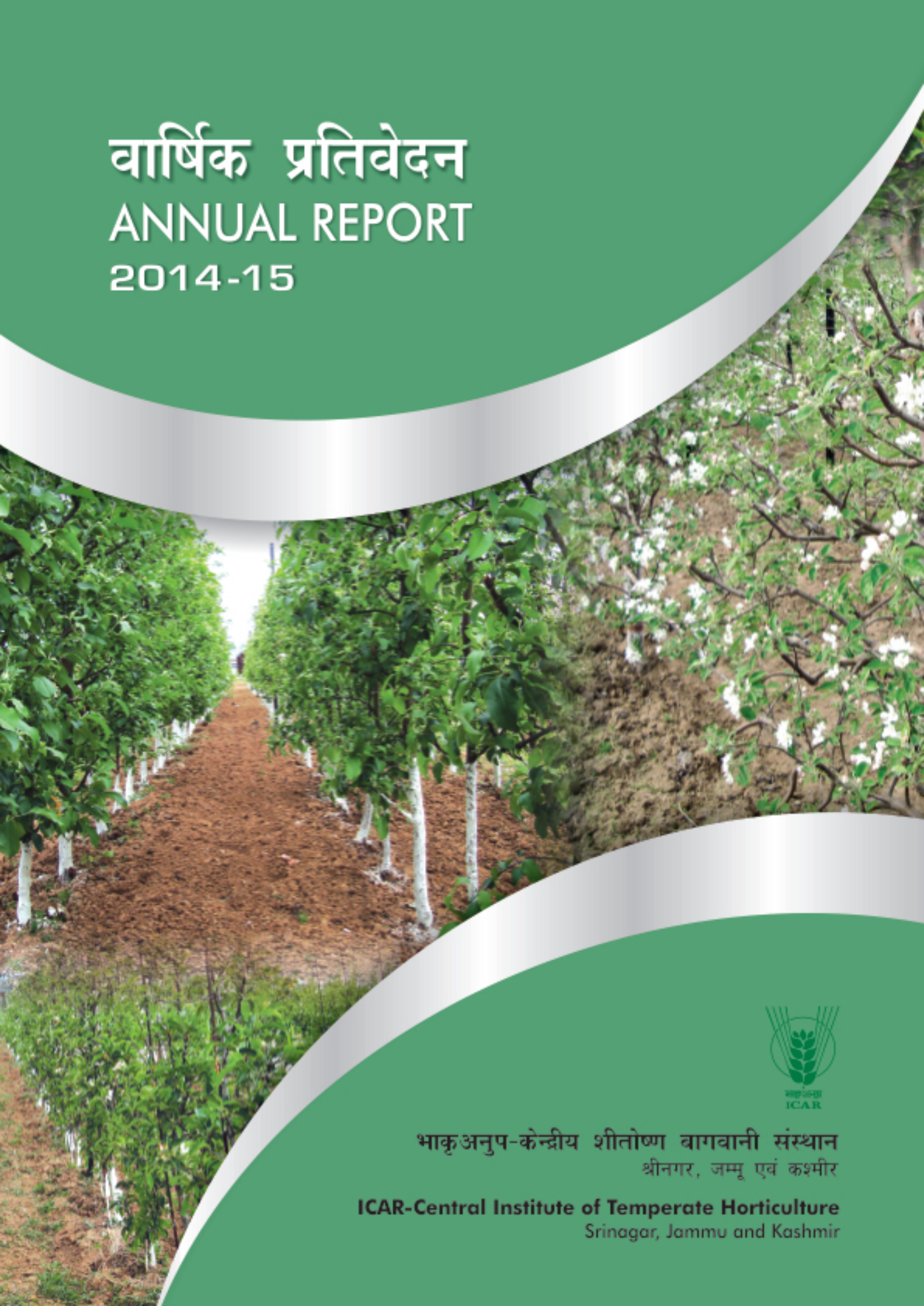
वार्षिक प्रतिवेदन
ANNUAL REPORT
2014-15



भाकृअनुप-केन्द्रीय शीतोष्ण बागवानी संस्थान
श्रीनगर, जम्मू एवं कश्मीर

ICAR-Central Institute of Temperate Horticulture
Srinagar, Jammu and Kashmir

वार्षिक प्रतिवेदन
Annual Report

2014-15

भाकृअनुप-केन्द्रीय शीतोष्ण बागवानी संस्थान
ओल्ड एयर फील्ड, पो.–रंगरेट, श्रीनगर 190 007
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Correct Citation:
CITH-Annual Report 2014-15
ICAR-Central Institute of Temperate Horticulture
Old Air Field, P.O.-Rangreth-190007, Srinagar (J&K)
Phone: 91-194-2305044, 2305045
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Word Processing:
Syed Mubeena
Mudasir

Cover Page:
Canopy Management Systems in Apple (Front)
Fruiting in elite Apple Variety (Back)

Printed by:
M/s Royal Offset Printers, A-89/1, Naraina Industrial Area, Phase-I, New Delhi-110028

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कार्यकारी सारांश

आजादी के पश्चात शीतोष्ण बागवानी फसलों के क्षेत्र मे संतोष जनक वृद्धि से इनके उत्पादन को जबर्दस्त प्रोत्साहन मिला है। यद्यपि कई उत्पादन से संबधित समस्याओं की वजह से विकसित देशों की तुलना मे इन फसलों की उत्पादकता अभी भी कम है, जिससे प्रति इकाई क्षेत्र से बहुत कम प्रतिलाभ मिल रहा है। इन समस्याओं को कम करने तथा उत्पादकता को बढ़ाने के लिए केन्द्रीय शीतोषण बागवानी संस्थान के मुख्य परिसर व क्षेत्रीय अनुसंधान केन्द्र मुक्तेश्वर मे 2014–15 मे किए गयें विभिन्न शोध कार्यो का सांराश नीचे वर्णित है।

फसल सुधार एवं जैव प्रौद्योगिकी

किसी भी फसल की उत्तम किस्में उस फसल की उत्पादकता व उत्पादन की गुणवत्ता की मुख्य घटक होती है। इस वर्ष मे लहसुन के दो जीन प्रारूपों (सी.आई.टी एच.–जी.–1 एवं 2) तथा चेरी के दो जीन प्रारूपों (सी. आई.टी एच– चेरी–7 एवं 9) को चिन्हित कर संस्थान की किस्म विमोचन समिति द्वारा जारी किया गया, तथा इसमें से लहसुन के जीन प्रारूप (सी.आई.टी. एच–जी–1) को केन्द्रीय किस्म विमोचन समिति द्वारा राष्ट्रीय स्तर पर विमोचित करने के लिए चिन्हित किया गया। इसके अलावा शिमला मिर्च के दो जीन प्रारूपों, गाजर, शलजम, मिर्च व करमसाग के एक–एक जीन प्रारूपों, जो उत्पादन व अन्य लक्षणों मे सर्वश्रेष्ठ थे उन्हें सब्जियों की फसलों पर अखिल भारतीय समन्वित अनुसंधान परियोजना (अ.भा. स.अ.प.) में मूल्यांकन के लिए प्रस्तुत किया गया। विभिन्न फसलों के जननइत्य में 107 नयें जीन प्रारूपों को जीन बैंक मे जोड़ा गया, जिसके परिणामस्वरूप के.शी.बा.स. में जन द्रब्यों की संख्या 2333 तक पहुँच गयी।

प्राकृतिक रूप से बीमारी के लिए अनुकुल परिस्थति में स्केब बीमारी के प्रति रोग प्रतिरोधिता कि संविक्षा के दौरान 30 किस्में, 13 प्रतिरूप तथा 5 जातियां ने इस रोग प्रतिरोधिता दर्शायी जबकि सेब के जननद्वत्यों के मूल्यांकन मे फलो का वजन 52.62 से 274.34 ग्राम के बीच दर्ज किया गया। 2.5x2.5 मी. अन्तराल पर एम.एम.–106 मूल वृन्त पर लगायी गई सेब की 10 किस्मों के मूल्यांकन के दौरान सर्वाधिक पैदावार ऑरिगन स्पर (43.2 टन/हे.) मे दर्ज की गई। जबकि 4.0x4.0 मी. अन्तराल पर बीजू मूलवृन्त पर सबसे ज्यादा पैदावार (28.93टन/हे.) रेड़ डेलिशियस मे दर्ज की गई। सेब की विभिन्न किस्मों के परिपक्वता समूह के मूल्यांकन में 12 जल्दी, 10 मध्य व 16 देर से परिपक्व होने वाली पायी गई। नाशपाती कि किस्मों को फूल आने के समय के अनुसार जल्दी, मध्यम एवं देर मे वर्गीकृत किया गया। नाशपाती मे सर्वाधिक उपज (27. 86 कि. ग्रा./पेड़) कश्मीरी नाख मे तथा उसके उपरान्त (26.63 कि.ग्रा/पेड़) सन्तिया बैइसकेज मे दर्ज की गई।

खुबानी के 54 जीन प्रारूपों के मूल्यांकन मे सबसें ज्यादा पैदावार (59.56 कि.ग्रा./पेड़ व 27.26 टन/हे.) सी.आई.टी. एच.– खुबानी–3 मे दर्ज की गई उसके उपरान्त सर्वाधिक पैदावार सी.आई.टी. एवं खुबानी–1 (47. 65 कि.ग्रा/पेड़ व 19.06 टन/हे.) मे दर्ज की गई। आलू बुखारा कि 23 किस्मों के मूल्यांकन मे किस्म मेरीपोसा मे सर्वाधिक पैदावार (68.16 कि.ग्रा./पेड़ व 27.26 टन/हे.) दर्ज की गई। इसके उपरान्त उपज की दृष्टि से ऑ चेरी, टेरोल, मोनारच एवं ब्यूटी अच्छी पाई गयी। बादाम के विभिन्न चयनों मे नट व गिरी के लक्षणों की दृष्टि से सी. आई.टी. एच. बादाम–8,9,19,21,22 एवं 23 को आशाजनक पाया गया, जबकि अखरोट मे वांछनीय नट व गिरी लक्षणों की दृष्टि से सी.आई.टी. एच.–अखरोट–1, 85 एवं 9 सबसे अच्छे पाए गयें। सबसे ज्यादा नट का वजन (26. 31 ग्राम) और गिरी का वजन (14.40 ग्राम) सी.आई.टी. एच.–अखरोट–1 मे दर्ज किया गया। चेरी के 23 चयनित प्रारूपों के मूल्यांकन मे सी.आई.टी.एच.– चेरी–7 और सी. आई.टी.एच.–9 आशाजनक पाए गए जिनमें क्रमशः 13.5 एवं 13.0 कि.ग्राम उपज प्रति पेड़ दर्ज की गई, जबकि विभिन्न विदेशों किस्मों मे सर्वाधिक उपज देने वाली किस्मे बीगारीऊ नेपोलियन (11.0 कि.ग्रा./पेड़) लेपिन्स (9.5 कि. ग्रा/पेड़) रही। जैतून की विभिन्न किस्मों के मूल्यांकन मे जैतूना, कोराटीना, सीप्रेसीनों व फ्रन्टियो को उपज की दृष्टि से उत्तम पाया गया। जैतून की विभिन्न किस्मों में

12.33 से 30.97 तक तेल की प्रतिशतता पायी गयी। आडू की विभिन्न किस्मों मे से सर्वाधिक फल का वजन (89.09 ग्राम) रेड़ ग्लोब में तथा इसके उपरान्त निमला मे दर्ज किया गया, जबकि सर्वाधिक उपज (26.01 कि.ग्रा./पेड़) किस्म निमला मे दर्ज की गई। किवी फल की विभिन्न किस्मों के तुलनात्मक अध्ययन मे फल के लक्षणों की दृष्टि से मोन्टी किस्म उत्तम पायी गयी।

हरित गृह मे लिलियम की विभिन्न किस्मों के मूल्यांकन में फूलों के प्रारम्भ होने का समय 25 गई से 27 जुलाई तक रहा। सबसे बड़ा फूल (21.65 से.मी.) केरोलिन टेन्सेन मे दर्ज किया गया जबकि सबसे ज्यादा समय तक फूल (42 दिन) देने वाली किस्म लिटॉवेन रही, जबकि सबसे ज्यादा फूलदान जीवन (15.4 दिन) ब्रिनड्सी मे दर्ज किया गया। काला जीरा के बीज की बुवाई फरवारी तक तथा बल्ब की रोपाई मार्च के प्रथम सप्ताह तक की जा सकती है। सब्जी फसलों के विभिन्न जीन प्रारूपों मे विभिन्न लक्षणों के मूल्यांकन मे गाजर में एस.एच–गाजर–11, शलजम मे सी.आई.टी.एच.–शलजम–1,मूली मे सी.आई.टी. एच.–मूली–1 तथा मिर्च की विभिन्न प्रविष्टियों मे 2013/ सी.एच.आई.टी.एच.वाई.बी.–3, 2012 सी.एच.आई.एच.वाई. बी.–7, 2011/ सी.एच.आई.एच.वाई.बी.–4, सी.एच.आई. वी.ए.आर.–1, 2012 सी.एच.आई.वी.ए.आर.–9, 2011/ सी.एच.आई.वी.ए.आर.–7, टमाटर की 2013/टी.ओ.डी. एच.वाई.वी.–3, 2012/टी.ओ.डी.एच.–6 टी.ओ.डी.एच.वाई. बी.–6, प्याज मे ओ.एल.आर.–1364, ए.एल.आर.ओ. 1213 एवं वी.एल.आर.ओ. 1229, लहसुन–5, जी.आर.एल. 1330 उपज एंव अन्य लक्षणों की दृष्टि से उत्तम पायें गयें। जीन प्ररूपों के संकलन व उनके मूल्यांकन का कार्य मुक्वेश्वर मे भी किया गया तथा आशाजनक जीन प्रारूपों को चिन्हित किया गया। वर्ष 2014 के दौरान सेब के उत्तम जीन प्रारूपों को प्राप्त करने के लिए विभिन्न किस्मों के बीच मे संकलन द्वारा 34 परस्पर संयोजन बनाए गयें तथा प्रारम्भिक संकरणों मे कुछ पौध जिनमें स्केब बीमारी का प्रकोप कम था उन्हें चिन्हित किया गया। अखरोट मे विदेशी व देशी जीन प्रारूपों के वांछनीय लक्षणों का गठबंधन करने के लिए संकरण द्वारा विभिन्न परस्पर संयोजन बनाए गए तथा प्रारम्भिक संकरणों से प्राप्त पौध का मूल्यांकन वृद्वि लक्षणों के लिए किया गया। सोलेनेसी कुल की सब्जियों के जीन प्रारूपों के प्रजनन मे बैंगन मे सी. आई. टी. एच.–बैंगन–1 (105.07 टन/हे.), मिर्च में सी.आई.टी.एच.पी.–के.एल.–2 (60.78 टन/हे.) तथा शिमला मिर्च मे एस.एच.–एस.पी.–603 (61.23 टन/हे.) को श्रीनगर मे सर्वाधिक पैदावारी के लिए चिन्हित किया गया। जबकि मुक्वेश्वर मे टमाटर मे वी.एल.–4 मे सर्वाधिक उपज (2202.19 वि./हे व 5945.93 ग्राम/पौधा) दर्ज की गई।

एस.एस.आर. एवं आई.एस.एस.आर.मार्कर द्वारा आलू बुखारा की 24 किस्मों की डी.एन.ए. फिंगर–प्रिन्टिग की गई तथा इनके समूही करण के दौरान पाया गया कि किस्म ईटालियन बाकी समूहों से अलग पाया गया। सेब के मूल वृन्त मे जड़ो का प्रतिशत, जड़ो की संख्या जड़ों की लम्बाई एवं जड़ों के आने की शुरूआत सर्वाधिक तब रही जब एम.एस. माध्यम मे परिपूरक के रूप मे आई. ए.ए. (2 माइक्रो/ग्रा.) + पी.जी. (10 मिग्रा./ली.)+ सक्रिमित चारकोल (200 मिग्रा./ली.) मिलाया गया। सेब के मूल वृन्त एम. एम.–111 मे सर्वाधिक जड़ उत्पादन की क्षमता आई.ए.ए.,सक्रियित चारकोल व फ्लोरोग्लूसीनॉल मिलाने पर पाई गई, जबकि चेरी मूलवृन्त मे एम.एस. माध्यम मे परिपूरक के रूप मे आई.बी.ए. (1 मिग्रा./ली.)+ सक्रिमित चारकोल (200 मिग्रा./ली.) मिलाने पर सर्वाधिक जड़ उत्पादन की दक्षता दर्ज की गई। केसर के 32 प्रतिरूपों की पैदावार 3.03 कि.ग्रा./हे. (सी.आई.टी. एच.–केशर–169) से 3.99 कि.ग्रा./हे. (सी.आई.टी.एच.–केशर–125) तक आंकी गयी।

फसल उत्पादन

सेब

सेब मे अच्छी उपज व गुणवत्ता के लिए सौर ऊर्जा का अधिकतम दोहन करने के लिए दो प्रयोग किए गए। इसमें से एक प्रयोग मे सेब की तीन किस्मों कोए रेड़ फूजी, ग्रेनी स्मिथ व स्पार्टन को विभिन्न संधाई प्रणालियों जैसे इस्पेलियर, वर्टीकल एक्सीस एवं कार्डन मे लगाया गया। इस प्रयोग मे सर्वाधिक उपज 31.88 कि. ग्रा./पेड़ (66.55 टन/हे.) इस्पेलियर संधाई प्रणाली मे लगाई गई किस्म कोए रेड़ फूजी मे दर्ज की गई। दूसरे प्रयोग मे सेब की 5 किस्मों (स्टार क्रिमसन, गोल्डन डिलिशियस, मोलिस डिलिशियस, वेस्टा बेला व फूजी) की संधाई स्पींडल बुश, हेड एन्ड स्प्रेड एवं मॉडीफायड् सेट्रल लीडर प्रणालियों मे की गई, जिसमें सवाधिक उपज (43.54 टन/हे.) स्टार क्रिमसन किस्म की संधाई हेड एन्ड स्प्रेड प्रणाली पर करने से दर्ज की गई। सेब मे फर्टीगेशन के अध्ययन मे संस्तुत मांग का 75 प्रतिशत उर्वरक दो खुराको में देने से सर्वाधिक उपज (28.05 कि.ग्रा./पेड़) दर्ज की गई उसके उपरान्त सर्वाधिक उपज (27.58 कि. ग्रा./पेड) संस्तुंत माग का 100 प्रतिशत उर्वरक देने पर दर्ज कि गई, यद्यपि दोनो उपचारों मे उपज की दृष्टि से सार्थक अन्तर नही पाया गया, लेकिन बाकि उपचारों की तुलना मे इनमें सार्थक रूप से ज्यादा उपज दर्ज की गई।

आड़ू

आड़ू की चार किस्मों (क्रेस्ट हेवन, रैट ग्लोब,ग्लो हेवन व फेन्टेसिमा) का मूल्यांकन छः विभिन्न संधाई प्रणालियों मे किया गया जिसमें सर्वाधिक उपज विभिन्न किस्मों मे क्रमशः 18.17, 22.16, 18.48 एवं 20.59 कि.ग्रा./पेड टटूरा ट्रेलिस मे दर्ज की गई इसलिए इस संधाई प्रणाली को आड़ू की संधाई प्रणालियों मे सर्वोत्तम पाया गया। इस संधाई प्रणाली मे दूसरी संधाई प्रणालियों के मुकाबलें फल का वजन भी ज्यादा दर्ज किया गया।

अखरोट

अखरोट की चार विभिन्न संधाई प्रणालियों मे सर्वाधिक नट दक्षता (0.7187 नट/सेमी^{2}) मॉडिफाइड सेन्ट्रल लीडर प्रणाली मे दर्ज की गई। विभिन्न कटाई छंटाई स्तरों में छंटाई, हेडिंग बैक, छंटाई+हेडिंग बैक के अध्ययन मे लगातार 10 प्रतिशत छंटाई (0.8449 नट/सेमी^{2}), हर दूसरे साल हेडिंग बैक (0.8449 नट/सेमी^{2}) एवं 10+10 प्रतिशत छंटाई+हेडिंग बैक (0.9932 नट/सेमी^{2}) हर दूसरे साल नट उपज की दृष्टि से उत्तम पाया गया।

केसर

काश्मीर के सिंचित क्षेत्रों मे केसर की सघन उत्पादन तकनिक मे उठी हुई क्यारी मे 10 लाख बल्ब प्रति हे. फव्वारा सिंचाई करना उपज की दृष्टि से (औसत 5.43 कि.ग्रा./हे.) सर्वोत्तम पाया गया। यह तकनिक करेवा क्षैत्र की असमतल भूमि के लिए भी उपयुक्त पायी गयी। इसी तरह उठी हुई क्यारियों मे 5 लाख बल्ब प्रति हे. लगातार फव्वारा सिंचाई करनें पर सबसे ज्यादा बल्ब गुणन दर (515.60 प्रतिशत) दर्ज की गई। काश्मीर वादी मे कमजोर जल निकास व बल्ब के सड़ने की अधिक प्रतिशतता के साथ–साथ कम उपज के कारण समतल क्यारी मे केसर की खेती को संस्तुत नही किया गया। केसर व बादाम के अंतर–फसल अध्ययन मे सर्वाधिक केसर की उपज (4.93 कि.ग्रा./हे.) तथा केसर समकक्ष उपज (5.20 कि.ग्रा./हे.) बादाम की सीधी बढ़ने वाली किस्मों के साथ केसर लगाने पर दर्ज की गई। केसर मे उर्वरक अनुप्रयोग की दक्ष विधि के अध्ययन मे उर्वरकों की बल्ब के ऊपर मध्य भूमि खण्ड मे स्थापित करना उत्तम पाया गया।

