Thukral, AAO attended a training programme on Public Procurement at NIFM, Faridabad w.e.f. 12 to17th Oct., 2015

Trainings attended by Technical Staff

- Shoaib Kirmani, STO attended a training programme on Competence Enhancement at NAARM, Hyderabad w.e.f. 14 to 23rd Dec., 2015
- Md. Mudasir Magray, STO attended a training programme on Competence Enhancement at NAARM, Hyderabad w.e.f. 14 to 23rd Dec., 2015
- Sh. Vinod Chandra, Technical Officer attended training on Competence Enhancement training programme at NAARM, Hyderabad w.e.f 19 to 28th Aug., 2015.

HRD Fund Allocation and Utilization:

Rs in Lakhs

Head	Allocation	Expenditure
Non Plan	0.25	0.25
Plan	1.77	1.76

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Awards/Rewards/Recognition received during the year

- Prof. Nazeer Ahmed received *Raj Bhasha Gourav Saman Gyan Vigyan Khand* award for writing original science book in hindi entitled as *Sheetoshan Phalon Ki Vigyanik Kheti* awarded by Hon'ble President of India Shri Pranab Mukherjee on 14th Sept., 2015

Prof. Nazeer Ahmed receiving award from Hon'ble President of India

- Dr Anil Sharma, Sr. Scientist was awarded Leadership Award 2015 during 25th National Conference on Natural Resource Management in arid and semi-arid eco-system for climate resilient agriculture and rural development held at Bikaner, Rajasthan w.e.f. 17 to 19th Feb., 2016.

- The Scientists of CITH received 4 Best Poster Award in various conferences during the year 2015-16

Dr Anil Sharma receiving Leadership Award 2015

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Publications

Research Papers (International/ National)

- Attri BL, Narayan R, Ahmed N, Mer MS and Kumar A. 2015. Evaluation of onion (*Alium cepa* L.) genotypes for growth, yield and quality under Mukteshwar conditions. *Prog. Agric.* 15(2): 272-276.
- Bhatt SC, Debnath S and Pareek N. 2016. Assessment of *Penicillium bilaii* inoculation in wheat (*Triticum aestivum* L.) for improving growth, yield and phosphorus availability in mollisols of India. *Journal of Applied and Natural Science* 8(1): 358-367.
- Debnath S, Narayan R, Kumar A, Attri BL and Kishor A. 2015. Deficiency of magnesium in maize (*Zea mays* L.) induced by high potassium level in a micaceous soil of Kumaon region of Uttarakhand, India. *Journal of Applied and Natural Science* 7(2): 903-906.
- Debnath S, Pachauri SP and Srivastava PC. 2015. Improving use efficiency of applied phosphorus fertilizer by zinc fertilization in *Basmati* rice-wheat cropping system. *Indian Journal of Agricultural Research* 49(5): 414-420.
- Debnath S, Patra AK, Ahmed N, Kumar S and Dwivedi BS. 2015. Assessment of microbial biomass and enzyme activities in soil under temperate fruit crops in north western Himalayan region. *Journal of Soil Science and Plant Nutrition* 15(1): 11-24.
- Kumar A and Sharma JN. 2015. Evaluation of pre-symptom activity of fungicides against *Marssonina coronaria* causing premature leaf fall in apple. *Indian Phytopathology* 68(3): 293-296.
- Kumar D, Lal S, Ahmed N. 2015. Morphological and pomological diversity among apricot (*Prunus armeniaca*) genotypes grown in India. *Indian Journal of Agricultural Sciences* 85(10): 1349-1355.
- Lal C, Sharma S and Kajla S. 2016. Effect of rootstocks and age of seedlings on success of *in vitro* shoot tip grafting in Kinnow mandarin. *Indian Journal of Horticulture* 73(1): 8 -12.
- Lal S, Ahmed N, Srivastava KK, Singh DB. 2015. Olive (*Olea europaea* L.) seed germination as affected by different scarification treatments. *African Journal of Agricultural Research* 10(35): 3570-3574.
- Mahendiran G, Ganie SA, Sheikh KA and Ahmed N. 2015. Development of IPM module for commonly grown vegetables under protected cultivation in Kashmir valley (India). *Biopesticides International* 11(1): 68-71.
- Mir JI, Ahmed N, Khan MH and Mokhdomi TA. 2015. Apocarotenoid gene expression in saffron (*Crocus sativus* L.). *Scientific Research and Assays* 10(15): 482-488.
- Mir JI, Ahmed N, Khan MH, Mokhdoomi TA, Wani SH, Bukhari S, Amin A and Qadri RA. 2015. Molecular characterization of saffron-potential candidates for crop improvement. *Not Sci Biol.* 7(1): 81-89.
- Mir JI, Ahmed N, Singh DB, Khan, MH, Zaffer S and Shafi W. 2015. Breeding and biotechnological opportunities in saffron crop improvement. *African Journal of Agricultural Research* 10(9): 970-974

- Mir JI, Ahmed N, Singh DB, Shafi W, Wani SH, Zaffer S, Khan MH, Yousuf S, Hamid A and Sheikh MA. 2015. *In-vitro* stigma like structure and stigma development in saffron. *International journal of plant research* 28(2): 55-58.
- Mir JI, Ahmed N, Singh DB, Sheemar G, Hamid A, Zaffar S, and Shafi W. 2016. Molecular identification of S alleles associated with self incompatibility in apple (Malus spp.) genotypes. *Indian Journal of Agricultural Research* 86(1): 78-81.
- Narayan R, Attri BL, Ahmed N, Kumar A, Mer MS, Pragya, Debnath S and Kishor A. 2015. Genetic variability and trait association studies in carnation (*Dianthus caryophyllus* L.) for quantitative attributes under low cost polyhouse in Kumaon region of Uttarakhand. *International Journal of Basic and Applied Agricultural Research* 13: 289-295.
- Sharma N, Singh SK, Lal S and Singh NK. 2016. Genome Sequence Information in Fruit Crops: Current Status. *Transcriptomics* 4: 130.
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Research (CSK, HP), Director of Research (NAU, Navsari), Director of Research (Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Ratnagri), Director of Research (PAU), Director of Experimental Station (G.B.P.U.A &T), Panda SK, Sahu KC, Mohapatra SN, Ganguli J, Lakpale N and Director of Research (SKUAST-K). 2015. AESA based IPM package for Apricot. 67p.

- Satyagopal K, Sushil SN, Jeyakumar P, Shankar G, Sharma OP, Sain SK, Chattopadhyay D, Srinivasa N, Sunanda BS, Asre R, Kapoor KS, Arya S, Kumar S, Patni CS, Mahendiran G, Kalra VK, Director of Research (CSK, HP), Director of Research (NAU, Navsari), Director of Research (Dr Balasaheb Sawant Konkan Krishi Vidyapeeth, Ratnagri), Director of Research (PAU), Directorate of Experimental Station (G.B.P.U.A &T), Panda SK, Sahu KC, Mohapatra SN, Ganguli J, Lakpale N and Director of Research (SKUAST-K). 2015. AESA based IPM package for Pear. 61p.
- Sharma A, Ahmed N, Kumar D, Kumar S and Mir JI. 2015. Advanced technologies in almond. Published by Director ICAR-CITH, Srinagar, 24p.
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- Srivastava KK, Ahmed N, Mir JI, Kumar D, and Singh SR. 2015. Manual for quality planting material production. Published by Director ICAR-CITH, Srinagar, 40p.
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- Narayan R, Kumar A, Attri BL, Debnath S, Singh DB, Mer MS and Kishor A. 2015. Technical folder on (no. 1/2015) "Sangakshit Sabji Utpadan Takneek" Published by Director ICAR-CITH-RS, Mukteshwar. 39 p.
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Books

- Rai PN, Shrivastava R, Lal S and Rai KM. 2015. *Shitoshan Phalo ki vyavasaik kheti*. Rajya krishi prabandhan and prasar prashikhan sansthan, Uttarakhand (Hindi) 121p.