पुष्प विज्ञान

एलस्ट्रोमेरिया की खेती के लिए हरितगृह को बेहतर पाया गया तथा इसकी किस्म रोजीटा को अधिक उपज सामर्थ्य (53.34 फूल/टहनी) व अप्रेल से दिसम्बर तक लगातार फूल आपूर्ति के कारण सबसे अधिक आशाजनक पाया गया। इसे उठी हुई क्यारियों में 45x60 सेमी. की अंतराल, वर्मीकुलाइट से भुत माध्यम एवं 10 प्रतिशत छंटाई करने पर सर्वाधिक पैदावार दर्ज की गई।

सब्जी विज्ञान

सेब व सब्जियों के अंतर–फसल मे समन्वित पोशक तत्व प्रबंधन मे विभिन्न उपचारों मे से गोबर की खाद+केचुए की खाद+जैव उर्वरक+अकार्बनिक उर्वरकों का संयोजन मटर व फूलगोभी की उपज की दृश्टि से बेहतर पाया गया साथ–ही–साथ सेब के पेड़ो की अच्छी वृद्धि तथा उपज में बढ़ोतरी भी दर्ज की गयी।

कम्पोस्टींग और मृदा की स्थिती

डल खर पतवार द्वारा केचुए की खाद बनाकर उसका पोशक तत्वों की माग के विष्लेशण मे 1.8 प्रतिशत नत्रजन, 0.21 प्रतिशत फॉस्फोरस, 0.71 प्रतिशत पोटाशियम, 223 प्रति दस लाख भाग जस्ता, एवं 6.79 प्रति दस लाख भाग बॉरोन पाया गया। कृमिक छितराने का अनुपात 15:1 (7.5 कि.ग्रा. ए.डी+डब्लू.) में पाया गया।

के.शी.बा.सं. के क्षेत्रीय केन्द्र मुक्वेश्वर की मृदा मे जैविक कार्बन का स्तर बहुत कम से बहुत ज्यादा तक दर्ज किया गया। कार्बन की मात्रा सतही मृदा (0–20 से. मी.) मे अधिक पायी गई जबकि 20 से.मी. से ज्यादा मृदा की गहराई पर कार्बन की मात्रा बहुत कम पायी गई।

पादप संरक्षण

यूरोपियन रेड माईट (पेनोनिक्स अल्मी) के अध्ययन मे पाया गया। कि इसकी गतिविधि जून के दूसरे सप्ताह से शुरू होकर अक्तूबर के अन्तिम सप्ताह तक लगातार पाई गई। यूरोपियन रेड माईट की सर्वाधिक आबादी घनत्व बादाम व सेब मे क्रमशः 31.56 व 6.46 वरूथी प्रति पत्ती रहा। यूरोपियन रेड माईट के विरूद्ध विभिन्न माइटीसाइड के मूल्यांकन मे फेन्जाक्वीन (0.002 प्रतिशत) को सर्वाधिक प्रभाव पाया गया। एफिड की प्रजाति पी परस्किी (आड़ू तना माहू) जम्मू एवं काश्मीर मे बादाम आड़ू व आलू बुखारा मे आक्रमण करने वाले एफिड की सबसे बड़ी प्रजातियों मे से एक पाया गया तथा इसे आड़ू व बादाम के लिए संभावित हानिकारक जीव के रूप मे दर्ज किया गया तथा इसके प्रबंधन के लिए नीम बीज गिरी निष्कर्श (5 प्रतिशत), क्लोरपायरफॉश (0.05 प्रतिशत) व डाईमिथ्योएट (0.03 प्रतिशत) का मूल्यांकन किया गया। तीनों किटनाशकी के एक बार उपयोग से ही 100 प्रतिशत मर्त्यता दर्ज की गई। आड़ू मे आड़ू पत्ती कुचितरोग व माहू के प्रबंधन के लिए किए गए अन्वेशण मे विभिन्न उपचारों मे से कवकनाशी केप्टान (0.05 प्रतिशत)

सर्वाधिक प्रभावशाली रहा इसके उपरान्त हेक्साकोनेजोल (0.05 प्रतिशत) प्रभापशाली रहा।

सेब की प्रमुख केंकर पर्णीय व फलों के रोगों के विरूद्ध नौ विभिन्न छिड़काव अनुसूची का मूल्यांकन किया गया। इसमें से अनुसूची मे प्रसुप्त अवस्था पर कॉपर ऑक्सी क्लोराइड (0.3 प्रतिशत), हरी शिखर अवस्था पर केप्टन (0.3 प्रतिशत), गुलाबी कलीका अवस्था पर मेन्कोजेब (0.3 प्रतिशत), पंखुड़ी गिरने की अवस्था पर कार्बेन्डेजिम (0.05 प्रतिशत) फल विकास अवस्था पर कार्बेन्डेजिम + मेन्कोजेब (0.05 प्रतिशत), चौथे छिड़काव के 20 दिन बाद डोडिन (0.075 प्रतिशत), तुड़ाई से पूर्व की अवस्था पर केप्टान (0.3 प्रतिशत), एवं तुड़ाई के उपरान्त कॉनर ऑक्सी क्लोराइड (0.3 प्रतिशत), का समाविश्ट किया गया और इस छिड़काव अनुसूची ने सेब मे लगने वाली लगभग सभी त्यार्धियों का समग नियंत्रण किया, मुख्य रूप से केंकर (96.54 प्रतिशत), पर्णित त्याधि र्यों (70.37 प्रतिशत), एवं फल त्यार्धियों (81.56 प्रतिशत), पौधशाला में सफेद जड़ गलन के समन्पित रोग प्रबंधन में एजोक्सीस्ट्रोबीन (0.1 प्रतिशत),+ कर्कस सेमइकार्पीफोलीया (खारसू) की पत्तिया+ट्राइकोडर्मा वीरिड़ी+नीम की खली के मिश्रण उपयोग से 82.74 प्रतिशत तक इस बीमारी का नियंत्रण दर्ज किया गया। जबकि थियोफेनेट मियाइल (0.1 प्रतिशत)+देवदार काटें+ट्राइकोडर्मा वीरिड़ी+नीम की खली के संयोजन से सबसे कम 62.27 प्रतिशत तक रोग की नियंत्रण किया गया जा सका। सेब के विभिन्न मूलवृन्तो मे से डेमाटाफोरा नेकाट्रिक्स के विरूद्ध रोग प्रतिरोधकता केवल कांटे वाले पेरोन (मालस बक्काटा वरायटी हिमालाईका) मे ही दर्ज की गई, इस मूलवृन्त पर पॉली हाउस मे 4 प्रतिशत तथा प्राकृतिक जगह पर डेमाटाफोरा नेकाटिक्स से ग्रसित मृदा मे यानि खेत पौधा मे 4.37 प्रतिशत दर्ज की गई।

पच्छ तुड़ाई प्रबंधन

सेब की 22 किस्मों (जल्दी, मध्य व देर से तैयार होने वाली) के भण्डारण अध्ययन मे सबसे ज्यादा भण्डारण अवधि (50–60 दिन), सबसे कम गुणवत्ता, संरचना व दृढता में ग्रेनी स्मिथ, वेल स्पर माइकैल, रेड़ फूजी, कोए रेड़ फूजी व औरेगन स्पर किस्मों मे पाया गया जब उन्हे 25 ± 2^0 सेल्सियस पर 70±5 प्रतिशत आपेक्षिक आद्रता पर भण्डारित किया गया। आलू बुखारा के निर्जलीकरण के प्रारंभिक अध्ययनों से यह संकेत मिला कि इसको प्रून के रूप मे सुखाने के लिए ग्रैन्ड ड्यूक व प्रसीडेंट किस्में उपयुक्त है, जब इन्हे 80^0 सेल्सियस तापमान पर क्रॉस फ्लो केबिनेट ड्रायर मे सुखाया गया। खूबानी व आलू बुखारा का मिश्रित रस बनाकर चार महीने तक भण्डारित करने व उसके संरचनात्मक अध्ययन से यह पाया गया कि खूबानी 75 प्रतिशत + आलू बुखारा 25 प्रतिशत तथा खूबानी 50 प्रतिशत आलू बुखारा 50 प्रतिशत का संयोजन पोशक तत्वों के अवरोधन स्वाद खूशबू व सुगन्ध की दृष्टि से उत्तम पाया गया तथा यह रस तीन महीने तक पीने के लिए स्वीकार्य पाया गया। आलू बुखारा में उत्कृश्ट संरचना, रंग, स्वाद व खाने की गुणवत्ता तथा कम से कम भूरापन व खराबी तथा जिसकों पोशकता, गुणवत्ता व आर्कशण मे बिना गिरावट के नौ महीने तक भंडारित किया जा सके ऐसी बार बनाने की तकनीक का मानकीकृत किया गया।

पत्थर नाख अदरक अरक तैयार करके उसका तुरन्त व छः महीने बाद विष्लेशण किया गया और उसमे कुल घुलनशील पदार्थ, अम्लता, विटामिन सी, व एल्डीहाइड मे कमी दर्ज की गई जबकि एल्कोहॉल, वाष्पीशील अम्लता तथा कुल फिनोल व एस्टर सार्थक रूप से अर्धिक दर्ज किया गया। अरक का रंग, सौरभ व समग्र गुणवत्ता को सार्मक रूप से बढ़ा हुआ पाया जबकि उसकी दिखावट व कसैलापन मे सार्थक यप हास पाया गया।

प्रसार एवं अन्य गतिविधियां

के.शी.बा.स. ने विभिन्न तकनिकों के तीव्र स्थानांतरण के लिए केसर व जैतून दिवस, दस दिन की एक त्यावसायिक प्रशिक्षण कार्यक्रम, विभिन्न पहलुओं पर एक दो व तीन दिन के प्रशिक्षण कार्यक्रम आयोजित कियें। सोलह किसानों व चार विधार्थियों के समूह ने के.शी.बा. स. श्रीनगर व मुक्वेश्वर का तकनिकी जानकारी व बीज सामग्री इत्यादी खरीदने के लिए दौरा किया। विभिन्न अवसरों पर पाँच प्रदर्शनियों का आयोजन किया गया। इसके अलावा 20 नैदानीक दौरे किए गयें तथा विभिन्न अवसरों पर 15 रेडियो/दूरदर्शन वार्तालाप किए गयें। 2014–15 में ट्राइबल सब प्लान प्रोजेक्ट मे जम्मू–काश्मीर के आठ विभिन्न जिलों लेह, करगिल, बांडीपुरा, गांद रबल, रामबन, पूंछ, राजौरी व श्रीनगर के जनजातीय क्षैत्रों को अन्तनिहित किया गया। तथा यहां विभिन्न तकनीकों व किस्मों के प्रदर्शन लगाए तथा उन्हें सहयोग व पठन सामग्री से परिपूरक किया गया।

प्रकाशन

के.शी.बा.सं. के वैज्ञानिकों ने 25 शोध पत, एक पुस्तक, 7 पुस्तक अध्याय, 7 लोकप्रिय लेख तथा 8 प्रसार/पत्रिकाएं/पम्पलेट, विधार्थियों, अनुसंधान कर्ताओं, प्रसार पदाधिकारियों, व किसानों को लाभ पहुचाने के लिए प्रकाशित किये गए।

Executive Summary

The substantial increase in area after independence has led to tremendous boost in production of temperate horticultural crops. However the productivity level of these crops is still low as compared to advance countries due to several production problems leading to very low returns per unit area. To minimize these problems and enhance productivity as well as returns, the research being carried out at CITH, Srinagar and it's regional station, Mukteshwar is summarized below.

Crop Improvement and Biotechnology

The superior varieties in any crop is the main component for increasing the productivity and quality of produce. The CITH in the current year has identified 2 genotypes each in Garlic (CITH-G-1 & 2) and Cherry (CITH-Cherry- 7 & 9) and were released at Institute level through IVRC of which one genotype namely Garlic CITH-G-1 was identified by CVRC for release at national level. Besides this, 2 genotypes in capsicum, one each in carrot, turnip, chilli and kale having superiority in yield and other traits were submitted for evaluation in AICRP-vegetable crops. In germplasm 107 new genotypes of various crops were added in genebank and total number of germplasm at CITH has now reached to 2333. In screening of apple germplasm for scab resistance, 30 cultivars, 13 clones and 5 species were found resistant under natural epiphytotic conditions while for evaluation of apple germplasm, the fruit weight ranged from 52.62-274.37 g. Among 10 apple varieties evaluated on MM 106 root stock at 2.5 x 2.5 m spacing, Oregon Spur gave highest yield (43.2 t/ha) while on seedling rootstock at 4 x 4 m spacing, Red Delicious was found highest yielder (28.93 t/ha). In the evaluation for maturity group, 12 were early, 10 were mid and 16 were late season cultivar. In pear grouping was done for early, mid and late flowering and for yield the Kashmiri Nakh was found to be highest (27.86 kg/tree) followed by Santiya Baiskage (20.63 kg/tree).

In evaluation of 54 apricot genotypes, CITH-Apricot-3 was found to be highest yielder (59.56 kg/tree & 27.26 t/ha) followed by CITH-Apricot-2 (57.56 kg/tree & 23.02 t/ha) and CITH-Apricot-1 (47.65 kg/tree & 19.06 t/ha). In evaluation of 23 plum cultivars, Mariposa was found superior for yield (68.16 kg/tree & 27.26 t/ha) followed by Au-Cherry, Tarrol, Monarch and Beauty. In almond selection CITH-A-8, 9, 19, 21, 22 and 23 were found promising for nut and kernel traits while in walnut, CITH-W-1, 85 and 9 were found best for desirable nut and kernel traits with CITH-W-1 having highest nut (26.31 g) and kernel weight (14.40 g). In evaluation of 23 cherry selections, CITH-Cherry-7 and CITH-Cherry-9 gave maximum yield of 13.5 and 13.0 kg/tree while among eight exotic cultivars maximum yield of 11.0 and 9.5 kg/tree was observed in Bigarreau Napoleon and Lapinus respectively. In evaluation of olive cultivars, Zaituna, Coratina, Cipressino and Frontia were found promising from yield point of view while the oil recovery ranged from 12.33 to 30.97 per cent. In peach heaviest fruit of 89.09 g was recorded in cultivar Red Globe followed by Nimla while Nimla was found highest yielder (26.01 kg/tree). In kiwifruit, cultivar Monty was found superior for fruit traits as compared to other cultivars.

In evaluation of lilium cultivars in polyhouse condition, the initiation of flowering varied from 25th May to 27th July. The biggest flowers

were recorded in Caroline Tensen (21.65 cm) while cultivar Litouwen (42 days) and Brindsi (15.4 days) were found promising in respect of flowering duration and vase life, respectively. In Kala zeera, seed sowing and corm planting can be done up to February and 1st week of March, respectively. In evaluation of different genotypes in vegetable crops for various traits SH-C-11 in carrot, CITH-T-1 in turnip, CITH-R-1 in radish, entry 2013/CHIHYB-3, 2012/CHIHYB-7, 2011/CHIHYB-4, CHIVAR-1, 2012/CHIVAR-9 and 2011/CHIVAR-7 in chilli, 2013/TODHYB-3, 2012/TODHYB-6 in tomato, OLR1364, ALRO-1213, BLRO-1229 in onion, CITH-G-5, GRL 1330 in garlic were found superior for yield and other traits. The genotype collection and evaluation work was also carried out at Mukteshwar and promising genotypes were identified in various fruit crops.

During 2014, 34 cross combinations among different varieties were attempted for development of superior genotype through hybridization. From early crosses, some seedlings were identified with least scab infection. To combine desirable traits of exotic and indigenous genotypes, several cross combinations were attempted in walnut and seedlings of earlier made crosses were evaluated for growth traits. In breeding of solanaceous vegetable crops, genotype CITH-BR-1 (105.07 t/ha) in brinjal, CITH-HP-KL-2 (60.78 t/ha) in chilli and SH-SP-603 (61.23 t/ha) in capsicum were identified as highest yielder at Srinagar while VL-4 produced highest yield 2202.19 q/ha and 5945.93 g/plant in tomato at Mukteshwar.

The DNA fingerprinting was done in 24 plum cultivar though SSR and ISSR markers and cultivar Italian was found completely diverse during grouping. The MS media supplemented with IAA (2 uM) + PG (10 mg/L) + activated charcoal (200 mg/L) was found superior with higher rooting percentage, maximum roots, root length and initiation of rooting in lilium. The enhanced rooting efficiency was obtained with IAA, activated charcoal and Phloroglucinil in apple rootstock MM-111 and MS media (1/2 strength) supplemented with IBA (1 mg/L) + activated charcoal (200 mg/L) in cherry rootstock. In 32 saffron clones yield varied form 3.03 kg/ha (CITH-S-169) to 3.99 kg/ha (CITH-S-125).

Crop Production

Apple

To harvest maximum solar energy for better yield and quality, two experiments were conducted on different varieties and training systems in apple. In one set of experiment, three apple varieties Coe Red Fuji, Granny Smith and Spartan trained under different training system viz. Espalier, Vertical Axis and Cordon. The highest fruit yield of 31.88 kg/tree (66.55 t/ha) was recorded in Coe Red Fuji trained on Espalier system. In second experiment, 5 apple varieties (Starkrimson, Golden Delicious, Mollies Delicious, Vesta Bella and Fuji) were trained under Spindle Bush, Head and Spread and Modified Central Leader. The maximum fruit yield (43.54 t/ha) was recorded in Starkrimson variety trained on Head and Spread system.

In fertigation trial maximum yield (28.05 kg/tree) was recorded when 75% of recommended fertilizer was applied in two splits followed by treatment where whole of the recommended fertilizers was applied in two splits (27.85 kg/tree).

Peach

Four peach varieties (Crest haven, Red Globe, Glo haven and Fantasia) were evaluated on six different training systems and highest yield of 18.17, 22.16, 18.48 & 20.59 kg per tree was recorded in Tatura trellis system and hence found best for peach. There was also a great improvement in this system for fruit weight as compared to other training system.

Walnut

Among four training systems in walnut, modified central leader system was found best for nut efficiency (0.7187 nuts/cm^2). Among various levels of thinning , heading back and thinning + heading back, 10% thinning regularly (0.8449 nuts/cm^2), 10% heading back in alternate years (0.8449 nuts/cm^2) and 10 + 10% level of thinning + heading back in alternate years (0.9932 nuts/cm^2) were found best for obtaining higher nut yield.

Saffron

In intensive saffron production technology, sprinkler irrigation with 10 lakh corms/ha planted on raised beds was found best with higher average saffron yield (5.43 kg/ha) under irrigated conditions of Kashmir valley and found suitable for undulated topography of karewa areas of saffron cultivation. Similarly higher corm multiplication rate 515.60 percent was obtained with 5 lakh corms/ha density on raised bed under sprinkler irrigation. Flat beds recorded least yield and were not recommended due to poor drainage and higher percentage of rotting of corms under Kashmir valley conditions. In inter cropping of saffron with almond, maximum saffron yield (4.93kg/ha) and saffron equivalent yield (5.20 kg/ha) were recorded in saffron+ erect type of almond varieties. In a trial of adept mode of fertilizer application, the fertilizer placed in mid rib upper to corm proved superior.

Floriculture

The polyhouse conditions were found to be best for alstroemeria production and cultivar Rosita was found to be most promising due to its high yield potential (53.34 flower shoots/ plant) and continuous supply of flowers from April to December. The raised bed planting with 45x60 cm spacing +10% thinning and media containing vermiculite were found promising to get maximum yield.

Vegetables

In INM of vegetables as intercrop in apple orchard, the treatment comprising of FYM + vermi-compost + biofertilizer + inorganics was found best in both pea and cauliflower as intercrops in apple orchard exhibiting highest growth and yield.

Composting and soil status

The vermicompost prepared from *Dal weed* was analyzed for its nutrient composition which contained 1.8% nitrogen, 0.21% phosphorus, 0.71% potassium, 223 ppm zinc and 6.79 ppm boron. The least value (15.92) of CN ratio was noticed in treatment where proportion of dissipate to worms was 15:1 (in 7.5 kg AD+W). The organic carbon level of soils of CITH, Regional Station, Mukteshwar varied from extremely low to extremely high. However, extremely high level of organic carbon is mainly observed in surface soil (0-20 cm) whereas, low level of organic carbon is generally observed in soil greater than 20 cm soil depth.

Crop Protection

In studies with European red mite (*Panonychus ulmi*), it was observed that the mite activity starts from second week of June and continue up to late October. The highest population density of ERM was 31.56 and 6.46 mites/leaf on almond and apple, respectively. Among the some miticides evaluated against European red mite, Fenzaquine (0.002%) was found effective. The aphid species *Pterochloroides persicae* (peach stem aphid) is one of the largest aphid found infesting almond, peach and plum in J&K. It has been recorded as a potential pest of peach and almond. For the management of *P. persicae*, NSKE (5%), Chloropyriphos (0.05%) and Dimethoate (0.03%) were evaluated and all the three insecticides gave 100% percent mortality in single application. In an experiment in peach for management of peach leaf curl disease and aphids, among the various treatments, fungicides captan (0.05%) was found effective followed by haxoconazole (0.05%).

In evaluation of different spray schedules against major canker, foliar and fruit diseases of apple, nine different spray schedules were evaluated and schedule comprising of copper oxychloride (0.3%) at dormant stage, captan (0.3%) at green tip, mancozeb (0.3%) at pink bud, carbendazim (0.05%) at petal fall, carbendazim + mancozeb (0.05%) at fruit development stage, dodine (0.075%) 20 days after 4th spray, captan (0.3%) at pre-harvest stage and copper oxychloride (0.3%) at post harvest stage exhibited highest overall disease control in respect of major canker (96.54%), foliar (70.37%) and fruit diseases (81.56%) of apple.

In Integrated disease management of white root rot of apple, maximum disease control of 82.74 per cent under nursery was recorded with combination of azoxystrobin (0.1%)+ *Quercus*

samiecarpifolia (Kharsu) leaves + *Trichoderma viride* + neem cake and it was minimum (62.27%) in a combination of thiophanate methyl (0.1%) + deodar needles + *Trichoderma viride* + Neem cake. Among different apple rootstocks, thorny paron (*Malus baccata* var. *himalaica*) showed resistant (R) reaction against *D. necatrix* test pathogen and exhibited least per cent disease severity under polyhouse (4.00%) and under natural infested soil i.e. under field nursery (4.37%).

Post harvest technology

The storage behavior of 22 apple varieties having early, mid and late season maturity indicated that that fruits of varieties Granny Smith, Well Spur, Michael, Red Fuji, Coe Red Fuji and Oregon Spur are having maximum shelf life (50-60 days) with minimum loss of quality, texture and firmness when stored at 25±2°C and R H 70±5%. The Preliminary studies in plum dehydration indicated that varieties Grand Duke and President Plum are ideal varieties for drying as prune when dried at the temperature of 80 °C in cross flow cabinet dryer. In blending of apricot and plum juices, the four months storage and compositional study revealed that blend ratio 75 % apricot + 25 % plum and 50% apricot + 50 % plum can be successfully prepared with maximum retention of nutrients, taste, flavor and aroma for 3 months. Technology was developed and standardized for making plum fruit bar having excellent texture, colour, taste and chewing quality with least browning and spoilage and can be stored for nine months without loss in nutrition, quality and appeal.

The sand pear ginger wine was prepared and analyzed immediately after preparation and after 6 months of storage and found that there was reduction in TSS, acidity, ascorbic acid, aldehydes whereas alcohol, volatile acidity, total phenols and esters registered a significant increase. The colour, aroma, taste and overall quality of the wine was found to increase significantly whereas the body and appearance and astringency registered a significant decline during this period.

Extension and other activities

For speedy transfer of various technologies, CITH organized saffron and olive days, one vocational training programme of 10 days duration, training programmes of 2 to 3 days and one day on various aspects. Sixteen farmers groups and four students groups visited CITH Srinagar/ Mukteshwar for technological inquiries and purchase of planting material etc. Five exhibitions were laid at various occasions. Besides this, more than 20 diagnostic visits were conducted and more than 15 radio/ TV talks were delivered. During 2014-15 tribal areas from eight districts viz Leh, Kargil, Bandipora, Ganderbal, Ramban, Poonch, Rajouri, and Srinagar were covered under TSP scheme. Technological and varietal demonstrations were laid out at their farms supplemented with inputs and complete package and practice.

Publication

The scientists of CITH published 25 research papers, one book, 7 book chapters, 7 popular articles and 8 extension bulletin/ folders for the benefit of students, researchers, extension functionaries and farmers.

Introduction

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's economy by supporting about 8-10 million people and generating revenue of about Rs. 10000 crores annually. Among temperate fruits and nuts; apple, pear, peach, plum, kiwi fruit, apricot, cherry, almond and walnut are very important with apple and walnut sharing major area while in vegetables, European type of cultivars of cole, bulb and root crops; high value leafy vegetables like lettuce, parsley, celery and Chinese cabbage; asparagus, artichoke, cucumber, capsicum and peas are commercially important. In floriculture, tulip, lilium, alstroemeria, carnation and gerbera and in medicinal and aromatic plants, Lavender, Lavendine, Geranium, Dioscoria, Podophyllum, Pyrethrum, Mentha, Artemisia etc. 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. In 1960-61 the area under temperate fruits in the country was just 0.82 lakh hectares which increased to 6.0 lakh hectares in 2012-13 and production increased from 3.0 lakh tonnes to 35.0 lakh tonnes. While the modest requirement of temperate fruits is about 50 lakh tones. The productivity during the same period however, increased only from 3.17 to 6.0 t/ha during 2012-13. Similar is the situation in temperate vegetables, floriculture and ornamental crops. Among various crops apple and walnut are the major crops of temperate fruits 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, 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 (8.80t/ha) our position is far behind (6.0 t/ha). Temperate horticultural research is still in infancy, the CITH as ICAR's alone institute has greater role in designing and developing research programmes on crop improvement, production, protection and post harvest management for achieving economic and nutritional security in the entire Himalayan region. To overcome the production constraints the research on temperate horticultural crops is being carried out both at main campus, Srinagar and at its Regional Station, Mukteshwar (Uttarakhand) with the following mandate and objectives.

Mandate

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

Objectives

- Establishment of field gene bank and management of genetic resources and scientific data base of temperate horticulture crops.

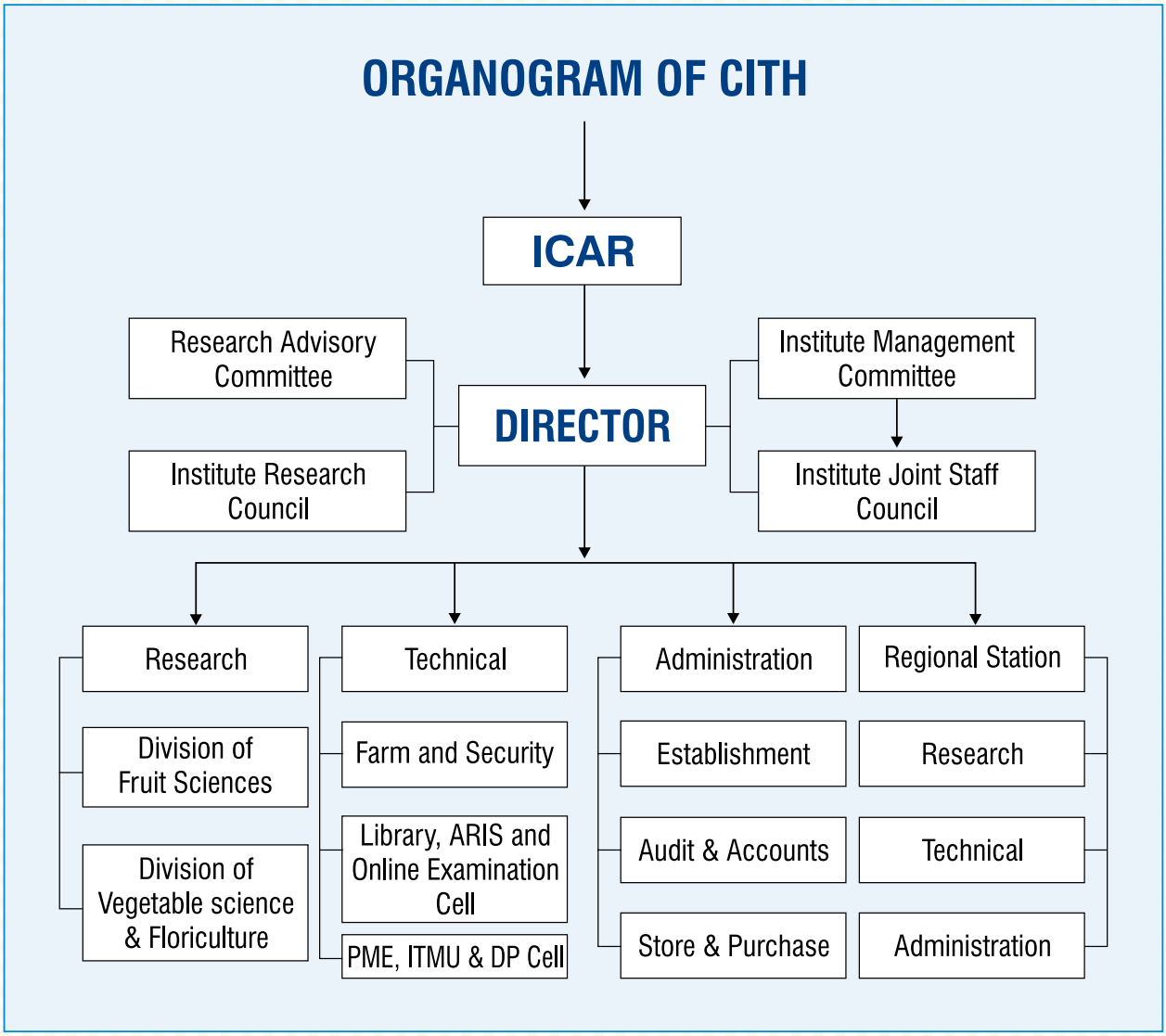
- Genetic improvement of temperate horticultural crops for yield, maturity, quality, resistance to biotic and abiotic stresses through conventional breeding methods and use of biotechnological tools.
- Standardization of nursery management and high tech propagation techniques of temperate horticultural 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 (2014-15)

Category	Sanctioned	Filled	Vacant
Scientific	22+1 RMP	15+1 RMP	07
Administrative	15	11	04
Technical	16	13	03
Supporting	19	13	06
Total	72+1 RMP	52+1 RMP	20

Financial Statement (2014-15)

S. No.	Sub-Head	Plan (In lakhs)	Non-Plan (In lakhs)
1	Establishment Charges	0.00	356.18
2	T.A	10.00	2.14
3	HRD	1.40	0.11
4	Contingency	248.84	140.93
5	Equipment	4.78	1.23
6	I.T	0.82	0.00
7	Works	90.94	0.00
8	Library	0.46	0.00
9	Furniture and Fixture	3.00	0.00
10	Network project	33.29	0.00
11	Pension	0.00	20.58
12	Loans and advances	0.00	5.62
13	Total	393.53	529.79


ORGANOGRAM OF CITH
ICAR
DIRECTOR
Research Advisory Committee
Institute Research Council
Institute Management Committee
Institute Joint Staff Council
Research
Division of Fruit Sciences
Division of Vegetable science & Floriculture
Technical
Farm and Security
Library, ARIS and Online Examination Cell
PME, ITMU & DP Cell
Administration
Establishment
Audit & Accounts
Store & Purchase
Regional Station
Research
Technical
Administration

I Crop Improvement and Biotechnology

The production and productivity of any crop is largely dependent on the superiority of variety and its adaptation in the particular growing area. The Central Institute of Temperate Horticulture, Srinagar and its Regional Station are continuously engaged to identify and develop superior genotypes in different temperate horticultural crops to enhance the productivity, quality and profitability. After continuous selection and evaluation for desirable traits and yield attributes the following genotypes were identified in different crops for release and their salient characteristics are given below.

New genotypes with superior yield and quality attributes identified for release

CITH-Garlic-1

- Plants are vigorous, semi dwarf with green foliage It has a curved bulb neck which differentiates it from other entries
- Moderately tolerant to purple blotch (16.90%) and resistant to *Stemphylium* blight (3.72%)

- Moderately resistant to thrips (8 no. /plant)
- It has recorded highest yield over all checks and candidate entries at all AINRP centres yielding 174.83, 199.86 and 240.97 q/ha during year 2010, 2011 and 2012, respectively.
- It has shown an increase in yield over national check VLG-1 at the tune of 107.34% 129.68 % and 187.85% during year 2010, 2011 and 2012 respectively.
- It also produces 93.28 % marketable bulbs as compare to national check (85.59 %.)

CITH-Garlic (M)-2

- Plants are vigorous, semi dwarf with green foliage.
- It is moderately tolerant to Purple blotch (20.12%) and resistant to *Stemphylium* blight (3.39%).
- It is moderately resistant to thrips (10 no. / plant).
- It has recorded higher yield over the all checks at all network centres (158.94 q/h,210.85 q/ ha,183.46 q/ha and 174.60 q/ha during four consecutive years of evaluations)
- It has recorded an increase in yield over national check VLG-1 at the tune of 114.26%,177.84 %, 266.39% and 108.66% during year 2008-09,2009-10, 2010-11& 2011-12.

- It has recorded 94.18% yield increase over all checks and candidate entries at all centers irrespective of years.
- It also recorded highest average bulb weight (39.85g)against the checks.
- Average 50 clove weight was also high (154.05g) against the checks.
- It has also produced higher percentage of marketable bulbs (91.47%) over the checks.

Cherry

CITH- Cherry-07

- Spreading tree growth habit
- High yielding genotype (12-14t/ha)
- Large and bold fruit size (22.76 mm)
- High pulp stone ratio (14.20)
- TSS (16.1°B)

CITH- Cherry-09

- Spreading tree growth habit
- High yielding genotype (10-12 t/ha)
- Attractive fruits with dark red skin colour
- High fruit set in natural condition (78.0%)

New entries submitted for AICRP (Vegetable crops) evaluation

Six promising advanced breeding lines of vegetable crops found superior under station trials for yield and yield attributes have been submitted for testing under All India Coordinated Research Project-Vegetable Crops for the year 2015-16 (Table 1).

Table 1. List of genotypes in different crops submitted for testing under AIRCP

S. No.	Crop	Entry	Salient features
1	Carrot 	SH-C-11	• Sweet flavoured, long orange, smooth, oblong, semi-blunt root with self core without forking, suitable for salad as well as cooking • Root yield is 61.3 t/ha • Tolerant to low temperature and foliar diseases
2	Turnip 	CITH-T-2	• Sweet flavoured uniformly dark purple colored shiny, round, smooth root • Tolerant to Cercospora leaf spot and low temperature • Root yield is 54 t/ha
3	Hot pepper 	SH-HP-1154-3-1	• Dark red fruits, early drying on plant • Slightly wilt tolerant • Frost tolerant • Early maturity • Fruit yield is 47.6t/ha

S. No.	Crop	Entry	Salient features
4	Sweet pepper 	SH-SP-603	• Fruit 3-4 lobed medium size dark green and yellowish-orange at maturity • Medium maturity • Tolerant to low temperature • Fruit yield is 60.1 t/ha
		SH-SP-3-1	• Fruit 3 lobed , slightly conical, medium size dark green , shiny red at maturity • Medium maturity • Tolerant to low temperature • Fruit yield is 35 t/ha
5	Kale 	CITH-KC-10	• Succulent, slightly puckered elliptic leaves with prominent and green mid-rib • Medium maturity • Tolerant to frost • Yield is 60.6 t/ha

Survey, collection, characterization and documentation of temperate horticultural crops

Western Himalayas with rich diversity is the home for temperate horticultural crops especially temperate fruits. The continuous efforts of researchers at CITH, Srinagar and its Regional Station, Mukteshwar in collaboration with NBPGR has resulted in collection, conservation and evaluation of large number of genotypes in various horticultural crops. By virtue of which, the Institute has identified large number of genotypes in different crops and added about 107 new genotypes this year totalling to 2333 (Table 2) which have been maintained and evaluated for various traits.

Table 2. The number of germplasm resources in different crops at CITH

S. No.	Crop/Group	Previous year (2012-2013)	New addition (2014-15)	Total collection
1	Fruits	957	53	1010
	Pome fruits	305	16	321
	Stone fruits	145	17	162
	Nuts	348	11	359
	Others	159	09	168
2	Vegetables	959	29	988
3	Ornamental	**285**	**25**	**310**
4	Medicinal & aromatic plants	25	00	25
	Total	2226	107	2333

Apple

Screening of apple varieties/lines/species for scab infection

Ninety commercial apple cultivars, 38 clones and 10 species were evaluated and screened for scab infection under open field conditions. Among 90 cultivars, 30 cultivars were found resistant, 21 moderately resistant, 12 moderately susceptible and 27 were found susceptible to scab infection under open field conditions. Among the 28 lines 13 were found resistant, 9 moderately resistant, 4 moderately susceptible and 2 lines were found susceptible to scab infection. Out of ten species, 5 showed resistance to scab, 3 were moderately resistant and 2 moderately susceptible (Table 3). The identified cultivars/lines and species will be further screened under controlled conditions through challenge inoculation by virulent *Venturia inequalis* strains to screen and select the most resistant ones which can be used for breeding programme in apple for incorporation of resistant genes.

Evaluation of apple germplasm for fruit quality diversity through cluster and principle component analysis

Thirty six apple varieties of same age group (12 years) maintained on seedling rootstock at 4.0 X 4.0 m spacing were evaluated for fruit quality diversity analysis (Table 4 & Fig. 1). Significant correlation was observed between fruit characteristics. Color traits "L", "b" and "Tint" were positively correlated with TSS while fruit size showed negative correlation with TSS but was positively correlated with fruit firmness. Principal component analysis showed that first three components were able to explain more than 78% of the total trait variation. PC1, PC2 and PC3 accounted for 37%, 28% and 13% trait variability respectively. The 35 cultivars were grouped into five distinct clusters and one cultivar Starkrimson Gold does not form the part of any cluster. Cluster analysis revealed the importance of fruit weight and fruit firmness for grouping of apple cultivars while as TSS was found to have no significant role in grouping. The PCA and clustering analysis in this study indicated a high level of diversity in the apple cultivars.

Table 3. Reaction of apple cultivars, clones and species against apple scab infection

Cultivars/ clones/ species	Total	Resistant	Moderately Resistant	Moderately susceptible	Susceptible
Cultivars	90	30	21	12	27
Clones	28	13	9	4	2
Species	10	5	3	2	-

Table 4. Evaluation of apple cultivars for fruit quality raised on seedling rootstock at 4.0 x 4.0 m spacing

Cultivars	Code	L	a	b	Tint	Firmness (RI)	Length (mm)	Breadth (mm)	Weight (g)	TSS (oB)
Stark Earliest	1	52.78	12.41	18.95	-49.08	53.47	67.16	65.16	129.15	13.93
Prima	8	47.47	24.25	15.52	-88.35	72.15	55.88	69.58	144.71	12.5
Razakwari	11	58.22	15.38	21	-55.16	70.03	55.11	54	157.02	11.8
Jonica	19	44.57	36.06	23.72	-143.8	77.8	68.49	74.91	205.08	17.95
Apple Queen	25	54.1	19.89	29.02	-79	49.83	53.5	66.35	131.47	17.47
Starkrimson Gold	32	65.6	11.93	37.31	51.73	26	38.67	48.17	52.62	16.05

Cultivars	Code	L	a	b	Tint	Firmness (RI)	Length (mm)	Breadth (mm)	Weight (g)	TSS (oB)
Gala Mast	2	56.15	8.23	20.15	-4.85	57.03	64.88	70.18	128	15.67
Orange Val	3	67.74	-5.17	34.77	-3.02	70.8	62.15	83.86	245.61	13.1
Fanny	4	43.43	19.56	7.67	-65.68	54.63	50.7	63.83	106.4	13.23
Cheapnest	5	58.91	7.76	21.85	-34.65	54.27	56.78	73.91	159.13	15.37
Gala	6	59.52	14.11	23.28	-53.04	62.33	49.56	62.49	108.76	14.83
King Luscious	7	43.22	20.34	6.86	-71.01	63.03	61.92	65.45	130.34	15.1
Snow Drift	9	72.35	-1.67	39.22	-13.63	75.7	64.27	71.59	188.1	15.3
Greensleeves	10	68.13	-7.7	38.86	2.31	60.73	63.51	74.95	175.57	13
Red Gold	12	42.58	21.8	11.99	-83.15	70.17	53.24	65.65	113.18	15
Rome Beauty	13	49.43	25.32	18.4	-92	87.95	62.94	70.22	148.58	14.45
Top Red	14	34.37	30.17	14.01	-133.9	90.85	70.23	77.09	215.59	13
Royal Delicious	15	32.83	29.8	12.66	-134.7	84.91	67.7	66.87	157.06	17.35
Red Delicious	16	43.43	28.12	20.41	-113.9	90.8	67.44	74.75	197.31	16.45
Well Spur	17	32.66	23.22	7.76	-99.8	40.75	61.66	62.05	125.7	14.3
Oregon Spur	18	37.01	29.41	12.71	-122.0	67.15	69.97	75.55	186.55	13.5
Belle-de-Bescope	20	59.24	6.88	34.6	-39.11	75.2	76.64	82.47	274.37	17.9
Salvapobedetalian	21	55.32	19.67	23.03	-71.23	63.6	49.64	62.02	91.68	20.03
Vance Delcious	22	44.23	23.37	12.28	-86.08	59.47	69.08	71.03	170.55	14.83
Starking Delicious	24	43.77	22.62	11.2	-82.94	49.97	71.12	76.64	204.02	14.7
Nema Delicious	26	44.09	21.42	9.99	-77.13	44.63	69.84	72.45	189.67	16.13
Shireen	27	38.43	24.7	10.7	-98.71	51.67	55.7	68.83	114.24	16.43
Sharpsaori	28	56.45	2.12	28.74	-22.75	42.8	45.84	59.6	94.97	19.83
Red Chief	29	44.31	20.43	10.27	-74.08	42.73	66.99	68.93	165.6	15.57
Saspol	30	71.45	5.24	34.98	-30.01	39.73	56.28	69.32	146.37	17.2
Hardiman	31	50.56	27.55	18.82	98.71	38.27	70.18	79.66	198.9	14.1
Supermore Gold	33	76.48	8.53	52.18	43.83	37.33	74.42	70.67	162.8	16.7
Yellow Supreme	34	45.28	22.93	16.15	87.79	35.3	70.76	63.81	192.3	16.7
Red Fuji	35	57.51	2.78	27.98	23.73	37.27	59.41	74.24	153.5	16.6
Red Spur	36	41.04	14.79	15.23	64.87	42.33	72.79	87.57	188.35	14.8
Antinovika	23	42.35	21.32	12.15	-82.52	56.43	56.11	72.84	176.3	16.0
CD at 5%		***0.30***	***0.14***	***0.32***	***2.74***	***0.32***	***0.10***	***0.31***	***0.31***	***0.57***