Popular articles

- Ahmed N, Srivastava KK, Lal S and Kumar D. 2015. Managing plant architecture for quality apple. *Indian Horticulture*, pp 6
- Attri BL, Kumar A and Ahmed N. 2015. Chestnut cultivation is a lucrative venture. *Indian Hort*., 60(6): 39-41.
- Attri BL, Kumar A and Ahmed N. 2015. Managing quality and yield of apple production in Kumaon region. *Indian Hort*., 60(4): 33-35.
- Bisht PS, Attri BL, Kumar A, Chandra V and Mer MS. 2015. Aushdhiye aur paustik paisan phal. *Phal Phul*., 36(5): 13-14.
- Debnath S, Ray P and Rakshit R. 2015. Remediation of heavy metal polluted soil: phytoremediation *vis-à-vis* chemical immobilization. *Popular Kheti*. 3(3): 162-171.
- Kumar A, Attri BL, Narayan R and Ahmed N. 2015. Leaf blotch on walnut in Uttarakhand. *ICAR News*, *New Initiative Section*, October-December, 6p.
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Book chapters

- Ahmed N, Kumawat KL and Lal C. 2016. Canopy Management and Plant Architectural Engineering in Temperate Fruits and Nuts. *In*: Temperate Fruits and Nuts – A Way Forward for Enhancing Productivity and Quality. Edited by KL Chadha, N Ahmed, SK Singh and P Kalia. New Delhi, Daya Publishing House a division of Astral International Pvt. Ltd., pp: 67-99.
- Ahmed N, Mir JI and Raja WH. 2015. Advances in varietal and rootstock improvement in temperate fruits. *In*: Temperate Fruits and Nuts – A Way Forward for Enhancing Productivity and Quality. Edited by KL Chadha, N Ahmed, SK Singh and P Kalia. New Delhi, Daya Publishing House a division of Astral International Pvt. Ltd., pp: 167-200.
- Dhakar MK, Sarolia DK, Kaushik RA, Kumawat KL, Singh S and Singh AK. 2015. Mahua (*Madhuca longifolia* (Koenig) J.F. Macribide). *In*: Breeding of Underutilized Fruit Crops-Part-II. Edited by SN Ghosh. Delhi, Narendra Publishing House, pp: 305-325.
- Kumawat KL, Sarolia DK, Singh V and Dhakar MK. 2015. Timroo (*Diospyros melanoxylon Roxb.*). In: Breeding of Underutilized Fruit Crops-Part-II. Edited by SN Ghosh. Delhi, Narendra Publishing House, pp: 507-518.
- Mahendiran G, Ahmed N and Ganie SA. 2016. Insect pests and diseases of almond, apricot, peach, plum, and pear. *In*: Insect Pests Management of fruit crops. Edited by Ajay Kumar Pandey and Pramod Mall. New Delhi, Biotech Books, pp: 357-377.
- Mahendiran G, Ahmed N and Ganie SA. 2016. Integrated pest management (IPM) in temperate fruits. *In*: Insect Pests Management of fruit crops. Edited by Ajay Kumar Pandey and Pramod Mall, New Delhi, Biotech Books, pp: 663-669.
- Sarolia DK, Kumawat KL and Bhardwaj RL. 2015. Khejri (*Prosopis cineraria* (L.) Druce). *In*: Breeding of Underutilized Fruit Crops-Part-I. Edited by SN Ghosh. Delhi, Narendra Publishing House, pp: 201-214.
- Sarolia DK, Kumawat KL and Ramnivas. 2015. Ker (*Capparis decidua* (Forsk.) Edgew). *In*: Breeding of Underutilized Fruit Crops-Part-I. Edited by SN Ghosh. Delhi, Narendra Publishing House, pp: 191-199.
- Singh DB and Ahmed N. 2015. Walnut. *In*: Managing Postharvest Quality and Losses in Horticultural Crops Vol-2. Edited by KL Chadha and RK Pal. New Delhi, Daya Pubishing House a Division of Astral International Pvt. Ltd., pp: 561-579.
- Singh DB and Ahmed N. 2015. Almond. *In*: Managing Postharvest Quality and Losses in Horticultural Crops Vol-2. Edited by KL Chadha and RK Pal. New Delhi, Daya Pubishing House a Division of Astral International Pvt. Ltd., pp: 253-268.
- Singh DB and Mir JI. 2016. Future fruits for temperate regions: Production and their nutraceutical importance. *In*: Temperate Fruits and Nuts – A Way Forward for Enhancing Productivity and Quality. Edited by KL Chadha, N Ahmed, SK Singh and P Kalia. New Delhi, Daya Publishing House, a division of Astral International Pvt. Ltd., pp: 227-248.

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Participation in Workshops/ Conferences/ Meetings

Dr. Desh Beer Singh, Director/Acting

- Participated in National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended Annual *Conference* of Vice-Chancellors of Agricultural Universities and *Directors* of ICAR Institutes held at NASC Complex, New Delhi w.e.f. 22 to 24th Jan., 2016.