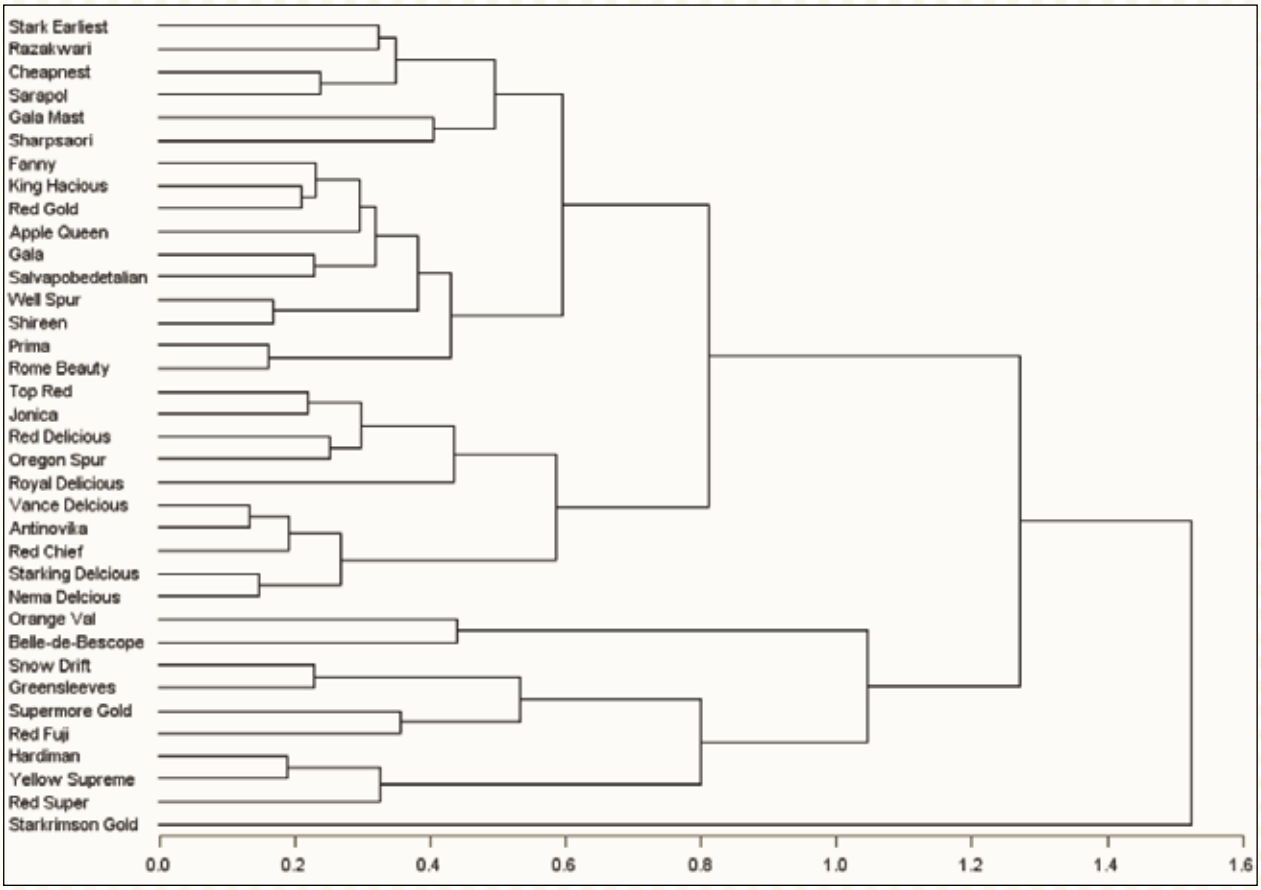


Fig 1. Unweighted Pair-Group Method Analysis (UPGMA) dendrogram for the 36 apple cultivars evaluated in the study for their clustering based upon fruit characteristics

Stark Earliest

Prima

Gala Mast

Fanny

Green Sleeves

King Luscious

Fruits of some evaluated cultivars

Performance of different apple cultivars on MM 106 and seedling rootstocks.

Ten apple varieties grown under two planting densities (2.5 x 2.5 m & 4.0 x 4.0 m) grown on MM-106 and seedling root stocks respectively were evaluated for fruit yield and its attributes. Highest crop density coefficient (number of fruits per unit trunk cross sectional area) and yield potential was observed under 2.5 x 2.5 m spacing in almost all varieties. Maximum yield potential of 43.2 t/ha was found in cultivar Oregon Spur with crop density coefficient of 1.48 under 2.5 x 2.5 m spacing followed by Vance Delicious (40.32 t/ha) and Golden Delicious (36.4 t/ha). Under 4 x 4m spacing maximum yield potential of 28.93 t/ha was observed in cultivar Red Delicious with crop density coefficient of 1.58 and fruit weight of 197 g followed by Oregon Spur (25.06 t/ha) and Red Chief (19.76 t/ha). Although highest crop density coefficient of 2.11 was observed in American Apirogue but its yield potential was low (16 t/ha) due to small fruit size. Six cultivars (Red Chief, Oregon Spur, Silver Spur, Starkrimson and Mollies delicious) are performing better and showing maximum yield potential under 2.5 x 2.5 m spacing while cultivar Red Delicious is showing higher yield potential under 4 x 4 m spacing followed by cultivar Oregon Spur.

Red Chief

Mollies Delicious

Oregon Spur

Silver Spur

Evaluation of apple cultivars for different maturity groups on seedling rootstock

Twelve early maturing apple cultivars with bloom to maturity period of < 120 days, ten mid maturing cultivars with bloom to maturity period range of 120-150 days and sixteen late maturing cultivars with >150 days maturity period were evaluated for yield during 2014. All the cultivars are grafted on seedling rootstock and planted at 4 x 4 m spacing. Under early maturity group cultivar June Eating gave maximum yield of 20.63 t/ha followed by 16.50 t/ha in Vista Bella. Among mid maturity group cultivar Red Barron gave maximum yield (26.15 t/ha) followed by Shireen (17.91 t/ha) and Starkrimson (17.65 t/ha). In late maturity group maximum yield (31.19 t/ha) was observed in cultivar Silver Spur followed by Red Gold (30.03 t/ha).

Pear

In Pear, 25 genotypes were evaluated for flowering and fruit yield traits. Earliest flowering was observed in Sand Pear and Kashmiri Nakh while Kiffer, Pysur Behapa and Badshah Nakh were found to be mid bloomer and rest of the genotypes showed late flowering. Highest fruit set and yield was observed in Kashmiri Nakh followed by Santiya Baiskage, William Bartlet, Gent Grouard and Fertility.

Kashmiri Nakh

Santiya Baiskage

Apricot

In apricot, 54 genotypes have been established and evaluated for fruit yield and quality traits. The performance of top ten genotypes indicated that the highest fruit yield (23.64 t/ha) was recorded in CITH-AP-03 followed by CITH-AP-02 (23.02 t/ha), CITH-AP-01 (19.06 t/ha) and Harcot (18.20 t/ha) respectively (Table.5)

Table 5. Performance of top ten genotypes of apricot for various traits

S.No.	Variety/ genotype	Fruit wt (g)	Kernel wt (g)	TSS (⁰ Brix)	Fruit number	Fruit yield	
						(kg/tree)	(t/ha)
1.	CITH-AP-3	52.85	1.09	10.37	1120	59.12	23.64
2.	CITH-AP-2	53.30	1.23	12.37	1080	57.56	23.02
3.	CITH-AP-1	76.98	1.17	14.60	619	47.65	19.06
4.	Harcot	75.11	0.85	10.43	630	47.31	18.2
5.	Rival Apricot	59.17	1.00	13.13	740	43.78	17.51
6.	Heartly	62.68	1.21	12.10	689	43.18	17.27
7.	CITH-AP-10	67.83	0.77	11.87	621	42.12	16.84
8.	Turky	27.15	1.13	14.33	1515	41.13	16.45
9.	Afghani	37.51	0.84	12.97	1050	39.38	15.75
10.	Erani	75.20	1.12	12.83	514	38.65	15.46
	CD at 5%	***9.22***	***NS***	***1.36***	***225***	***10.12***	-

CITH-AP-1

CITH-AP-2

CITH-AP-3

Fruiting in elite apricot cultivars

Plum

In plum, out of 26 genotypes, 23 were evaluated for yield and quality. Among top ten genotypes the yield ranged from 11.22 to 27.26 t/ha (Table 6). The highest fruit yield of 27.26 t/ha was recorded in Mariposa followed by AU-Cherry (23.99 t/ha) and Tarrol (23.40 t/ha).

Table 6. Performance of top ten varieties/genotypes of plum for various traits

S. No.	Varieties/ genotype	Fruit wt (g)	Stone wt. (g)	TSS (⁰Brix)	Fruit number	Fruit yield	
						(kg/tree)	(t/ha)
1	Mariposa	50.30	1.57	15.67	1355	68.16	27.26
2	AU-Cherry	27.63	1.03	13.77	2171	59.98	23.99
3	Tarrol	52.71	1.99	12.44	1110	58.51	23.40
4	Monarch	33.80	0.84	10.27	1613	54.52	21.08
5	Beauty	46.41	1.60	18.95	3240	53.17	21.26
6	Methley	24.16	0.60	10.67	2135	51.58	20.63
7	Black Amber	26.31	0.82	11.63	1839	48.38	19.35

S. No.	Varieties/ genotype	Fruit wt (g)	Stone wt. (g)	TSS (^{0}Brix)	Fruit number	Fruit yield	
						(kg/tree)	(t/ha)
8	Green Gage	19.31	1.54	14.80	2113	40.80	16.32
9	Frontier	53.90	2.42	12.73	640	34.50	13.80
10	Red Beaut	50.12	0.86	14.60	560	28.07	11.22
	CD at 5%	***6.23***	***0.42***	***1.96***	***452***	***10.02***	-

Fruiting in some plum cultivars

Almond

In almond, total 23 germplasm lines were evaluated for nut yield and quality traits (Table 7). The performance of 23 genotypes indicated that highest kernel recovery (50.0%) having soft shell was observed in CITH-A-08 followed by semi hard CITH-A-21 (48.38%), CITH-A-23 (45.85%), CITH-A-22 (43.72%), CITH-A-09 (43.42%) and CITH-A-19 (39.09%).

Table 7. Nut and kernel characters of different almond genotypes

S. No.	Genotypes	Nut wt. (g)	Nut size (mm)		Shell thickness (mm)	Kernel wt. (g)	Kernel size (mm)		Kernel Recovery %	Softness of shell
			Length	Dia.			Length	Dia.		
1.	CITH-A-1	3.31	29.67	20.20	2.75	0.97	17.90	11.71	29.30	Hard
2.	CITH-A-2	3.95	29.42	19.25	2.41	0.95	19.56	12.23	24.05	Hard
3.	CITH-A-3	2.71	31.11	20.20	2.52	0.77	21.11	12.30	28.41	Hard
4.	CITH-A-4	2.12	29.45	20.58	2.35	0.86	20.86	12.53	40.56	Hard
5.	CITH-A-5	2.52	28.95	19.83	2.38	0.70	19.38	12.29	27.78	Hard
6.	CITH-A-6	2.24	30.73	19.29	2.35	0.74	21.32	10.87	33.04	Hard
7.	CITH-A-7	2.78	30.89	21.90	2.74	0.88	21.23	12.52	31.65	Hard
8.	CITH-A-8	1.54	39.05	19.54	0.82	0.77	27.41	11.55	50.00	Soft
9.	CITH-A-9	2.28	29.31	20.01	2.26	0.99	16.68	10.15	43.42	Semi hard
10.	CITH-A-10	2.94	28.20	18.90	2.12	0.73	18.46	10.14	24.82	Hard
11.	CITH-A-11	2.35	31.52	16.51	2.31	0.62	20.37	10.13	26.38	Hard
12.	CITH-A-12	2.57	31.78	21.35	2.73	0.77	17.89	12.06	29.96	Hard
13.	CITH-A-13	3.28	31.41	18.40	2.48	0.96	22.24	10.98	29.27	Hard
14.	CITH-A-14	3.07	30.74	21.19	2.73	0.90	18.24	12.49	29.80	Hard

S. No.	Genotypes	Nut wt. (g)	Nut size (mm)		Shell thickness (mm)	Kernel wt. (g)	Kernel size (mm)		Kernel Recovery %	Softness of shell
			Length	Dia.			Length	Dia.		
15.	CITH-A-15	3.06	31.53	20.82	2.55	0.85	21.21	12.70	27.78	Hard
16.	CITH-A-16	2.66	36.78	15.10	3.17	0.87	20.02	11.89	32.71	Hard
17.	CITH-A-17	2.48	36.19	21.11	2.68	0.65	22.42	11.36	26.20	Hard
18.	CITH-A-18	2.98	29.22	19.57	3.45	0.74	17.31	10.77	24.83	Hard
19.	CITH-A-19	2.43	29.60	21.02	2.16	0.95	17.68	11.33	39.09	Semi hard
20.	CITH-A-20	3.11	30.46	17.33	2.21	0.96	21.91	10.48	30.86	Hard
21.	CITH-A-21	1.86	37.90	21.54	2.65	0.90	24.37	12.19	48.38	Semi hard
22.	CITH-A-22	2.15	34.07	19.05	2.52	0.94	19.99	10.07	43.72	Semi hard
23.	CITH-A-23	1.81	33.47	18.82	1.27	0.83	17.54	12.35	45.85	Semi hard
CD at 5%		*0.17*	*2.81*	*1.65*	*0.48*	*0.12*	*1.99*	*1.04*	-	

Nut and kernel of 23 almond genotypes

Walnut

In evaluation of walnut genotypes (Table 8), highest average nut weight (26.31g) and kernel weight (14.40 g) with good kernel recovery (54.73%), light shell colour, long trapezoidal shape and easy kernel removal was recorded in CITH-W-1 followed by CITH-W-85 and CITH-W-9 having nut and kernel weight of 24.02 &10.95 g and 23.51&10.78 g, respectively.

CITH-W-7 CITH-W-2 CITH-W-9 CITH-W-1

Fruiting in some promising CITH walnut selections

Table 8. Nut, kernel and yield attributes of some promising walnut genotypes

	Nut weight (g)					Kernel weight (g)				Average number of nuts/plant				Average nut yield /plant (kg)			Average
	Genotype	2012	2013	2014	Average	2012	2013	2014	Average	2012	2013	2014	Average	2012	2013	2014	
1.	CITH-Walnut-1	24.43	26.41	28.10	26.31	13.66	14.99	14.90	14.40	410	488	433	443	10.01	12.88	12.16	11.68
2.	CITH-Walnut-2	16.10	19.10	19.55	18.25	9.66	9.80	8.81	9.42	322	345	390	330	5.18	6.58	7.62	6.46
3.	CITH-Walnut-3	19.99	22.47	23.11	20.68	9.66	11.22	10.27	10.38	287	305	334	308	5.73	6.85	7.71	6.76
4.	CITH-Walnut-4	20.48	20.94	24.28	21.90	9.66	11.06	12.99	11.23	288	276	295	291	5.89	5.77	7.16	6.27
5.	CITH-Walnut-5	19.47	19.41	21.47	20.11	9.56	10.18	10.12	9.95	281	297	301	291	5.47	5.76	6.46	5.89
6.	CITH-Walnut-6	23.45	24.35	24..35	15.90	11.66	12.24	12.88	12.26	296	300	321	316	6.94	7.30	7.81	7.35
7.	CITH-Walnut-7	21.42	22.42	22.44	22.90	11.62	12.45	12.43	12.16	287	299	305	297	6.14	6.70	6.98	6.60
8.	CITH-Walnut-8	20.00	23.00	23.10	22.03	10.01	10.08	11.08	10.39	344	340	371	355	6.88	8.05	8.57	7.84
9.	CITH-Walnut-9	21.77	24.99	23.77	23.51	9.65	10.68	12.02	10.78	378	386	401	388	8.42	9.64	9.59	9.21
10.	CITH-Walnut-10	19.83	19.98	21.44	20.41	13.66	13.00	12.52	13.06	345	339	345	343	6.84	6.77	7.39	7.00
11.	CITH-Walnut-22	20.33	21.12	20.32	20.59	9.99	10.89	10.89	10.55	177	197	205	193	3.59	4.18	4.16	3.97
12.	CITH-Walnut-23	19.00	19.23	19.30	19.17	8.88	9.66	9.62	10.54	220	255	300	258	4.18	4.92	5.75	4.95
13.	CITH-Walnut-24	18.66	18.76	19.76	19.06	8.71	9.99	9.91	9.50	205	301	354	286	5.57	5.64	6.99	6.06
14.	CITH-Walnut-38	16.33	17.87	18.86	17.68	7.99	7.78	7.87	7.92	310	343	349	84	5.06	6.12	6.58	5.92
15.	CITH-Walnut-41	11.22	12.86	12.96	12.34	6.00	6.30	6.38	6.22	342	341	350	344	3.38	4.38	4.53	4.24
16.	CITH-Walnut-44	11.99	12.24	12.22	12.15	5.90	6.80	6.89	6.53	378	401	430	403	4.93	4.90	5.25	4.89
17.	CITH-Walnut-51	17.66	18.27	18.78	18.07	8.11	9.94	9.64	9.23	189	231	252	224	3.33	4.22	4.73	4.10
18.	CITH-Walnut-52	18.66	19.71	19.99	19.45	7.91	8.50	8.50	8.30	134	165	176	158	2.50	3.25	3.51	3.08
19.	CITH-Walnut-56	17.33	18.48	18.82	18.21	7.01	7.42	7.55	7.32	259	321	340	306	4.48	5.93	6.39	5.60
20.	CITH-Walnut-83	17.00	15.77	18.45	8.77	8.67	9.02	8.98	8.89	76	87	98	261	1.29	1.52	1.80	1.53
21.	CITH-Walnut-84	16.77	16.81	16.92	7.71	7.55	7.66	7.99	7.73	30	55	34	39	0.50	0.93	0.57	0.02
22.	CITH-Walnut-85	23.33	23.87	24.88	24.02	10.87	10.98	11.02	10.95	154	178	199	176	3.59	4.24	4.95	4.26
23.	Opex Caulchery	11.61	11.99	12.01	11.87	6.12	6.65	6.55	6.44	223	242	250	238	2.61	2.90	3.00	2.83
24.	Sulaiman (C)	17.75	21.01	21.17	19.97	7.88	8.99	9.89	8.92	244	254	266	764	4.50	5.33	5.63	5.15
25.	Hamdan (C)	17.30	19.01	19.00	18.43	7.67	7.55	8.99	8.07	221	233	252	254	4.20	4.42	4.78	4.46
26.	Nugget (C)	12.25	13.80	14.32	12.78	6.33	6.98	7.60	6.97	87	88	90	88	1.06	1.21	1.28	1.18
27.	Franquette (C)	7.23	7.99	8.33	7.85	5.88	4.02	4.00	4.63	12	18	25	18	0.13	0.14	0.20	0.15
28.	Turtle (C)	9.04	9.34	9.99	9.45	5.99	4.66	5.02	5.22	78	87	90	85	0.86	0.72	0.86	0.86

Gynoeciasm observed in walnut-A new report

Two gynoecious plants were observed in walnut germplasm at CITH. These plants produced no male catkin during last two years. If they continue the same behaviour in coming years, they can be of immense value in crop improvement through conventional breeding and hybrid development. This is the first report from CITH on observation of gynoecious plants in walnut with potential for exploitation in walnut breeding.

Cherry

In cherry, 23 germplasm lines were evaluated for yield and quality traits. Maximum fruit yield (13.5 kg/tree) was recorded in CITH-Cherry-7 followed by CITH-Cherry-09 (13.0 kg/tree) and CITH-Cherry-01 (12.5 kg/tree). Highest TSS (21.0 °B) was observed in CITH-Cherry-02 followed by CITH-Cherry-03 (19.0 °B). Under evaluation of 8 exotic cultivars maximum fruit yield (11.0 kg/tree) was recorded in Bigarreau Napoleon followed by Lapinus (9.5 kg/tree) and Stella (7.8 kg/tree). Maximum TSS (19.50 °B) was observed in Lapinus followed by Stella (18.50 °B) and Sweet Heart (18.00 °B).

Gynoecious plants and branches without male catkins

Promising cherry selections from CITH

Olive

Among 18 cultivars of olive maintained at CITH, seventeen cultivars fruited during 2014 and highest yield efficiency (0.120 kg/cm^2) was recorded in Zaituna (Table 9) followed by Coratina (0.111 kg/cm^2), Cipressino (0.101 kg/cm^2) and Frontoio (0.100 kg/cm^2). The cultivar Tonda Ibea produced heaviest fruits having weight of 4.70g, followed by Cipressino (4.27g), Pendolino (4.13g) and Coratina (4.07g). Similarly, Tonda Ibea also excelled other cultivars for fruit length (24.32mm) & pulp weight (4.03g), while maximum fruit width (18.54mm) was recorded in Cipressino.The smallest seeds were produced by Morolio (0.43g). The oil percentage in different cultivars varied from 12.33 in cultivar Carignola to 30.97 percent in cultivar Cipressino (Fig. 2).

Table 9. Fruit and yield characteristics of different olive cultivars under temperate conditions

Cultivars	Fruit weight (g)	Fruit length (mm)	Fruit width (mm)	Pulp weight (g)	Seed weight (g)	Yield Efficiency (Kg/cm²)
Belice	3.10	21.06	16.38	2.43	0.67	0.025
Biancollio	3.70	22.77	16.97	2.87	0.83	0.017
Carignola	2.90	18.80	16.18	2.20	0.70	0.056
Cornicobra	3.80	23.06	17.11	3.13	0.67	0.010
Cipressino	4.27	21.12	18.54	3.23	1.03	0.101
Coratina	4.07	23.16	17.32	2.97	1.10	0.111
Etnea	3.77	22.93	16.85	2.93	0.83	0.030
Frontoio	3.07	19.73	15.84	2.30	0.77	0.100
Leccino	2.60	19.96	15.30	2.03	0.57	0.050
Messenese	3.83	22.92	16.16	2.73	1.10	0.038
Morolio	2.50	18.73	15.49	2.07	0.43	0.048
Ottobratica	2.90	19.89	14.85	2.27	0.63	0.052
Pendolino	4.13	23.56	18.06	3.27	0.87	0.063
Picholine	3.47	22.36	15.97	2.67	0.80	0.090
Tonda Ibea	4.70	24.32	17.81	4.03	0.67	0.038
Toffia	3.17	21.07	15.12	2.33	0.83	0.023
Zaituna	3.30	20.60	16.68	2.47	0.83	0.120
C D at 5%	***0.47***	***1.53***	***1.06***	***0.38***	***0.18***	***0.051***

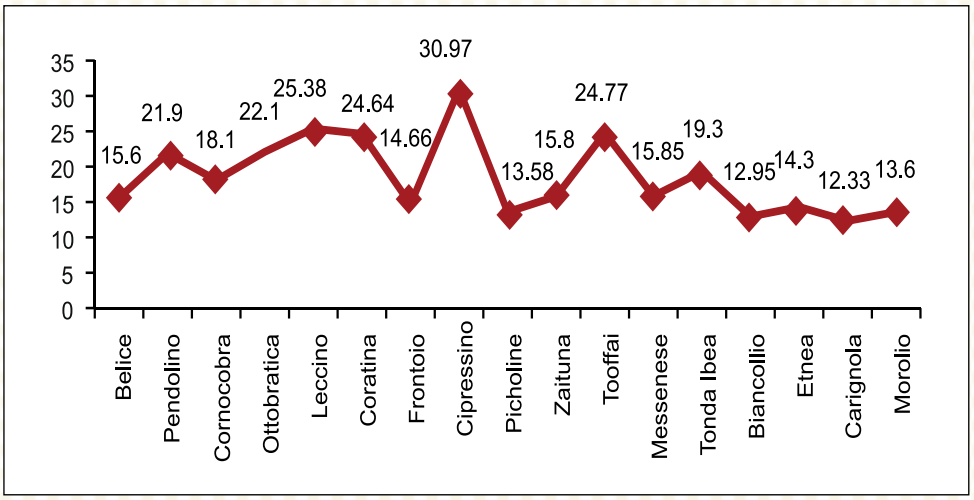


Fig.2. Oil percentage of different olive cultivars under temperate conditions

Coratina Zaituna Cipressino Leccino Frontoio

Peach

In peach, out of 38 genotypes maintained at CITH, 25 genotypes fruited during 2014 and heaviest fruits of 89.09 g were produced by Red Globe followed by Nimla (82.56 g). The cultivar Nimla excelled all genotypes by producing the yield of 26.01 kg /plant. The longest and widest fruits were also produced by cultivar Red Globe having length and width of 59.48mm and 62.04mm respectively (Fig. 3).

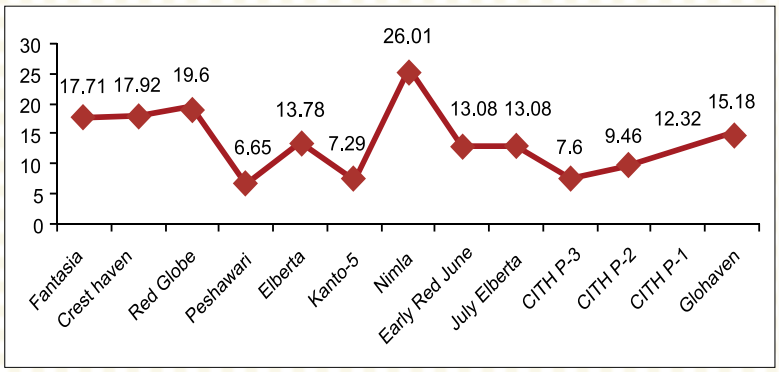


Fig 3. Yield (Kg/plant) of some promising genotypes of peach/nectarines

Fruiting in different peach/ nectarine cultivars

Kiwi fruit

Among seven cultivars maintained at CITH, 3 cultivars fruited during 2014 & heaviest fruit (39.0g) were recorded in cultivar Monty while maximum fruit length (46.03mm) & TSS (9.13^0 B) was recorded in Hayward. The maximum fruit width (43.08mm) and number of fruits per vine were recorded in Monty followed by Hayward.

Germplasm collection and evaluation at Mukteshwar

The collection and evaluation of germplasm pertaining to horticultural crops is continuously going on at Mukteshwar to recommend promising varieties for the region. The station is evaluating different varieties of pome and stone fruits as well as vegetable crops. During the year, 3 genotypes

Fruiting in different cultivars of Kiwi fruit

of *paron*-Kumaoni wild apple and 11 genotypes of *mahel*- Kumaoni wild pear were collected and planted in the green house for its establishment and further evaluation. Apple varieties such as Anna, Dorset Golden, Scarlet Gala, Pusa Gold and Pusa Amartara Pride; in Peach, varieties such as Red haven, Sun Crest and Myrobalan-B and in pear Starkrimson have been introduced for evaluation.

Lilium

In protected conditions, among seven lilium cultivars, Brunello was found earliest for initiation of flowering (25th May) while Mero Star was last to initiate flowering (27th July). The plant height, number of leaves and leaf length varied from cultivar to cultivar (Table 10). The cultivar Brindsi produced maximum number of flowers per spike (10.59), spike girth (14.67mm) and maximum vase life (15.4 days). The biggest flowers were produced by Caroline Tensen having flower diameter of 21.65 cm while maximum spike length (94.29 cm) was found in Royal Trinity followed by Litouwen (93.28cm), Mero Star (92.04), Brindisi (89.47cm), Caroline Tensen (85.17cm) and Brunello (84.32cm).

Flowering in different lilium cultivars

Table 10. Evaluation of lilium varieties for various traits under polyhouse condition.

Varieties	Plant height (cm)	No. of leaves /plant	Leaf length (cm)	Flowering initiation	Flowering duration (days)	No. of flower /spike	Flower diameter (cm)	Spike length (cm)	Spike diameter (mm)	Vase life (days)
Brunello	89.42	50.03	17.80	25th May	35.00	8.00	14.36	84.32	9.72	12.3
Pavia	84.39	45.12	14.52	27th May	40.00	6.11	19.84	75.33	8.97	14.5
Litouwen	104.24	64.95	16.46	29th May	42.00	9.85	18.89	93.28	14.04	14.7
Brindisi	98.23	84.09	15.33	27th May	41.00	10.59	15.70	89.47	14.67	15.4
Royal Trinity	101.87	98.17	8.11	2nd June	36.00	6.60	17.84	94.29	12.05	13.1
Mero Star	97.66	38.00	18.15	27th July	30.00	5.46	19.13	92.04	12.30	12
Caroline Tensen	90.55	36.22	12.41	25th July	35.00	3.59	21.65	85.17	10.63	10.8
CD at 5%	***9.00***	***11.86***	***2.00***	-	***4.46***	***2.80***	***2.81***	***9.41***	***1.39***	***2.22***

Kala zeera

Planting time of kala zeera seed and corm significantly effected its germination and establishment. The seeds sown during December to February germinated but there was no germination in March sown seeds. In corm plantation, germination occured upto sowing during first week of March indicating that the seed of Kala zeera can be sown upto February while corms can be planted upto first week of March .The plants raised through seeds do not withstand more as they wither without coming into flowering indicating that the Kala zeera do not produce any yield during first two years.

Corm planted crop of Kala zeera in Flowering

Carrot

Fifteen advanced breeding lines of carrot along with checks were evaluated for root yield and yield attributes under AVT trial and the results revealed that the total root yield ranged from 20.50 t/ha to 69.40 t/ha. The highest yield was recorded in SH-C-11(69.40 t/ha) followed by SH-C-59(LT) to the tune of (56.00 t/ha) and SH-C-42 (52.80 t/ha), which is significantly higher than both the checks Early Nantes (26.50 t/ha) and Chamman (26.95 t/ha).

Turnip

In evaluation of 15 advanced breeding lines of turnip revealed that total root yield ranged from 36.67 t/ha to 74.50 t/ha. The genotype CITH-T-1 recorded the highest root yield (74.50 t/ha) followed by CITH-T-5 (64.17 t/ha) and CITH-T-3 (63.50 t/ha).

Radish

Six radish genotypes along with checks were evaluated for yield and related attributes and CITH-R-1 and CITH-R-2 were found to have highest root yield of 30.22 t/ha and 29.22 t/ha, respectively.

Tomato

In tomato, entry 2013/TODHYB-3 expressed highest fruit yield in IET (hybrid), 2012/TODHYB-6 in AVT-I (hybrid) and 2011/TODHYB-6 in AVT-II (hybrid).

Chilli

In AICRP varietal and hybrid trials of hot pepper from different sources, entry 2013/CHIHYB-3 of chilli showed maximum red ripe fruit yield under IET (hybrid), 2012/CHIHYB-7 in AVT-I (hybrid), 2011/CHIHYB-4 in AVT-II (hybrid), 2013/CHIVAR-1 in IET (varietal), 2012/CHIVAR-9 in AVT-II (varietal), and 2011/CHIVAR-7 in AVT-II (varietal).

Onion

In onion, 53 long day onion genotypes collected in previous year and 82 exotic collections received from DOGR are in seed production for the year 2015. Among varietal trials in onion, onion variety OLR-1364 in IET trial recorded highest marketable yield (864.53 q/ha) followed by Onion variety ALRO-1213 (783.29 q/ha) in AVT-I and Onion variety BLRO-1229 (780.27 q/ha) in AVT-II.

Garlic

In garlic, 43 long day genotypes collected in the previous year were evaluated for different traits with CITH-MG-1 as national check and with local varieties. The highest marketable yield was recorded in CITH-G-5 (672.03 q/ha) while highest total yield was observed in CITH-G-12 (712.23 q/ha). In case of garlic, IET trial the genotype GRL-1330 (336.09 q/ha) showed maximum yield followed by AGLD-1215 with 264.46 q/ha marketable yield in AVT-I.

Onion and Garlic evaluation at Mukteshwar, nine germplasm lines of garlic were evaluated for important characters during the year 2014-15. The line GRL-1349 recorded the highest average bulb weight (67.33 g), total bulb yield (444.33 q/ha), average polar diameter (53.86mm) and average equatorial diameter (49.07 mm). Yield

and related attributes were recorded in various varietal trials of varieties and hybrids of onion and garlic. The entries OLR-1352 (462.4 q/ha), ALRO-1277 (359.14 q/ha) and BLRO-1229 (407 q/ha) recorded the highest bulb yield in IET (variety), AVT-I (variety) and AVT-II (variety) trials of onion, respectively. The entries OLR-1377 (308.7 q/ha) and ALRO-1222 (331.2 q/ha) showed the highest bulb yield in IET (hybrid) and AVT-I (hybrid) trials of onion. In garlic varietal trials, entries GRL-1349 (444.33 q/ha), AGLD-1204 (347.5 q/ha) and BGLD-1315 (415.5 q/ha) recorded the highest bulb yield in IET, AVT-I and AVT-II trials, respectively.

Breeding for development of superior varieties/hybrids in Solanaceous crops

Brinjal

Fifteen best performing advanced breeding lines of brinjal were evaluated under AVT trial. Yield potential of these breeding lines ranged from 46.78 t/ha to 105.07 t/ha, which is significantly higher than both the checks Pusa Purple Cluster (44.11 t/ha) and Local Long (34.52 t/ha). The highest yielding breeding lines were CITH-BR-1 (105.07 t/ha). CITH-B (O)-4-6 (96.19 t/ha) and CITH-B (O)-4-8 (93.99 t/ha).

Chilli

Fifteen advanced breeding lines of hot pepper were evaluated for fruit yield and yield attributes and highest yield was exhibited by CITH-HP-KL-2 (60.78 t/ha) followed by CITH-HP-1154-7-2 (54.93 t/ha) and CITH-HP-10-13 (54.56 t/ha).

Promissing hot pepper breeding lines

Capsicum

Among the 15 sweet pepper breeding lines, the highest yield was recorded in CITH-SP-1(67.16 t/ha) followed by SH-SP-603 (61.23 t/ha). The number of fruits per plant ranged from 14 to 33 with highest number in CITH-SP-2-2.

Promissing sweet pepper breeding lines

Tomato

Twenty five diverse tomato genotypes were

Green house evaluation of tomata a germplasm

studied for fruit yield under greenhouse at ICAR-CITH Regional Station, Mukteshwar, during April-December 2014. Significant differences for various traits were observed in the most of tomato genotypes under study. Among the genotypes, VL-4 exhibited highest fruit yield of 2202.19 q/ha with highest average fruit yield (5945.93 g/plant) followed by CITH- RS CT-4 (1216.92 q/ha), H-86 (1055.09q/ha), Pant Tomato-3 (1042.52q/ha) and FT-5 (1039.02q/ha). However, number of fruits/plant (166.28) and average fruit weight/plant (103.64 g) was highest in CITH- RS CT-4 and HDT-44-1, respectively. The highest yielding genotype (VL-4) ranked 3rd in number of fruits /plant (70.92), fruit diameter (54.66 mm) and average fruit weight (83.84 g).

DNA Fingerprinting of temperate horticultural crops

Plum

The genetic characterization of 24 elite plum cultivars (*Prunus* sp.) was carried out by analyzing 31 pairs of Simple Sequence Repeat (SSR) markers and 15 ISSR markers. A high level of genetic variability was found for these two molecular markers among the plum cultivars. Both marker techniques proved to be highly effective in discriminating the 24 plum genotypes analysed, since the majority of bands were polymorphic amongst genotypes (more than 90%). The number and percent of polymorphic loci, polymorphic information content (PIC), resolving power of primer (Rp) and marker index of primers (MI) were higher for ISSR than for SSR markers. The genetic relationship between the cultivars was clearly depicted in the dendrogram which was constructed from the DNA profile. The dendrogram showed that 23 cultivars accessions formed two main clusters and one cultivar Italian does not form the part of any cluster (Fig 4). The principal coordinate analysis (PCO) showed that the first three axes accounted for 73.2 % (65.83, 3.77 and 3.61 by Ist, 2nd and 3rd co-ordinate respectively) of total variation. The grouping shown in dendrogram was at par with that shown in 3D scatter (Fig 5) and the cultivar Italian can be considered outlier. The results obtained, using SSR and ISSR primers that yield a total of 108 loci produced a unique fingerprint for each of the 24 plum cultivar included in this study allowing an unequivocal identification of each cultivar. Besides, the fingerprint of each cultivar is defined by multiple SSR and ISSR bands presumably at multiple genetic loci. This is important for cultivar characterization since each cultivar is not defined by a single marker but by a set of several markers.

Standardization of micropropagation protocol

Enhancing rooting efficiency in lilium for better survival during micro propagation

Successful shoot multiplication rate of lilium cultures on MS media supplemented with BAP (2mg/l) & NAA (0.5mg/l) was attained. The success during hardening in lilium was low due to poor root development. In present study

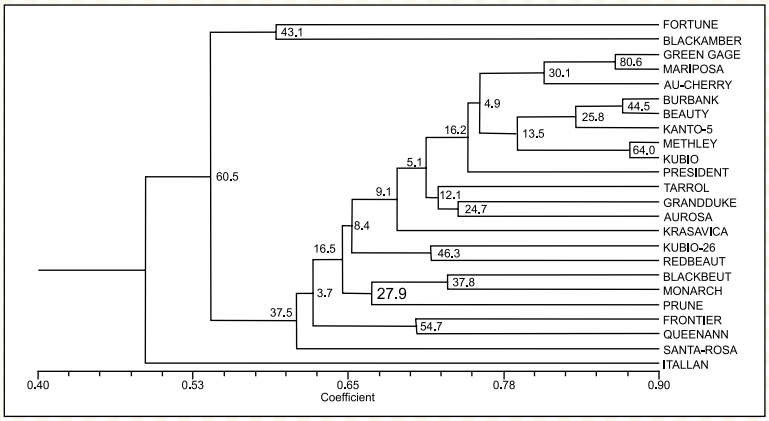


Fig 4. UPGMA dendrogram showing clustering pattern of plum cultivars. The bootstrap values are given on the nodes

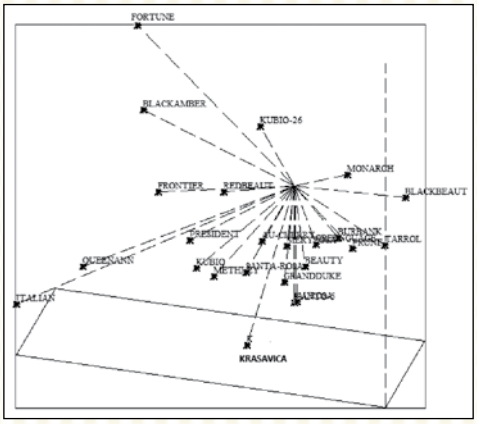


Fig. 5 Three dimensional PCO (principal co-ordinate analysis) scaling of 24 plum cultivars using SSR and ISSR markers

different combinations of NAA, IBA, PG and activated charcoal were used and best rooting combination with respect to rooting percentage, number of roots, days to root and root length was standardized. Best rooting percentage (>95%), maximum number of roots (>10), length of roots (4 cm), minimum days to initiate rooting (7 days) with no intermediate callusing was observed on MS media supplemented with IAA (2µM) + PG (10 mg/l) + activated charcoal (200 mg/l).

Enhanced rooting efficiency in apple & cherry clonal root stocks

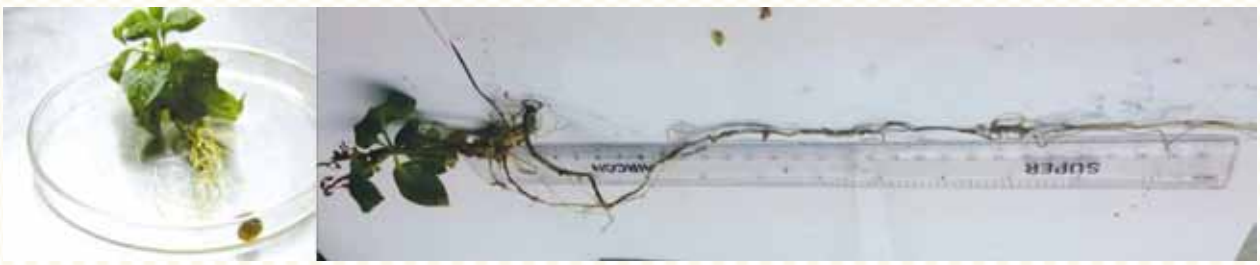
Successful protocol for efficient root development in apple clonal root stock MM-111 has been standardized on MS (1/2 strength) supplemented with IAA, activated charcoal and phloroglucinol. Minimum duration of initial establishment (8 days), maximum number of primary roots (20), maximum root length (20 cm), maximum root weight (183 mg) and maximum number of secondary roots (150) were observed on 1/2MS supplemented with IAA (2 µM), activated charcoal (200 mg/l) and phloroglucinol (20 mg/l).

Rooting and hardening in apple clonal root stock MM-111

Successful rooting in cherry clonal rootstock has been observed on MS media supplemented with different combinations of IBA, NAA, GA_3, 2,4-D and activated charcoal. But the best combination for rooting with respect to number (6) and length (30) of roots was observed on MS (half strength) supplemented IBA (1 mg/l) and activated charcoal (200 mg/l). There is significant difference with other media combinations on rooting parameters because this media combination is far better than other combinations (Table 11).