Dr. Raj Narayan, Principal Scientist (Hort. Science)

- Attended Workshop on Intellectual Property Management in Fisheries & Agriculture Sector held at ICAR-DCWFR, Bhimtal on 28th April, 2015.
- Attended National Seminar on 'Sustaining Hill Agriculture in Changigng Climate' at ICAR Research Complex for NEH Tripura Centre, Agartala w.e.f. 5 to 7th Dec., 2015.

Dr. O C Sharma, Sr. Scientist (Hort.-Fruit Science)

- Participated in National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar, w.e.f. 6 to 9th Nov., 2015.
- Attended Pre workshop of Challenge Programme on Canopy Management and Plant Architectural Engineering in Temperate Fruits held at CITH, Srinagar, on 18th June, 2015.
- Attended 50th RCM meeting of SKUAST-K held at Shalimar on 11th May, 2015
- Attended XXIV Group Meeting of All India Coordinated Research Projects on Floriculture held at SKUAST K, Srinagar organized by SKUAST K and DFR, Pune w.e.f. 17 to 19th April, 2015.

Dr Anil Sharma, Sr. Scientist (Soil Science)

- Attended 25th National Conference on Natural Resource Management in arid and semi-arid eco-system for climate resilient agriculture and rural development held at Bikaner, Rajasthan w.e.f. 17 to 19th Feb., 2016.
- Participated in National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.

Dr. J. I. Mir, Scientist, Sr. Scale (Biotechnology)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended international conference on low temperature science and biotechnological process held at NBPGR, New Delhi w.e.f. 27 to 30th April, 2015.
- Attended Indo-German joint workshop on DUS testing at LBS Auditorium, held at NRCPB, New Delhi w.e.f. 23 to 24th Nov., 2015.
- Participated in review meeting of CRP-AB held at CISH, Lucknow on 17th March, 2016.
- Attended 9th Review Meeting of DUS test centers held at JAU on 9th March, 2015.

Dr. G. Mahendiran, Scientist Sr. Scale (Entomology)

- Attended Annual review meeting for the project Outreach programme on management of sucking pests in Horticultural crops, held at IIHR, Bengaluru on 13th Feb., 2016.
- Participated in National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.

Dr. Anil Kumar, Scientist (Plant Pathology)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended review meeting of ORP on Fungal Foliar Diseases held at ICAR-IIHR, Bengaluru, Karnataka on 7th Aug., 2015.
- Attended International workshop on Rapid diagnostic tools for Phytophthora on horticulture crops held at ICAR-IIHR, Bengaluru, Karnataka on 8th Sept., 2015.

Dr. Arun Kishor, Scientist (Fruit Science)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended Pre workshop of Challenge Programme on Canopy Management and Plant Architectural Engineering in Temperate Fruits held at CITH, Srinagar, on 18th June, 2015.
- Attended official meeting on "Strategic research component of NICRA" held at ICAR-CITH, Srinagar on 15th Dec., 2015.
- Attended official meeting on fixation/ modification of standards for district and state level plans of horticulture department held at G.B.P.U.A.T., Pantnagar, Uttarakhand on 10th Dec., 2015.

Dr. Geetika Malik, Scientist (Vegetable Science)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Participated in state level seminar on Production and Popularization of Temperate Spice Crops for Livelihood Security (CSS-MIDH) held at the Division of Vegetable Science, SKUAST-K, Shalimar w.e.f. 15 to17th March, 2016.
- Attended nodal workshop of KRISHI held at NASC, New Delhi w.e.f. 4 to 5th Aug., 2015.

Dr. K. L. Kumawat, Scientist (Fruit Science)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended National Annual Review Workshop of the National Innovations on Climate Resilient Agriculture (NICRA) project held at ICAR-Central Marine Fisheries Research Institute (CMFRI) Kochi, Kerala w.e.f. 13 to 14th Aug., 2015.
- Attended Pre workshop of Challenge Programme on Canopy Management and Plant Architectural Engineering in Temperate Fruits held at CITH, Srinagar, on 18th June, 2015.
- Attended official meeting on "Strategic research component of NICRA" held at ICAR-CITH, Srinagar on 15th Dec., 2015.

Dr. Wasim Hassan Raja, Scientist (Fruit Science)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.

Shri Lal Chand, Scientist (Fruit Science)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended Launch workshop of Taskforce on Himalayan Agriculture (TF-6) held at NASC Complex, New Delhi on 13th May, 2015.
- Attended Workshop on Generic Vulnerability Analysis of Himalayan Region under NMSHE-TF-6 held at ICAR-IISWC, Dehradun w.e.f. 17 to 18th Nov., 2015.
- Attended Consultation Workshop of National Mission for Sustaining Himalayan Ecosystem, TF-6 (Himalayan Agriculture: Cold Arid Region) held at ICAR-CAZRI, Jodhpur on 22nd March, 2016.
- Attended Pre workshop of Challenge Programme on Canopy Management and Plant Architectural Engineering in Temperate Fruits held at CITH, Srinagar, on 18th June, 2015.

Dr. K. M. Rai, Scientist (Fruit Science)

- Attended National Conference on Temperate Fruits and Nuts-a way forward for enhancing productivity and quality held at Srinagar w.e.f. 6 to 9th Nov., 2015.
- Attended National Workshop-cum-seminar on Emerging prospects of protected cultivation in horticultural crops under changing climate held at ICAR-CISH, Lucknow w.e.f. 22 to 23rd Dec., 2015.

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List of Ongoing Projects

Institute Research Projects	
A. Project: Crop improvement and Biotechnology **Sub projects:**	
1	Survey, collection, characterization and documentation of temperate horticultural crops (CITH-01)
2	Studies on improvement and production of saffron (CITH-06)
3	Breeding for development of superior varieties/hybrids in Solanaceous vegetables (CITH–07)
4	Development of superior cultivars/ hybrids in temperate fruits through conventional and non conventional methods (CITH-40)
5	DNA finger printing of apple, walnut and apricot(CITH-47)
6	Standardization of micro propagation of apple, walnut, saffron and lilium (CITH-48)
7	Development of CMS lines in long day onion [*Allium cepa* L] (CITH-70)
B. Project: Crop Production and Propagation **Sub projects:**	
1	Development of almond based saffron inter cropping system (CITH 11)
2	Energy harvest through plant architectural engineering for increasing source and sink relationship in apple and other temperate fruit crops (CITH-31)
3	Effect of various training and pruning systems in Persian walnut (CITH-54)
4	Standardization of integrated nutrient management of vegetables as intercrop in apple orchard (CITH-57)
5	Enhancing alstroemeria production involving different growing condition (CITH-58)
6	Divulging the adept mode of fertilizer application to optimize saffron yield (CITH 60)
7	Fertigation: An efficient soil management stratagem for escalating nutrient and water use efficiency in apple (CITH 61)
8	Aquatic dissipate management (ADM) through vermitechnology (CITH 62)
9	Characterization of soil Nutritional survey in Apple and Peach Growing Areas of Uttrakhand (CITH-64)
10	Standardization of growing /nutrients media and growing conditions for the cost effective production of quality vegetables and their seedlings (CITH-65)
11	Development of diversification technology for round the year vegetable crops under mid and high hills of Uttrakhand (CITH-66)
C. Project: Crop Protection **Sub projects:**	
1	Management of major soil born diseases of apple (CITH-55)
2	Development of spray schedule against major canker and foliar diseases of apple in Uttarakhand (CITH-56)
3	Study of bio-ecology and management of aphid and mite in temperate fruits (CITH-59)

Institute Research Projects	
D. Project: Post Harvest Management **Sub projects:**	
1	Preparation and evaluation of fruit wine from different cultivars of pear grown in Uttarakhand (CITH 63)
2	Studies on dried prunes in relation to cultivars and drying technology (CITH-67)
3	Standardization of technology for blending of temperate stone fruit juice (CITH-68)
4	Assessment of Kashmiri chilli for commercial traits (CITH-69)
E. Ongoing externally funded projects **Sub projects:**	
1	Network project on outreach of technologies for temperate fruit crops (Main centre)
2	Network project on onion and garlic (co-operation centre)
3	All India Coordinated Research Project (Vegetable Crops)
4	Intellectual property management and transfer/ commercialization of agricultural technology scheme
5	National saffron Mission for economic revival of J & K saffron sector
6	Outreach programme on management of sucking pests in horticultural crops
7	Consortium research platform on borers
8	National initiative on climate resilient agriculture (NICRA)
9	Micronutrient management in horticultural crops
10	Consortia research platform on fungal foliar diseases
11	CRP on agro biodiversity
12	Challenge programme on canopy management and plant architectural engineering in temperate fruits
13	National mission for sustainable Himalayan ecosystem (TF-6)
14	DUS testing centre for temperate fruits