Table 11. Enhancing rooting efficiency through combinatorial effect of phytohormones and activated charcoal in cherry clonal root stock

MS	IBA (mg/)	NAA (mg/l)	GA_3 (mg/L)	2,4 ,D (mg/l)	AC(mg/l)	No of pri roots	Root length (cm)
Full	1.0	0.5	0.0	0.0	000	**1.33^{DE}± 0.33**	**5^{F}**±0.57
	2.0	0.0	0.0	0.0	000	**3^{C}**±0.57	**7^{E}**±0.33
	1.0	0.2	0.5	0.0	100	**2^{D}**±0.57	**5^{F}**±0.57
	0.5	0.1	0.5	1.0	200	**2^{D}.33±0.33**	**9^{D}**±0.57
Half	1.0	0.0	0.5	0.0	000	**3^{C}**±0.57	**14^{B}**±0.57
	1.0	0.0	0.0	0.0	200	**6^{A}**±0.57	**30^{A}**±0.57
	2.0	0.0	0.0	1.0	200	**4^{B}**±0.57	**11^{C}**±0.57
	1.5	0.0	0.5	0.5	200	**1.3^{DE}**±0.57	**7^{E}**±0.57



Cherry root multiplication and elongation

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

Apple

During the year 2014 about thirty four crosses were attempted between the cultivars of diverse traits.Twenty eight crosses showed fruit set, maximum fruit set (73%) was observed in Granny Smith x Oregon Spur and rest of the crosses showed an average fruit set of 30.5 %. Seeds from hybrid fruits were harvested and grown for further evaluation and screening. Hybrid plants raised previous year's (2009-2013) were screened for scab, powdery mildew and aphid infection/infestation. Least scab infection (14%) was recorded in Copper IV × Firdous, this may be because Firdous cultivar being scab resistant contributing to scab resistance. Crosses with *M. floribunda* showed minimum scab, aphid and powdery mildew infection (Table 12).

Walnut

During 2013 and 2014, a total of 50 crosses each were attempted in walnut involving cultivar Opex Caulchery and diverse CITH genotypes. Among the crosses only 10 crosses of 2013 and nine crosses of 2014 were germinated .Their hybrids have been raised in green house and data on plant growth is being recorded (Table 13).

Studies on improvement and production of Saffron

A total of 32 elite saffron clones were evaluated for different economic characters such as flower number per plant, fresh and dry weight of pistil, stigma/ style length and weight. Based on performance, total of ten best clones having high saffron yield/ ha were identified. They include CITH-125 (3.99 kg/ha), CITH-124 (3.90 kg/ ha), CITH-123 (3.87 kg/ha), CITH-122 (3.80kg/ ha), CITH-12 (3.74 kg/ha),CITH-121 (3.68 kg/ ha), CITH-107 (3.63 kg/ha), CITH-120 (3.62 kg/ ha),CITH-117 (3.61 kg/ha) and CITH -104 (3.60 kg/ha).All the clones are maintained in field and being multiplied for further utilization.

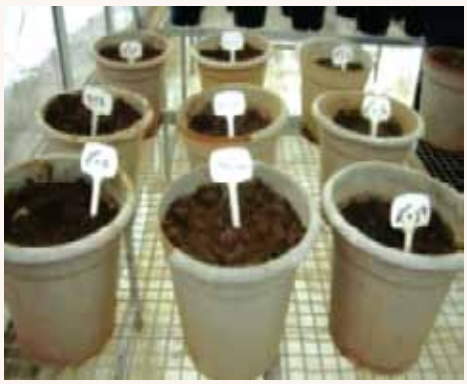
Table 12. Field screening of different hybrid seedlings against common diseases and pests

S. No	Cross Combination	Scab (Infection on 20 terminal leaves)	Powdery mildew (5 Point scale)	Aphid (No. per 20 leaves)
1	Ambri × Granny Smith.	0	0	2
2	Ambri × *M.floribunda.*	0	0	2
3	Ambri × Maharaji	10	2	1
4	Ambri × Mollies Delicious.	18	2	9
5	Ambri × Summer Red.	10	1	2
6	Ambri × Top Red.	15	3	1
7	Ambri × Vista Bella.	10	2	2
8	American Apirouge × *M. floribunda*	6	1	2
9	American Apirouge × Well Spur.	10	1	1
10	Golden Delicious × Cooper IV.	14	1	1
11	Golden Delicious × Gala Mast.	10	3	2
12	Golden Delicious × Mollies Delicious.	10	1	1
13	Golden Delicious × Oregon Spur.	20	3	2
14	Golden Delicious × Silver Spur	10	1	1
15	Golden Delicious × Top Red.	10	1	1
16	Golden Delicious × Snow Drift.	10	1	2
17	Jonica × Oregon Spur.	5	1	0
18	*M. floribunda* × American Apirouge.	1	0	0
19	*M.floribunda* × Prima.	2	0	0

S. No	Cross Combination	Scab (Infection on 20 terminal leaves)	Powdery mildew (5 Point scale)	Aphid (No. per 20 leaves)
20	*M.floribunda* × Well Spur.	2	0	0
21	Mollies Delicious × Red Delicious.	10	2	9
22	Prima × Ambri.	5	1	0
23	Prima × Maharaji.	8	1	0
24	Prima × Red Delicious.	7	1	0
25	Prima × Top Red.	5	0	0
26	Red Delicious × Silver spur.	18	2	1
27	Red Delicious × Mollies Delicious.	18	1	0
28	Red Spur × Summer Red.	12	2	1
29	Red Spur × Prima .	10	1	0
30	Royal Delicious × Golden Delicious.	15	0	0
31	Starkrimson × Gold Spur.	10	1	0
32	Well Spur × Vista Bella.	12	2	0
33	Well Spur × Prima.	15	2	0
34	Well Spur × Summer Red.	14	2	0

Table 13. Growth of hybrid seedlings obtained from crosses made during 2013

Cross Combinations	Plant height (cm)	Stem dia (mm)
2013		
Opex Caulchery x CITH-walnut -1	17.00	9.27
Opex Caulchery x CITH-walnut -18	6.00	5.10
Opex Caulchery x CITH-walnut -19	11.3	12.17
CITH-walnut -8 x CITH-walnut - 6	15.00	6.56
Opex Caulchery x CITH-walnut -10	12.20	10.00
Opex Caulchery x CITH-walnut -27	10.11	9.11
Opex Caulchery x CITH-walnut -9	11.3	12.18
Opex Caulchery x CITH-walnut -4	11.10	9.20
Opex Caulchery x Hamdan	12.4	8.09
Opex Caulchery x CITH-walnut -3	13.5	3.88
Cross combinations attempted during 2014		
Opex Caulchery x CITH-walnut -1		
Opex Caulchery x Wussan -3		
Opex Caulchery x CITH-walnut -49		
Opex Caulcheryx CITH-walnut - 18		
Opex Caulchery x CITH-walnut -9		
Opex Caulchery x CITH-walnut -27		
Opex Caulchery x CITH-walnut -19		
Opex Caulchery x Hamdan		
Opex Caulchery x CITH-walnut -6		



Walnut hybrid seedlings in pots

II Crop Production

Energy harvest through plant architectural engineering for increasing source and sink relationship in apple and other temperate fruits.

Apple

In one set of experiment, three apple varieties (Coe Red Fuji, Granny Smith and Spartan) trained under different training systems (Espalier, Vertical Axis and Cordon) to harvest maximum solar energy for better yield and quality. The apple variety Coe Red Fuji registered maximum fruit yield of 23.31 kg/tree (62.94 t/ha) and productivity efficiency (0.57 kg/cm^2) and was significantly superior over other varieties. Among training systems, Espalier system performed better in respect to fruit yield and quality. Interaction effect of varieties and training system indicated that highest fruit yield of 31.88 kg/tree (66.55 t/ha) was recorded in Coe Red Fuji variety trained on Espalier system in apple (Table 14).

In second experiment, 5 apple varieties (Starkrimson, Golden Delicious, Mollies Delicious, Vesta Bella and Fuji) trained under different training system (Spindle Bush, Head and Spread and Modified Central Leader). The apple variety Starkrimson registered maximum yield of 18.67 kg/tree (41.5 t/ha). Among training systems, Head and Spread performed better in respect to fruit yield. Interaction effect of varieties and training system indicated that maximum fruit yield (43.54 t/ha) was recorded in Starkrimson variety trained on Head and Spread system (Table 15).

Table 14. Performance of different varieties on various training systems in apple

Treatments	TCSA (cm^2)	Fruit wt (g)	Yield (kg/tree)	Yield (t/ha)	T.S.S (^{0} Brix)	Productivity Efficiency (kg/cm^2)
Variety						
Coe Red Fuji (V_1)	39.88	154.07	23.31	62.94	13.16	0.57
Granny Smith (V_2)	30.35	174.14	15.71	59.45	12.63	0.51
Spartan (V_3)	27.53	159.03	14.35	58.10	12.66	0.51
CD at 5%	*4.17*	*8.73*	*4.25*	*2.11*	*NS*	*NS*
Training system						
Espalier (T_1)	42.41	167.12	26.36	63.76	13.59	0.61
Vertical axis (T_2)	28.52	158.63	13.81	59.55	11.66	0.48
Cordon (T_3)	26.50	161.68	13.19	57.18	13.17	0.49
CD at 5%	4.94	6.25	5.18	2.05	0.77	0.07
Interaction						
V_1T_1	48.26	158.91	31.88	66.55	14.20	0.66
V_1T_2	36.35	150.42	19.33	62.33	12.30	0.53
V_1T_3	35.04	153.48	18.71	59.96	13.00	0.53
V_2T_1	41.02	178.78	24.29	63.05	13.27	0.59
V_2T_2	28.79	170.29	11.73	58.83	11.27	0.41
V_2T_3	21.25	173.35	11.11	56.47	13.36	0.52
V_3T_1	37.96	163.67	22.93	61.70	13.30	0.60
V_3T_2	20.43	155.18	10.37	57.48	11.53	0.51
V_3T_3	23.21	158.23	9.75	55.12	13.17	0.42
CD at 5%	***7.22***	***8.19***	***6.24***	***3.16***	***0.79***	***0.13***

Table15. Performance of apple varieties on various training systems in apple

Treatments	TCSA (cm^2)	Fruit wt (g)	Yield (kg/tree)	Yield (t/ha)	T.S.S (^{0} Brix)	PE (kg/cm^2)
Variety						
Starkrimson (V_1)	50.15	158.58	18.67	41.5	14.43	0.37
Golden Delicious (V_2)	66.92	152.83	13.01	28.92	15.30	0.19
Mollies Delicious (V_3)	59.03	152.67	13.42	29.84	13.62	0.23
Vista Bella (V_4)	57.32	159.03	14.05	31.22	14.05	0.24
Fuji (V_5)	50.36	154.33	11.95	26.55	13.06	0.23
CD at 5%	*8.21*	*4.12*	*3.07*	*3.37*	*0.90*	*0.09*
Training system						
Spindle Bush (T_1)	59.80	156.82	13.64	30.30	14.05	0.23
Head & Spread (T_2)	53.10	156.6	15.13	33.65	13.38	0.29
Modified Central Leader (T_3)	52.10	153.05	13.89	30.87	14.77	0.24
CD at 5%	*3.82*	*2.16*	*1.12*	*1.24*	*NS*	*0.11*
Interaction						
V_1T_1	54.59	159.91	18.09	40.19	16.60	0.33
V_1T_2	45.94	159.70	19.58	43.54	12.66	0.43
V_1T_3	49.93	156.14	18.34	40.77	14.05	0.36
V_2T_1	71.36	154.15	12.43	27.61	16.42	0.17
V_2T_2	62.71	153.95	13.93	30.96	12.96	0.22
V_2T_3	66.70	150.38	12.68	28.19	16.53	0.19
V_3T_1	63.47	154.0	12.84	28.54	11.30	0.20
V_3T_2	54.82	153.80	14.34	31.88	13.18	0.26
V_3T_3	58.81	150.23	13.10	29.11	16.38	0.22
V_4T_1	61.28	160.36	13.46	29.91	12.70	0.21
V_4T_2	52.63	160.15	14.96	33.26	16.05	0.28
V_4T_3	58.05	156.59	13.72	30.48	13.04	0.24
V_5T_1	48.30	155.66	11.36	25.24	13.26	0.23
V_5T_2	49.40	155.45	12.86	28.59	12.07	0.26
V_5T_3	53.39	151.89	11.62	25.82	13.86	0.21
CD at 5%	***6.54***	***4.32***	***2.57***	***4.25***	***0.92***	***0.14***

Espalier System | Cordon System | Spindle Bush and Head & Spread | Vertical axis

Different training systems in apple

Peach

Four peach varieties were evaluated for various yield and fruit traits and data revealed that all varieties performed better on Tatura Trellis training system at 2.5x2.5 mm spacing. The different varieties like Cresthaven, Red Globe, Glohaven and Fantasia gave highest yield of 18.17, 22.16, 18.48 & 20.59 kg per tree in Tatura trellis system. There is a great improvement in this system for fruit weight as compared to other training systems (Table 16 and Fig. 6)

Table 16. Effect of various training systems on fruit weight and yield in peach

Training system	Varieties							
	Crest haven		Red Globe		Glohaven		Fantasia	
	Fruit weight (g)	Yield/tree (kg)	Fruit weight (g)	Yield/tree (kg)	Fruit weight (g)	Yield/tree (kg)	Fruit weight (g)	Yield/tree (kg)
Central leader	65.00	10.70	61.33	13.77	64.33	13.39	83.00	10.24
Modified central leader	58.00	11.65	63.33	13.06	65.67	10.75	90.00	10.36
Open centre	69.33	14.82	97.67	15.17	73.00	15.14	96.00	16.77
Tatura trellis	65.00	18.17	116.33	22.16	83.00	18.48	107.67	20.59
Four scaffold	53.33	9.43	77.67	9.63	61.67	8.74	77.67	7.35
Modified open leader	58.00	10.16	68.00	8.35	58.00	11.44	90.00	9.38
C D at 5%	N.S	1.38	6.69	1.65	5.81	1.58	7.87	1.75

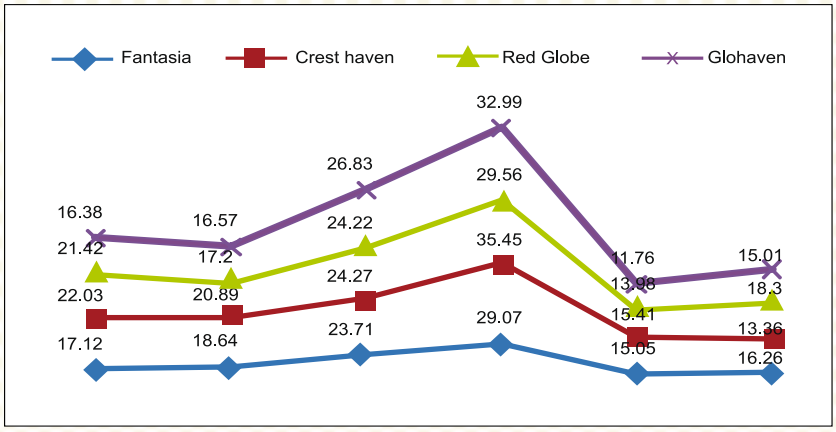


Fig 6.Yield (t/ha) of different varieties under different training systems

Fruiting in different peach cultivars trained on Tatura Trellis system

Effect of various training and pruning systems in Persian walnut

Effect of different training systems on various traits in walnut.

The results obtained in different training systems for various traits indicated that highest nut efficiency to the tune of 0.7187 (nuts/cm^2) was recorded in modified central leader system followed by multiple leader system(0.4952 nuts/ cm^2). The open central leader system gave a yield of 0.4369 nuts/ cm^2. The minimum nut efficiency and maximum nut weight (12.4g) was recorded in central leader system . The modified central leader system produced nuts having weight of 12.03g, hence modified central leader system was found best for walnut.

Effect of different thinning levels on various traits in Persian walnut.

The results pertaining to different levels of thinning regularly and alternate years depicts that highest nut efficiency (0.8449 nuts/cm^2) was recorded with 10% thinning regularly closely followed by 10% thinning in alternate years (0.8249 nuts/cm^2) The nut efficiency reduces as the thinning level increases in regular as well as in alternate years. Similarly the 10% level of thinning regularly produced heaviest nuts (13.3g) followed by 20% thinning (12.6g). Every level of thinning increases the fruit weight as compared to control. The maximum number of branches per meter was recorded in 10% level of thinning in alternate years. The weight of pruned wood also increases with increase in thinning level.

Effect of different heading back levels on different traits in Persian walnut

The data obtained from different heading back levels indicated that maximum nut efficiency (0.7440 nuts /cm^2) was recorded at 10% level of heading back in alternate years followed by 10% heading back (0.5587) nuts/cm^2) regularly. Maximum nut weight of 17.3g was recorded at 10% heading back regularly. The maximum branching density was also recorded at 10% level of heading back regularly. The differences were also noticed on various leaf traits through different levels of heading back . The amount of pruned wood also increased as the heading back levels advanced.

Effect of different thinning + heading back levels on various traits in Persian walnut

In the combined effect of various thinning + heading back levels on various traits, maximum nut efficiency (0.9932 nuts/cm^2) was recorded at 10 +10% level of thinning + heading back and was found best .The thinning + heading back levels increased the nut weight as compared to control and maximum nut weight (14.19g) was recorded at 30+30% level of thinning+ heading back .Non significant differences were also noticed for branching density. The effects were also noticed in some leaf traits. Differences were also recorded for amount of pruned wood among different levels (Fig 7, 8 and 9).

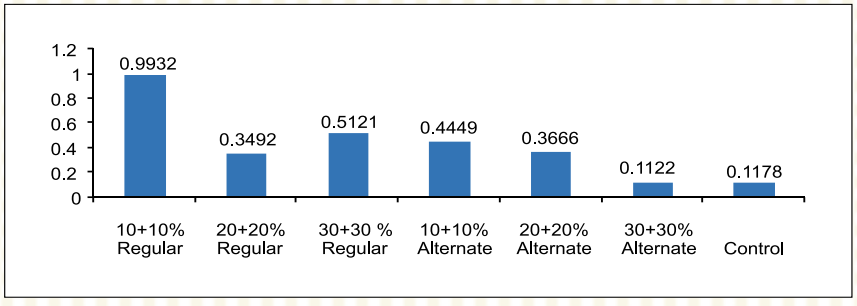


Fig 7. Effect of different thinning + heading back levels on nut efficiency

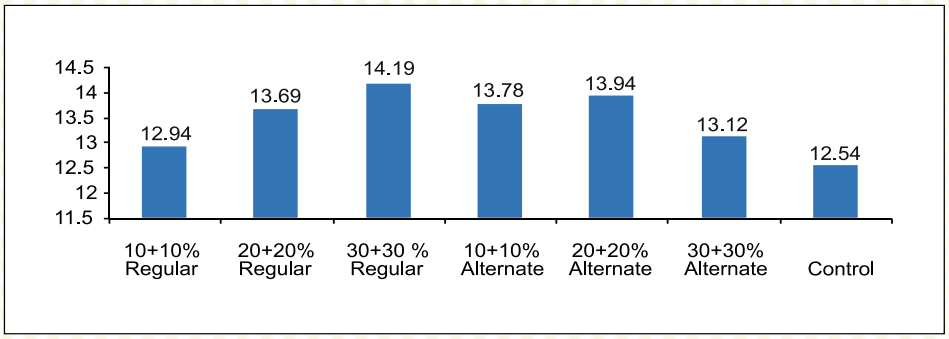


Fig 8. Effect of different thining + heading back levels on nut weight

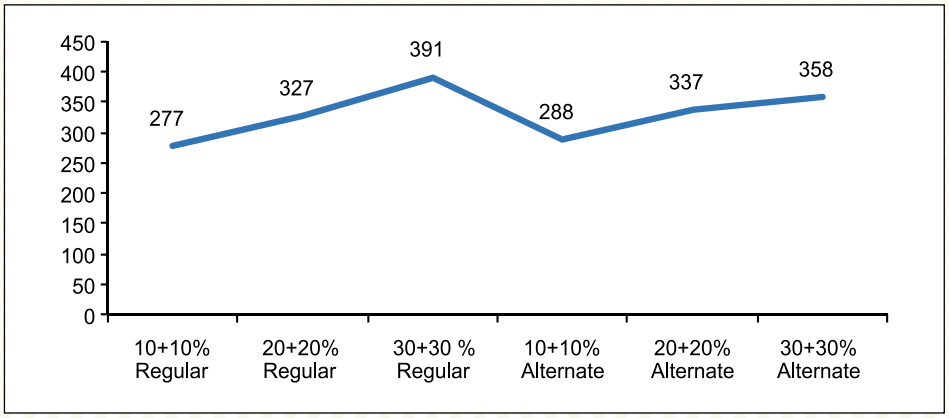


Fig 9. Weight of wood removed in different thinning +heading back levels

Standardization of intensive agro techniques for maximization of saffron productivity

The data pertaining to effect of different treatments on saffron yield during last 5 years is presented in Table 17. Significant differences existed among different treatments of irrigation regimes, planting methods and corm densities. Sprinkler and drip irrigation methods resulted early flowering with increased foliage height and more number of leaves and flowers/m^2 as compared to control (rain fed) which may help in escaping the saffron crop from early rain and snow fall during flowering and from saffron yield loss. Pistil fresh weight, pistil dry weight, pistil length and saffron yield per hectare were improved in sprinkler and drip irrigation methods as compared to control. Planting method- raised beds resulted in early flowering with increased foliage height and more number of leaves and flower/m^2 as compared to ridge & furrow and flat bed systems.

Highest total saffron yield of 27.16 kg/ha in 5 years with average yield of 5.43 kg/ha was obtained in planting density 10 lakh corms/ha in raised bed system with sprinkler irrigation followed by 25.76 kg/ha from planting density 15 lakh corms/ha in raised bed system with sprinkler irrigation which was statistically at par with saffron yield (25.67 kg/ha in 5 years) in planting density 10 lakh corm/ha in raised bed system with drip irrigation followed by saffron yield (25.23 kg/ha in 5 years) obtained in planting density 15 lakh corms/ha in raised bed system with drip irrigation.