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Research Review and Management Committees

Research Advisory Committee of ICAR-CITH

1	**Padma Shri Dr. K.L. Chadha,** Ex. DDG, Hort. ICAR, New Delhi 7281, Sector-B, Pocket-10, Vasant Kunj, New Delhi	Chairman
2	**Dr. B. Venkateswarlu,** Vice Chancellor, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani-431402, Maharastra	Member
3	**Dr. A.A. Sofi,** Ex-Director, CITH, Srinagr, Iqbal Colony, Opposite Baba Marbels, HMT, Zainakot, Srinagar-190012 (J&K)	Member
4	**Dr. V.V. Ramamurthy,** Ex-Professor, Division of Entomology, ICAR-IARI, New Delhi.	Member
5	**Dr. Surinder K. Tikoo,** Director Research, Breeding and Dev Tierra Seed Science, Pvt Ltd D 18, Hill View Residency, Baner, Pune-411045, HO: Malaxmi Courtyard, Khajaguda, Hyderabad-500008, India	Member
6	**Dr. J.L. Karihaloo,** Co-ordinator of APCAB, Asia Pacific Association of Agriculture Research Institution (APAARI), C/o ICRISAT, NASC, DPSM, New Delhi-110012	Member
7	**Dr. Hina Shafi,** D/o Sh. M. S. Bhat, M.P. Lane, Kursu Rajbagh, Srinagar	Member
8	**Shri Desh Kumar Nehru,** S/o Syam Lal, Panjla, Teh.: Rohama, Distt.: Baramullah (J&K)	Member
9	**Dr. T. Janakiram** ADG (Hort-I), KAB-II, ICAR, New Delhi	Member

10	**Dr. D.B. Singh,** Director (Acting), ICAR-CITH, Srinagar	Member
11	**Dr. O.C. Sharma,** Sr. Scientist, ICAR-CITH, Srinagar	Member secretary

Institute Management Committee (IMC)

1	**Dr. Desh Beer Singh** Director/Acting, ICAR-CITH, Srinagar	Chairman
2	**Director Horticulture** Govt. of J&K, Raj Bagh, Srinagar	Member
3	**Director** Horticulture and Food Processing, Department of Horticulture, Chaubattia Ranikhet, Almora (Uttarakhand)	Member
4	**Prof. & Head** Div. of Fruit Science, SKUAST-K, Shalimar	Member
5	**Dr. Hina Shafi Bhat** D/O Sh. M.S. Bhat R/O M.P. Lane Kursoo, Rajbagh, Srinagar -190008	Member
6	**Sh. Desh Kumar Nehru** S/O Sh. Sham Lal R/O Rohama, District Baramulla, J&K	Member
7	**Dr. Major Singh** Principal Scientist, Crop Improvement Division, ICAR-IIVR, Varanasi	Member
8	**Dr. O.P. Awasthi** Principal Scientist (Fruit Science), ICAR-IARI, New Delhi	Member
9	**Dr. Anil Sharma** Senior Scientist, ICAR-CITH, Srinagar	Member
10	**Dr. S. Sultan,** Senior Scientist and I/C, ICAR-NBPGR, Regional Station, Srinagar	Member
11	**Asstt. Director General (Hort.-I)** ICAR, KAB-II, Pusa, New Delhi-110012	Member
12	**Shri S.K. Sharma** F&AO, ICAR, Krishi Bhawan, New Delhi	Member
13	**Shri Ramesh** AAO, ICAR-CITH, Srinagar	Member Secretary

Quinquennial Review Team (QRT)

1	**Dr. S.D. Shikhamany** No. 3106 Sirla Towers, Hyder Nahar, Kukatpali, Hyderabad-500072	Chairman
2	**Dr. K. Kumar** Professor, YSPUH&FS, Solan	Member
3	**Dr. P. Anand Kumar** Director, IBT, ANGRAU, Hyderabad	Member
4	**Dr. R.P. Singh** Dean Agri. Campus, Banaras Hindu University, Varanasi (UP)	Member
5	**Dr. R.D. Rawal** Head (Rtd.) Division of Plant Pathology, IIHR, Bangaluru	Member
6	**Dr. Sharan Angadi** Plant Breeder No. 16 IA-Man Road, Canara Bank Road, Bengaluru	Member
7	**Dr. Desh Beer Singh** Principal Scientist, ICAR-CITH, Srinagar	Member Secretary