Highest corm yield (40.11 t/ha) was recorded after 5 years of planting in treatment sprinkler irrigation in raised bed with 15 lakh corms/ha density followed by 39.05 t/ha in sprinkler irrigation in raised bed with 10 lakh corms/ha density and lowest (3.25 t/ha) was recorded under drip irrigation with flat bed and 5 lakh corms/ha density, due to poor drainage and rotting of corms.

Highest propagation coefficient of 515.60 % was recorded after 5 years of planting in raised bed with sprinkler irrigation and 5 lakhs corms/ha density followed by 442.40 % in raised bed with drip irrigation and 5 lakhs corms/ha density. Propagation coefficient was recorded less than 100 % in flat beds due to poor drainage and rotting of corms. (Table 18)

Table 17. Effect of different irrigation regimes, planting methods and densities on yield characteristic of saffron

Treatments	Saffron yield (kg/ha)							Corm yield (t/ha)
	1st year	2nd year	3rd year	4th year	5th year	Total yield of 5 years	Average saffron yield	
I1P1D1	0.80	2.9	2.69	2.94	2.13	11.46	2.29	18.37
I1P1D2	1.50	4.49	4.3	4.48	1.96	16.73	3.34	27.25
I1P1D3	2.20	4.86	4.72	4.89	1.55	18.22	3.64	30.12
I1P2D1	1.00	4.16	4.52	4.69	4.01	18.38	3.67	25.78
I1P2D2	1.80	5.71	7.43	7.79	4.43	27.16	5.43	39.05
I1P2D3	2.50	5.98	6.96	7.13	3.19	25.76	5.15	40.11
I1P3D1	0.70	2.05	2.08	1.38	0.80	7.01	1.40	4.32
I1P3D2	1.30	3.12	2.29	1.66	0.93	9.30	1.86	9.61
I1P3D3	2.00	3.52	3.18	1.71	1.15	11.56	2.31	10.12
I2P1D1	0.70	3.03	3.08	3.43	1.84	12.08	2.41	17.14
I2P1D2	1.50	4.62	4.51	4.73	1.59	16.95	3.39	25.28
I2P1D3	2.10	4.93	5.28	5.36	1.44	19.11	3.82	30.12
I2P2D1	0.90	4.29	4.64	4.34	3.18	17.35	3.47	22.12
I2P2D2	1.60	5.98	7.51	7.23	3.35	25.67	5.13	24.18
I2P2D3	2.40	6.32	7.08	6.62	2.81	25.23	5.04	38.25
I2P3D1	0.70	2.14	2.13	1.63	0.83	7.43	1.48	3.25
I2P3D2	1.30	3.22	2.44	1.75	1.03	9.74	1.94	5.37
I2P3D3	2.00	3.62	3.25	2.55	1.45	12.87	2.57	8.25
I3P1D1	0.60	3.22	1.97	1.90	1.36	9.05	1.81	4.62
I3P1D2	1.30	3.73	4.06	2.43	1.52	13.04	2.60	8.27
I3P1D3	2.00	4.07	4.42	3.05	1.51	15.05	3.01	8.59
I3P2D1	0.60	3.38	3.67	3.34	2.94	13.93	2.78	15.25
I3P2D2	1.20	4.94	5.17	4.97	2.48	18.76	3.75	26.3
I3P2D3	2.00	5.14	4.99	4.65	2.30	19.08	3.81	32.15
I3P3D1	0.50	2.21	2.1	2.43	1.51	8.75	1.75	8.25
I3P3D2	0.90	3.37	2.24	2.66	1.36	10.53	2.10	12.25
I3P3D3	1.20	3.77	3.61	3.23	1.33	13.14	2.62	13.78
CD at 5%	0.10	0.21	0.34	0.44	0.26	1.97	0.35	3.21

Where : Irrigation methods : I1-Sprinkler , I2- Drip and I3- Control (Rainfed)
Planting methods: P1- Ridge and Furrow, P2-Raised bed and P3-Flat bed.
Planting densities: D1-5, D2-10 and D3-15 Lakh Corms /ha.

Table 18. Saffron yield, corm yield, propagation coefficient and B:C ratio under intensive production technology (raised bed with recommended package of practices)

Treatment	Corm density/ ha	Saffron yield* (kg/ha)	Corm yield (t/ha)	Propagation coefficient (%)	B:C ratio
Sprinkler irrigation with raised bed	5 lakh	18.38	25.78	515.60	4.47
	10 lakh	27.16	39.05	390.50	4.63
	15 lakh	25.76	40.11	267.40	3.50
Drip irrigation with raised bed	5 lakh	17.35	22.12	442.40	3.80
	10 lakh	25.67	24.18	241.80	3.45
	15 lakh	25.23	38.25	255.00	3.28
Rainfed condition with raised bed	5 lakh	13.93	15.25	305.00	3.53
	10 lakh	18.76	26.30	263.00	3.52
	15 lakh	19.08	32.15	214.33	3.47

*cumulative yield of five years

Saffron under drip irrigation system

Saffron under sprinkler irrigation system

Enhancing Alstroemeria production involving different growing conditions

Performance of different alstroemeria cultivars under different growing conditions

Nine cultivars of alstroemeria were evaluated for various traits under polyhouse and open conditions. The maximum flower yield at the tune of 53.34 and 32.67 flowering shoots/ plant were recorded in cultivar Rosita and No 14 under polyhouse and open conditions, respectively. The different cultivars gave varied degree of growth and flower yield in different months. Majority of cultivars attain maximum plant height during month of June and flower yield during May and June under polyhouse conditions. The flowering continued from May to October in some cultivars in open conditions while under polyhouse conditions, cultivar Rosita gave continuous flowering from April to December, hence found suitable for round the year (approximately 9 months) production under polyhouse conditions (Fig 10).

Effect of planting method and density in Alstroemeria

The planting methods and planting density influenced growth and flower yield in alstroemeria cv. Rosita. Maximum flower yield of 42.6 flowering shoots per plant was obtained on the raised bed with planting density of 45x60 cm with sufficient space for next year while lowest flower yield of 25.4 flower shoots per plant at ridge and furrow method with planting density of 45x60cm. The maximum rhizome weight (1612gm) was also recorded in raised bed+ 45x60 cm spacing in cv Rosita. Similar trend was also observed in cv. Alladin and raised bed planting with 45x60 cm was found best.

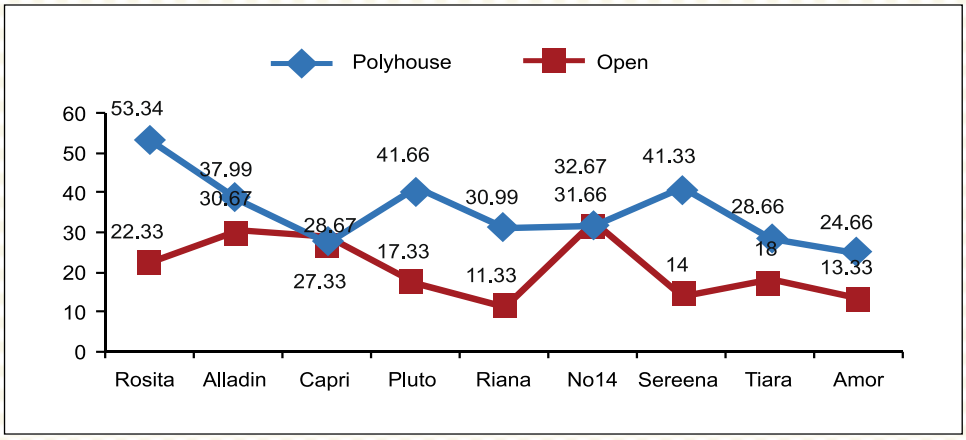


Fig 10. Flower yield of different varieties under polyhouse and open conditions

Effect of different growing media on flower yield in alstroemeria cultivar Rosita.

To find the best suitable growing media for alstroemeria, cocopeat, perlite and vermiculite were used in different combinations along with sand, soil and FYM. The flower yield was improved in all media but media containing soil + vermiculite gave maximum yield of 49.67 flower shoots per plant and maximum rhizome weight (1730 gm) per plant.

Effect of different thinning levels in Alstroemeria cultivar Rosita

The data pertaining to effect of different thinning levels on different traits indicated that flower yield increased upto 10% level of thinning. The maximum flower yield (44.4 flower shoots per plant) was recorded in 10% level of thinning .The flower yield reduced after 10% level of thinning. However, thinning will also vary from cultivar to cultivar and may be practiced accordingly. The rhizome weight increases as we increased level of thinning.

Repeated occurrence of new disorder in Alstromeria

A new disorder "shoot flatness" or "shoot deformation" was again observed in Alstromeria with similar symptoms as in 2013-14. This disorder was noticed in some plants of some varieties with very low frequency.

Development of saffron based inter cropping system involving almond

There was no significant impact of different type of almond varieties on saffron growth, floral and yield attributes as almond plantation is in initial stage. Maximum saffron yield (4.93kg/ha) was recorded in treatment saffron+ erect almond and minimum yield (4.50kg/ha) was recorded in saffron + drooping almond variety. Highest saffron equivalent yield (5.20 kg/ha) was recorded in treatment saffron+ erect almond and minimum (4.58 kg/ha) in treatment saffron+ drooping almond variety. There was no harmful effect of almond on saffron, as both are low water requiring crops and active growth phase of both saffron and almond do not coincides (Table 19).

Flowering in different Alstroemeria cultivars

New disorder in alstroemeria

Table 19. Effect of intercropping on growth and floral attributes of saffron.

Treatment	Foliage height (cm)	No. of leaves/ plant	Pistil length (cm)	Pistil fresh weight (mg)	Pistil dry weight (mg)	Number of flower /m²	Saffron yield (kg/ha)	Intercrop yield (nut no. / plant)	Intercrop yield (nut q/ha)	Saffron equivalent yield (kg/ ha)
Saffron sole	37.70	26.18	4.27	36.54	7 .79	62.14	4.84	-	-	5.03
Saffron + erect almond	36.50	25.15	4.23	35.18	7.80	63.28	4.93	138.33	1.81	5.20
Saffron + semi erect almond	34.17	21.18	4.21	35.14	7.89	60.14	4.74	118.00	1.43	4.95
Saffron + drooping almond	32.12	20.34	4.19	34.10	7.75	58.11	4.50	44.67	0.53	4.58
CD at 5 %	***2.78***	***1.82***	***NS***	***NS***	***NS***	***2.52***	***0.09***	-	-	***0.10***

Flowering and fruiting in saffron –almond intercropping system

Integrated nutrient management in vegetables under protected cultivation

Tomato (SH-TH-1)

Five treatment combinations of integrated nutrient management i.e T1- RDF N P K 150: 112.5: 75 (kg/ha), T2- FYM (10t/ha), T3-Vermicompost (4T/ha), T4: 50% RDF + 50% FYM + Biofertilizer and T5: 50% RDF + 50% Vermicompost + Biofertilizer were tried to ascertain their impact on fruit yield in tomato. During the year 2014-15, the treatment T4 i.e. 50% RDF + 50% FYM +Biofertilizer followed by T5 (50% RDF + 50% vermicompost + biofertilizers) recorded highest fruit yield and more number of fruits than other treatments.

Cucumber (SH-CH-1) under protected cultivation

Among different treatment combinations of integrated nutrient management in cucumber, the highest fruit yield (t/ha) was obtained in treatment T5 (50% RDF+50% VC+ biofertilizer) followed by T-4.

Capsicum (SH-SPH-1) under protection

The sweet pepper hybrid SH-SPH-1 was tested for yield and related attributes with different integrated nutrient management schedules under poly house. The treatment T5 consisting of 50% RDF + 50% Vermicompost + Biofertilizer was found best recording highest fruit yield (101.74 t/ha) and average fruit weight (89.01 g).

Onion

Effect of salicylic acid and drip irrigation in onion

In salicylic acid trial in onion, the treatment T3: 30 days after sowing and 60 days of transplanting gave highest total and marketable yield of 59.65and 40.55 t/ha, respectively. In micronutrient trial, treatment T3: Soil application of borax @ 10.0 kg/ha showed highest marketable yield (40.55 q/ha) and total bulb yield (59.65 q/ha).

In demonstration of drip irrigation in onion, higher marketable bulb yield (488.27q/ha) was recorded in raised bed drip irrigation with chemical fertigation followed by flat bed with flood irrigation and chemical fertilizer application.

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

Two crops viz. pea and cauliflower were inter cropped with apple and four different treatment combinations comprising FYM + Inorganic fertilizer (Recommended dose), FYM + Vermi-compost + Inorganic fertilizer, FYM + Vermi-compost + Bio-fertilizers + Inorganic fertilizer and FYM + Inorganic fertilizer (half of the recommended doses). Data on effect of intercropping on fruit quality i.e. length, diameter, fruit weight, firmness and yield of apple were recorded. In both the intercrops, treatments with FYM + Vermi-compost + Bio-fertilizer + Inorganic fertilizer recorded highest average yield per tree as compared to other treatments. This treatment also significantly improved the fruit quality. Data on effect of Integrated Nutrient Management (INM) on different growth parameters of intercrops such as plant height, number of leaves, curd diameter, curd weight, yield in cauliflower and plant height, number of branches, pod length and yield in pea were recorded. From the 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 20, 21, 22 & 23).

Intercropping with cauliflower var. Snow Crown under apple orchard

Intercropping with pea var. VL-7 under apple orchard

Table 20. Effect of different treatments when intercropped with cauliflower on fruit quality and yield

Treatments	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit firmness (lb/in^2)	Fruit TSS (^{0}Brix)	Yield (kg/tree)
Apple sole	59.23	66.38	135.60	12.85	10.58	15.04
FYM + inorganic (Recommended)	61.05	68.02	153.66	14.50	11.06	13.96
FYM + Vermi + inorganic	65.09	73.47	159.47	15.22	10.54	15.08
FYM + Vermi + biofertilizer + inorganic	67.05	75.02	165.62	15.60	12.50	16.86
FYM + inorganic (half of the inorganic)	58.85	70.43	139.71	13.73	8.96	13.06
CD 5%	***8.59***	***11.31***	***32.99***	***4.37***	***1.09***	***0.60***

Table 21. Effect of different treatments when intercropped with pea on fruit quality and yield of apple

Treatments	Fruit length (mm)	Fruit diameter (mm)	Fruit weight (g)	Fruit firmness (lb/inch^2)	Fruit TSS (^{0}Brix)	Yield (kg/tree)
Apple sole	56.88	65.75	135.60	12.85	9.38	15.68
FYM + inorganic (Recommended)	57.24	68.02	135.28	13.78	10.11	14.54
FYM + Vermi + inorganic	58.95	69.46	140.18	14.48	10.58	17.69
FYM + Vermi + biofertilizer + inorganic	59.50	71.81	157.29	14.78	12.12	19.84
FYM + inorganic (half of the recommended doses)	56.52	66.74	133.74	14.08	9.90	14.30
CD 5%	***3.06***	***5.68***	***25.22***	***2.15***	***1.21***	***1.12***

Table 22. Effect of INM on growth and yield of cauliflower as intercrop with apple

Treatment	Apple with Cauliflower as intercrop				
	Plant height (cm)	No. of leaves/ plant	Curd diameter (cm)	Curd weight (g)	Yield q/ha
FYM + inorganic (Recommended)	41.43	15.80	17.65	265.38	108.00
FYM + Vermi + inorganic	41.70	16.66	18.90	285.77	112.33
FYM + Vermi + biofertilizer + inorganic	49.68	18.13	21.66	310.00	125.00
FYM + inorganic (half of the recommended doses)	38.04	15.00	18.00	253.20	104.60
C D at 5%	***7.02***	***2.12***	***1.84***	***29.66***	***11.90***

Table 23. Effect of INM on growth and yield of pea as intercrop with apple

Treatment	Apple with pea as intercrop			
	Plant height (cm)	No. branches/plant	Pod length (cm)	Yield q/ha
FYM + inorganic (Recommended)	71.33	13.73	8.70	41.70
FYM + Vermi + inorganic	66.91	12.56	8.65	43.00
FYM + Vermi + biofertilizer + inorganic	82.99	14.77	9.58	46.00
FYM + inorganic (half of the recommended doses)	64.73	10.06	7.56	39.70
C D at 5%	***0.78***	***0.41***	***0.56***	***1.99***

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

Soils representing different blocks of CITH, RS Mukteshwar, were sampled and analyzed for organic carbon status and data is presented in presented in Table 24. The organic carbon level of the station varied from extremely low to extremely high. However, extremely high level of organic carbon is mainly observed in surface soil (0-20 cm) whereas, low level of organic carbon is generally observed in soil greater than 20 cm soil depth. Organic carbon values varied significantly between same soil depths of different soil profiles as well as between soil profiles within a particular block.

Table 24. Soil organic carbon status at different locations of CITH farm Mukteshwar

Name of block	Organic Carbon status			
	0-20 cm	21-40 cm	41-60 cm	61-80 cm
New building	Very high	Medium to high	High	Medium to high
A	Very high	Low to very high	Very low to high	Extremely low to high
B	Very high	High to very high	Low to very high	Extremely low to high
C	Very high	High	High	High
D	Low to high	Low to high	Very low to medium	Very low to medium
E	Very high	Very low to high	Very low to high	Extremely low

SOC:: low: <5.0 g kg-1; medium: 5.0-7.5 g kg-1 ; high: >7.5 g kg-1

Aquatic Dissipate/waste management through vermitechnology

Aquatic dissipate from water bodies was used to prepare vermicompost. The vermicompost prepared from this aquatic dissipate/waste was analysed for its nutrient composition as well as for carbon nitrogen (CN) ratio. Besides this proportion of aquatic dissipate to vermiculture for getting utmost economic returns through quality vermicompost preparation was standardized. Average nutrient composition of vermicompost prepared (Table 25) revealed that it contained 1.8% nitrogen, 0.21% phosphorus, 0.71% potassium. Amongst the micronutrients it contained substantial amount of zinc and boron which was 223 ppm, and 6.79 ppm, respectively. Elevation in earthworm count and weight as influenced by different quantities of aquatic waste was also assessed. Favourable temperature for worms was maintained throughout the process and daily data regarding maximum and minimum temperature was recorded. It was observed that earth worm count and weight increased significantaly in treatment where the proportion of Aquatic dissipate to worms was 15:1. After evaluating the CN ratio (Fig 11) it was again observed that least value i.e. 15.92 of CN ratio was noticed in treatment where proportion of dissipate to worms was 15:1 (in 7.5 kg AD+W). Hence it can be said that there was comparatively more mineralization of nitrogen was in the aforesaid treatment. It was further observed that CN ratio as well as amount

Table 25. Average composition of vermicompost prepared of aquatic dissipate

S. No.	Average Vermicompost composition	
	Element	Amount
1	Nitrogen (N)	1.80%
2	Phosphorus (P)	0.21%
3	Potassium (K)	0.71%
4	Carbon (C)	39.0%
5	Sulfur (S)	0.13%
6	Calcium (Ca)	2.39%
7	Magnesium (Mg)	0.63%
8	Iron (Fe)	1.92%
9	Zinc (Zn)	223 ppm
10	Boron (B)	6.79 ppm

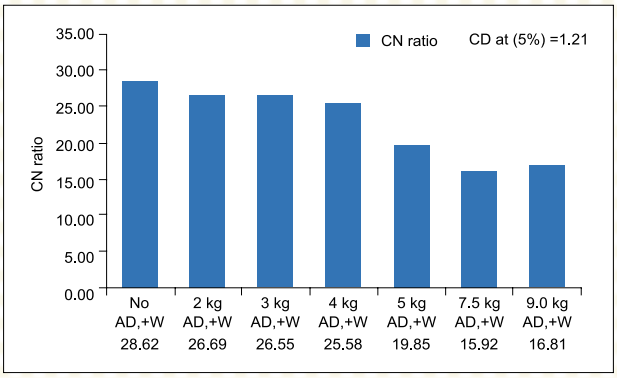


Fig 11. CN ratio of Vermicompost prepared as influenced by worm-dissipates proportion.
AD: Aquatic dissipate; W: Earthworm

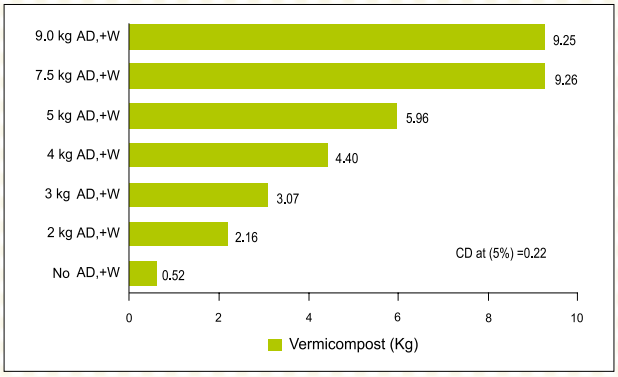


Fig 12. Vermicompost as influenced by worm-dissipate proportion.
AD: Aquatic dissipate;W: Earthworm

of vermicompost prepared (Fig 12) was best in the said treatment although the quantity of compost prepared was at par with treatment where 9 kg AD was added.

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 was having different impact on saffron yield (Table 26). Two years results revealed that saffron yield in case where small corms were planted (CS1; Corm size = 5-7gm) was more in treatment where fertilizer was placed in mid rib and upper to the corm position. In case where the corm size was around 8-10 gms (CS2) mid rib placement of fertilizers was superior over other treatments, but within the mid rib treatment both upper as well as parallel placement were at par with each other, during the first year of experimentation. But in the second year the fertilizer placed in mid rib upper to corm proved statistically superior over all other treatments. Different modes of fertilizer application followed were broad casting, band placement and foliar fertigation.