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Distinguished Visitors

Hon'ble Minister for Horticulture

Hon'ble Minister for Horticulture and Haj & Auqaf, Jammu and Kashmir, Jenab Abdul Rehman Bhat (Veeri) visited ICAR-Central Institute of Temperate Horticulture, Srinagar on 8th June, 2015. He emphasized the need for formulating a core group comprising scientists and experts from development departments for executing the plan for management of horticultural crops. The Hon'ble Minister asked the scientists to extend their expertise to the orchardists of Jammu and Kashmir for improving farm productivity and returns. He was again invited as Chief Guest during Apple Day celebration at ICAR-CITH, Srinagar on 23rd Sept., 2015.

Director CITH showing high yielding cultivars of fruits to Jenab Abdul Rehman Bhat (Veeri), Hon'ble Minister for Horticulture and Haj & Auqaf, J&K

Deputy Chairman J and K Legislative Council

Jenab Jahangir Hussain Mir Deputy Chairman, Jammu and Kashmir Legislative Council visited ICAR-Central Institute of Temperate Horticulture, Old Air Field, Rangreth, Srinagar (J &K) on 11th Aug., 2015.

Regional Station, Mukteshwar

Hon'ble Governor, Uttarakhand

Hon'ble Governor Uttarakhand, Dr K.K. Paul visited CITH, Regional Station Mukteshwar on 1st June, 2015 and interacted with scientist of ICAR-CITH-RS, Mukteshwar. His Excellency praised the work of Institute.

Vice-Chancellor, GBPUA&T, Pantnagar

Dr. Mangla Rai, Ex-DG, ICAR and present Vice-Chancellor, GBPUA&T, Pantnagar, Uttarakhand visited the Institute on 15th Jan, 2016. He was shown the various research activities being undertaken at the station

Deputy Director General (Horticulture Sciences)

Dr. N.K. Krishna Kumar, Deputy Director General (Horticulture Sciences), Visited CITH Regional Station Mukteshwar on 8th May, 2015. He reviewed various activities going on in field and Labs. He gave critical inputs for improving the research activities further in the Institute.

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Personnel

CITH Head Quarter, Srinagar

RMP

- Dr. D.B. Singh, Director /Acting

Scientific

- Dr. O.C. Sharma, Senior Scientist, Hort.-Fruit Science
- Dr. Anil Sharma, Senior Scientist, Soil science
- Dr. J.I. Mir, Scientist (Senior Scale), Plant Biotechnology
- Mr. Shiv Lal, Scientist (Senior Scale), Fruit Science (on study leave)
- Dr. G. Mahendiran, Scientist (Senior Scale), Agri. Entomology
- Dr Susheel Kumar Raina, Scientist Plant Breeding
- Dr. Geetika Malik, Scientist, Vegetable Science
- Dr. Kishan Lal Kumawat, Scientist, Fruit Science
- Dr. Wasim Hassan Raja, Scientist, Fruit Science
- Dr K.M. Rai, Scientist, Fruit Science
- Sh. Lal Chand, Scientist, Fruit Science
- Sh. Selvakumar, Scientist, Vegetable Science

Administrative

- Sh. Fayaz Ahmad Dar, AF &AO
- Sh. Ramesh, Asstt. Admn. Officer
- Mrs. Shahida Rafiq, P.A. to Director
- Sh. Showkat Ahmad Mir, Assistant
- Sh. Riyaz Ahmad Mir, Assistant
- Sh. Mukhtar Ahmad, Assistant (KVK, Baramulla)
- Sh. Tariq Ahmad Mir, Jr. Stenographer
- Sh. Mehraj-ud-Din Meer, UDC
- Sh. Muzaffer Lone, LDC
- Sh. Rouf Ahmad Sheikh, LDC

Technical

- Sh. Shoaib Nissar Kirmani, Senior Technical Officer
- Sh. Mohammad Mudasir Magray, Senior Technical Officer
- Sh. Eshan Ahmad, Tech. Officer
- Sh. Muneer Ahmad Sheikh, Sr. Techinical Asst. (Study Leave)
- Sh. Mehraj-ud-din Bhat, Technical Assistant (Driver)
- Sh. Farman Ali, Technical Assistant (Driver)
- Sh. Mohammad Ramzan Wani, Senior Technician (Lab.)
- Sh. Mushtaq Ahmad Khan, Senior Technician (Lab.)
- Smt. Mubeena, Technican (Computer / data operator)
- Sh. Ajaz Ahmad Wani, Technician (Field)
- Sh. Ishtiyaq Ahmad Sheikh, Technician (Field)

Skilled Supporting Staff

- Sh. Bashir Ahmad Dar, SSS
- Sh. Showkat Ahmad Dar, SSS
- Sh. Abdul Rashid Bhat, SSS (KVK, Baramulla)
- Sh. Bashir Ahmad Ganai, SSS.
- Sh. Zubair Ahmad Swathi, SSS
- Sh. Madan Lal, SSS.
- Sh. Khushi Ram, SSS
- Sh. Ghulam Nabi Bhat, SSS

Personnel at CITH-RS, Mukteshwar

Scientific staff

- Dr. Raj Narayan, Principal Scientist, Hort. Science
- Dr. Anil Kumar, Scientist, Plant Pathology
- Dr. Arun Kishor, Scientist, Fruit Science
- Sh. Sovan Debnath, Scientist, Soil Science

Administrative

- Sh. Akhil Thukral, Asstt. Admn. Officer
- Sh. Diwan Chandra, Assistant
- Sh. Pushpendra Kumar, LDC

Technical staff:

- Sh. Vinod Chandra, Technical Officer
- Sh. Puran Chandra, Senior Technician (Field Asst.)
- Sh. Mohammad Touseef Ali, Technician (Field Asst.)

Supporting staff:

- Sh. Narayan Singh, SSS
- Sh. Govind Giri, SSS
- Sh. Shabir Ahmad Mir, SSS

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Appointments/ Promotions/Transfers/ Retirements/Demise

- Prof. Nazeer Ahmed, Director, CITH left this Institute on 21st Oct., 2015 and joined as Vice Chancellor, SKUAST-K, Srinagar.
- Dr B.L. Attri, Principal Scientist (Hort.-Fruit Science) transferred from CITH, RS, Mukteshwar to DMR, Solan on 11th Feb., 2016.
- Sh. Brajendra Kumar Puskar, STO transferred from ICAR-CITH, Srinagar to ICAR-CISH, Lucknow on 27th Jan., 2016 .
- Dr. D.B. Singh, Principal Scientist & Head, VC & F took the charge of Acting Director
- Dr. Manoj Kumar, Joined as Senior Scientist & Head (Programme Coordinator) at KVK, Baramulla on 21st Sep., 2015.
- Dr. Susheel Kumar Raina, joined as Scientist, Plant Breeding on 4th Dec., 2015 after being transferred from ICAR-NIASM, Baramati.
- Dr. Wasim Hassan Raja, joined as Scientist, Fruit Science on 6th April, 2015.
- Dr. K.M. Rai, joined as Scientist, Fruit Science on 9th April, 2015.
- Sh. Lal Chand, joined as Scientist, Fruit Science on 9th April, 2015.
- Sh. Selvakumar R., joined as Scientist, Vegetable Science after being transferred from DMR Solan on 21st March, 2016.
- Sh. Muzaffer Lone, joined as LDC on 13th April, 2015.
- Sh. Rouf Ahmad Sheikh, joined as LDC on 15th April, 2015.
- Sh. Shoaib Nissar Kirmani, joined as Senior Technical Officer on 13th April, 2015.
- Sh. Mohammad Mudasir Magray, joined as Senior Technical Officer on 13th April, 2015.
- Sh. Mohammad Touseef Ali, joined as Technician on 20th April, 2015.
- Sh. Shabir Ahmad Mir joined as SSS on 18th April, 2015

Retirements

- Sh. Abdul Rashid Dar, SSS, ICAR-CITH, Srinagar retired from Council's services on 31st July, 2015
- Shri Ghulam Ahmad Rather, SSS, ICAR-CITH, Srinagar retired from Council's services on 29th Feb., 2016

Demise

- Sh. Manmohan Singh, Senior Technical Assistant, passed away on 27th June, 2015.

NOTE

NOTE

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