On studying the impact of these treatments on corm multiplication rate, it was observed that corm multiplication rate was highest in treatment where fertilizer was placed in mid rib and upper to the corm position in both the cases that is in CS1 and CS2 (Fig 13). In CS2 corm multiplication rate was 92% where as the same was around 76.67% in CS1.

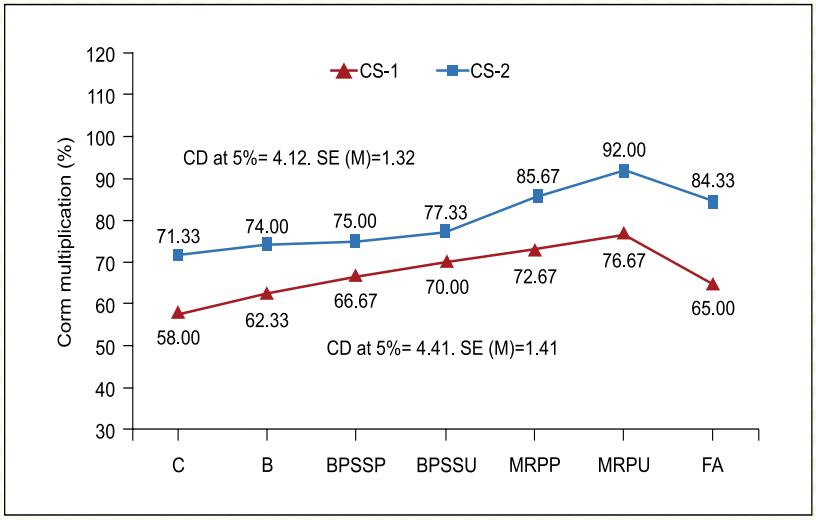


Fig 13. Per cent corm elevation as influenced by fertilizer application through different modes

Table 26. Saffron yield (kg ha^{-1}) as influenced by different modes of fertilizer application

Treatments	CS1		CS2	
	2013	2014	2013	2014
C	0.53	0.54	1.25	1.27
B	0.55	0.59	1.58	1.64
BPSSP	0.58	0.60	1.48	1.51
BPSSU	0.68	0.73	1.79	1.82
MRPP	0.66	0.74	1.99	2.05
MRPU	0.70	0.80	1.91	2.19
FA	0.65	0.75	1.63	1.69
CD(5%)	*0.03*	*0.02*	*0.08*	*0.10*
SE(m)	*0.012*	*0.009*	*0.026*	*0.033*

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 g

Fertigation in apple

Apple yield as influenced by fertigation (having varying quantity of fertilizer as well as splits) was assessed. A significant impact of fertigation treatments on fruit yield was noticed (Fig 14). Two years average data revealed that highest fruit yield of 28.05 kg Tree^{-1} was noticed in fertigation treatment where 75% of recommended fertilizer was applied in two splits followed by treatment where whole of the recommended fertilizer was applied in two splits (27.85 kg Tree^{-1}). But both these values were statistically at par with each other but significant over other treatments.

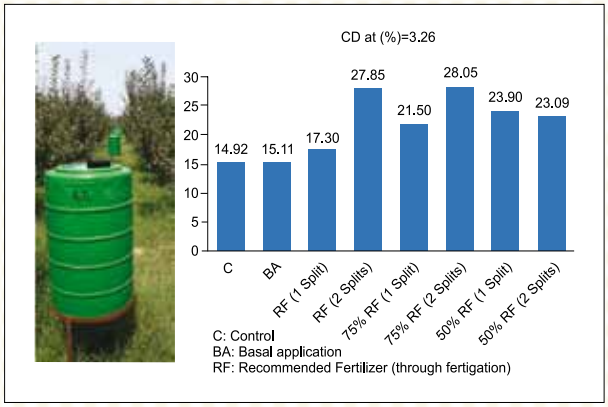


Fig 14. Apple fruit yield as influenced by fertigation treatments

III Crop Protection

Bio-ecology and management of aphid and mite pests in temperate fruits and nuts

The pest density of the European red mite, (*Panonychus ulmi*) was recorded on weekly interval from March to November on apple and almond. The mite activity starts from second week of June and continue up to late October. The highest population density of ERM was 31.56 and 6.46 mites/leaf on almond and apple, respectively. The life cycle of *Panonychus ulmi* was also studied under laboratory condition. The mite natural enemies have been collected and identified, which includes anthocorid bug, Coccinellids *Adalia tetraspilota*, *Calvia punctate*, *Priscibrumus uropygialis*, *Hippodomia variegata*, *Stethorus aptus*, *Coccinella septumpunctata*, *Oenopia conglobata*, *Halyzia sanscita*, *Serangium montazerii* and *Calvia* spp. 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 some miticide evaluation against European red mite, Fenzaquine (0.002%) was found effective, followed by Fenpyrioximate (0.005%). Large walnut aphid, *Callaphis juglandis* population density were also recorded on weekly interval at CITH. The pest population reached peak i.e. 56.54 aphids/ leaf during first week of July. The Coccinellids prey on walnut aphid were collected and identified.

The aphid species *Pterochloroides persicae* (peach stem aphid) is one of the largest aphid found infesting almond, peach and plum in J&K. In India, it is earlier reported in Punjab and Himachal Pradesh on ornamental and commercial varieties of peach. It has been recorded as a potential pest of peach and almond. Large colonies of these aphids feed on trunks or branches of their host plants and produce large quantity of honey dew, which ultimately cause sooty mould. Its life cycle was observed under field condition. Overwintering eggs start emerging on 2rd week of March, single generation last for about 31-68 days, number of nymphs produced was 15 -56 per female and over-wintering eggs were laid from 2rd week of November to late December. The natural enemies have also been collected and identified. For the management of *P. persicae*, NSKE (5%), Chloropyriphos (0.05%) and Dimethoate (0.03%) were evaluated and all three insecticides gave 100% percent mortality in single application. In an experiment for management of peach leaf curl disease and aphids, among the various treatments, fungicides captan (0.05%) was found effective followed by haxoconazole (0.05%). Other aphid and mite pests observed were mealy plum aphid *Hylaopterus pruni* (Geoffroy) on apricot, small walnut aphid *Chromaphis juglandicola*, green apple aphid *Aphis pomi* de Geer, walnut leaf gall mite (*Aceria erinea*), soft scale on walnut, leaf curl aphid *Brachycaudus helichrysi* on almond and two spotted mite *Tetranychus urticae* on strawberry.

European red mite (*Panonychus ulmi*) on almond

Leaf curl aphid (*Brachycaudus helichrysi*) on almond

Giant black peach stem aphid (*Pterochloroides persicae*) on peach

Soft scale on walnut

Symptom of peach leaf curl disease

Walnut leaf gall mite (*Aceria erinea*)

Development of spray schedule against major canker and foliar diseases of apple in Uttarakhand

Evaluation of different spray schedules against major canker, foliar and fruit diseases of apple

Nine different spray schedules (Table 27) were evaluated against major diseases of apple and all the spray schedules reduced the disease incidence to a greater extent over control. However, among the spray schedules, schedule V comprising of copper oxychloride (0.3%) at dormant stage, captan (0.3%) at green tip, mancozeb (0.3%) at pink bud, carbendazim (0.05%) at petal fall, carbendazim + mancozeb (0.05%) at fruit development stage, Dodine (0.075%) 20 days after 4th spray, captan (0.3%) at pre-harvest stage and copper oxychloride (0.3%) at post harvest stage exhibited highest overall disease control in respect of major canker (96.54%), foliar diseases (70.37%) and fruit diseases (81.56%) of apple (Table 28, 29 & 30).

Epidemiological studies on major canker and foliar diseases of apple

The abiotic factors such as temperature, relative humidity and rainfall affect development of foliar diseases of apple and are important for developing suitable management strategies against them. Correlation studies revealed a positive correlation between severity of major foliar diseases of apple viz., Marssonina blotch, Alternaria leaf spot and powdery mildew and abiotic factors viz., average minimum and maximum temperature, relative humidity and rainfall . Relative humidity is probably the most important environmental factor influencing the pathogenesis of foliar diseases of apple in Nainital district. Relative humidity showed significant effect on the severity of foliar diseases of apple during both the experimental years (2013 and 2014). In case of Marssonina blotch of apple ,relative humidity played significant positive role in disease development in both the experimental years i.e. 2013 (r= 0.779) and 2014 (r= 0.758). In case of canker diseases, relative humidity showed highly significant relation with stem black, papery bark and smoky blight cankers in both the experimental years. In order to find out the total effect of temperature, relative humidity and rainfall on per cent disease severity of major canker and foliar diseases of apple multiple regression equation was fitted between these factors during 2013 and 2014. The coefficient of multiple determination (R2) was calculated as 0.807- 0.985 for major canker and foliar diseases of apple which signifies that 80.7 – 98.5 per cent variation in per cent incidence of major canker and foliar diseases dependent on weather parameters included in these studies. From this study it can be inferred that weather parameters strongly influenced the disease occurrence on apple crop and schedule V may be recommended for effective management of major canker and foliar disease of apple in Uttarakhand conditions.

Management of major soil born diseases of apple

Integrated disease management of white root rot of apple

Kharsu leaves, deodar needles and neem cake among the organic amendments; *Trichoderma*

viride among biocontrol agents, and azoxystrobin, carbendazim and thiophanate methyl among chemicals were tested in 2014 to see their individual as well as integrated effect on incidence of white root rot and plant health in pot culture and nursery. All the individual treatments with organic amendments, biocontrol agents and fungicides were found inferior to their integrated applications, 100% under nursery conditions, limited disease control was recorded. Among different treatment combinations maximum disease control of 82.74 per cent under nursery was recorded with combination of azoxystrobin (0.1%)+ *Quercus samiecarpifolia* (Kharsu) leaves+ *Trichoderma viride*+ neem cake and it was minimum (62.27%) in a combination of thiophanate methyl (0.1%)+ deodar needles+ *Trichoderma viride*+ Neem cake. All the treatments improved plant health over control under pot culture as well as in the nursery. In pot culture, maximum shoot length (102.33cm) and root length (64.33cm) was recorded in Azoxystrobin (0.1%)+ *Quercus samiecarpifolia* (Kharsu) leaves+ *Trichoderma viride*+ Neem cake) and it was minimum in case of individual treatment with thiophanate methyl (0.1%). Under nursery maximum increase in shoot length (100.25cm) and root length (55.33 cm) was recorded in *azoxystrobin* (0.1%), *Quercus samiecarpifolia* leaves + *Trichoderma viride* + Neem cake.

Diseases reaction of different apple rootstocks against Dematophora necatrix

All rootstocks under study viz. M-9, MM-111, MM-106, *Paron* (*Malus baccata* var. *himalaica* and *Malus baccata* from Kashmir showed appearance of disease. Thorny paron (*Malus baccata* var. *himalaica*) showed resistant (R) reaction against *D. necatrix* test pathogen exhibiting least per cent disease severity under polyhouse (4.00%) and under natural infested soil i.e. under nursery (4.37%). *Malus baccata* from Kashmir showed highly susceptible disease reaction against this pathogen both in polyhouse (76.55%) and under nursery conditions with disease severity of 70.95 per cent.

Table 27. Different test spray schedules for the management of major apple diseases in Uttarakhand

S. No.	Tree Stage	Spray schedule*								
		I	II	III	IV	V	VI	VII	VIII	IX
1.	Dormant stage	Copper oxychloride (0.3%)	-	-	-	Copper oxychloride (0.3%)	Captan (0.3%)	Copper oxychloride (0.3%)	Copper oxychloride (0.3%)	Copper oxychloride (0.3%)
2	Green tip	-	-	-	-	Captan (0.3%)	Dodine (0.075%)	Zirum (0.3%)	Captan (0.3%)	Captan (0.3%)
3.	Pink bud	Zineb + Hexaconazole (0.025%)	Zineb + Hexaconazole (0.025%)	Mancozeb (0.3%)	Metiram (0.3%)	Mancozeb (0.3%)	Carbendazin +mancozeb (0.05%)	Difenoconazole (0.05%)	Mancozeb (0.3%)	Mancozeb (0.3%)
4.	Petal Fall/ Pea Stage	Cabrio top (0.05%)	Cabrio top (0.05%)	Kresoxim methyl (0.05%)	Dodine (0.075%)	Carbendazim (0.05%)	Thiophanate methyl (0.05%)	Shield (0.3%)	Carbendazim (0.05%)	Carbendazim (0.05%)
5.	Fruit Development (walnut size)	Pyraclostobin (0.05%)	Pyraclostobin (0.05%)	Carbendazim (0.05%)	Thiophanate methyl (0.05%)	Carbendazin +mancozeb (0.05%)	Carbendazin +mancozeb (0.05%)	Iprodione +carbendazim (0.05%)	Metiram (0.3%)	Cabrio-top (0.05%)
6.	Fruit Development (20 days after 4th spray)	Dodine (0.075%)	Dodine (0.075%)	Cabrio Top (0.05%)	Kresoxim methyl (0.05%)	Dodine (0.075%)	Propineb (0.3%)	Zineb+ Hexaconazole (0.05%)	Dodine+ Hexaconazole - (0.05%)	Kresoxim methyl (0.05%)
7.	Pre-Harvest (20-25 days before harvest)	Carbendazim (0.05%)	Carbendazim (0.05%)	Thiophanate methyl (0.05%)	Carbendazim (0.05%)	Captan (0.3%)	Mancozeb flowable (0.3%)	Zirum (0.3%)	Mancozeb (0.3%)	Mancozeb (0.3%)
8.	Post harvest	Shield (0.3%)	Copper oxychloride (0.3%)	Copper hydroxide (0.3%)	Copper hydroxide (0.3%)	Copper oxychloride (0.3%)	Copper oxychloride (0.3%)	Shield (0.3%)	Copper oxychloride (0.3%)	Copper hydroxide (0.3%)

*To get the desired results of the schedules proper host nutrition and use of fungicidal paste on the training-pruning cuts is necessary

Table 28. Evaluation of different spray schedules against major canker diseases of apple in Uttarakhand

Spray schedule	Papery bark	Control	Stem black	Control	Pink canker	Control	Smoky blight	Control	European canker	Control	Nail head canker	Control	Overall disease control
Control	50.21 (45.14)	0.00 (0.00)	37.62 (37.85)	0.00 (0.00)	6.47 (14.74)	0.00 (0.00)	50.45 (45.28)	0.00 (0.00)	53.50 (47.03)	0.00 (0.00)	24.31 (29.56)	0.00 (0.00)	0.00 (0.00)
I	8.54 (17.00)	82.99 (62.34)	0.00 (0.00)	100.00 (100.00)	0.00 (0.00)	100.00 (100.00)	4.54 (12.31)	91.00 (72.81)	6.54 (14.83)	87.77 (68.48)	0.00 (0.00)	100.00 (100.00)	93.63 (83.94)
II	11.54 (19.87)	77.01 (55.98)	2.33 (8.78)	93.81 (76.79)	0.00 (0.00)	100.00 (100.00)	8.76 (17.23)	82.63 (61.96)	12.54 (20.75)	76.56 (55.88)	4.96 (12.88)	79.59 (56.44)	84.93 (67.84)
III	13.46 (21.54)	73.19 (52.29)	2.96 (9.91)	92.13 (73.81)	0.00 (0.00)	100.00 (100.00)	13.46 (21.54)	73.32 (52.44)	15.46 (23.17)	71.10 (50.74)	8.88 (17.35)	63.47 (41.32)	78.87 (61.77)
IV	12.96 (21.11)	74.19 (53.23)	1.46 (6.95)	96.12 (81.65)	0.00 (0.00)	100.00 (100.00)	10.71 (19.11)	78.77 (57.79)	13.54 (21.60)	74.69 (54.07)	6.96 (15.31)	71.37 (48.22)	82.52 (65.83)
V	5.55 (13.63)	88.94 (69.80)	0.00 (0.00)	100.00 (100.00)	0.00 (0.00)	100.00 (100.00)	1.55 (7.16)	96.93 (84.19)	3.55 (10.87)	93.36 (76.89)	0.00 (0.00)	100.00 (100.00)	96.54 (88.48)
VI	7.79 (16.22)	84.48 (64.08)	0.00 (0.00)	100.00 (100.00)	0.00 (0.00)	100.00 (100.00)	3.79 (11.23)	92.49 (75.19)	5.79 (13.93)	89.18 (70.38)	0.00 (0.00)	100.00 (100.00)	94.36 (84.94)
VII	6.54 (14.83)	86.97 (67.16)	0.00 (0.00)	100.00 (100.00)	0.00 (0.00)	100.00 (100.00)	2.54 (9.18)	94.96 (79.73)	4.54 (12.31)	91.51 (73.83)	0.00 (0.00)	100.00 (100.00)	95.57 (86.79)
VIII	7.04 (15.40)	85.98 (65.89)	0.00 (0.00)	100.00 (100.00)	0.00 (0.00)	100.00 (100.00)	3.04 (10.05)	93.97 (77.81)	5.04 (12.98)	90.58 (72.40)	0.00 (0.00)	100.00 (100.00)	95.09 (86.02)
IX	6.29 (14.53)	87.47 (67.80)	0.00 (0.00)	100.00 (100.00)	0.00 (0.00)	100.00 (100.00)	2.29 (8.71)	95.46 (80.76)	4.29 (11.96)	91.98 (74.57)	0.00 (0.00)	100.00 (100.00)	95.82 (87.19)
CD at 5%	*0.03*		1.16		0.40		0.57		0.23		1.03		

*Figures in parenthesis are arc sine transformed values

Table 29. Evaluation of different spray schedules against major foliar diseases of apple in Uttarakhand

Spray schedule	Marssonina blight	Control	Alternaria leaf spot	Control	Mycosphaerella leaf spot	Control	Powdery mildew	Control	Overall disease control
Control	41.07 (39.88)	0.00 (0.00)	32.44 (34.74)	0.00 (0.00)	31.42 (34.11)	0.00 (0.00)	33.60 (35.44)	0.00 (0.00)	0.00 (0.00)
I	25.54 (30.37)	37.81 (23.84)	10.46 (18.88)	67.75 (45.65	11.96 (20.24)	61.93 (40.65)	1.54 (7.13)	95.41 (79.87)	65.73 (47.50)
II	27.46 (31.62)	33.14 (20.71)	11.46 (19.80)	64.67 (43.01)	13.78 (21.80)	56.14 (36.08)	3.46 (10.73)	89.70 (69.73)	60.91 (42.38)
III	30.21 (33.36)	26.44 (16.35)	16.03 (23.61)	50.58 (32.03)	15.71 (23.36)	50.00 (31.51)	6.88 (15.22)	79.52 (57.07)	51.64 (34.24)
IV	29.71 (33.05)	27.66 (17.13)	14.87 (22.69)	54.16 (34.67)	15.54 (23.23)	50.54 (31.90)	5.54 (13.62)	83.51 (61.56)	53.97 (36.32)
V	23.55 (29.05)	42.66 (27.17)	8.47 (16.93)	73.89 (51.27)	9.97 (18.42)	68.27 (46.01)	1.12 (6.08)	96.67 (82.85)	70.37 (51.82)
VI	25.79 (30.54)	37.20 (23.43)	10.71 (19.11)	66.98 (44.98)	12.21 (20.46)	61.14 (40.01)	1.79 (7.69)	94.67 (78.29)	65.00 (46.68)
VII	24.54 (29.71)	40.25 (25.50)	9.46 (17.92)	70.84 (48.41)	10.96 (19.34)	65.11 (43.29)	1.04 (5.86)	96.90 (83.48)	68.28 (50.17)
VIII	25.04 (30.04)	39.03 (24.67)	9.96 (18.41)	69.29 (47.01)	11.46 (19.80)	63.52 (41.96)	1.04 (5.86)	96.90 (83.47)	67.19 (49.28)
IX	24.29 (29.54)	40.85 (25.92)	9.21 (17.68)	71.61 (49.12)	10.71 (19.11)	65.91 (43.97)	1.08 (5.97)	96.79 (83.16)	68.79 (50.54)
CD at 5%	*0.08*		0.13		0.11		0.24		

*Figures in parenthesis are arc sine transformed values

Table 30.Evaluation of different spray schedules against major fruit diseases of apple in Uttarakhand

Spray schedule	Sooty blotch	Control	Fly speck	Control	Overall disease control
Control	28.25 (32.12)	0.00 (0.00)	31.74 (34.31)	0.00 (0.00)	0.00 (0.00)
I	5.87 (14.03)	79.22 (56.32)	11.46 (19.80)	63.89 (42.30)	71.55 (49.31)
II	4.87 (12.76)	82.76 (60.28)	10.46 (18.88)	67.04 (44.97)	74.90 (52.63)
III	8.96 (17.43)	68.28 (45.74)	15.88 (23.50)	49.97 (31.52)	59.12 (38.63)
IV	7.46 (15.86)	73.59 (50.62)	12.71 (20.90)	59.95 (39.09)	66.77 (44.86)
V	2.88 (9.78)	89.80 (69.56)	8.47 (16.93)	73.31 (50.66)	81.56 (60.11)
VI	5.12 (13.09)	81.87 (59.26)	10.71 (19.11)	66.25 (44.29)	74.06 (51.78)
VII	3.87 (11.35)	86.30 (64.66)	9.46 (17.92)	70.19 (47.76)	78.24 (56.21)
VIII	4.37 (12.07)	84.53 (62.41)	9.96 (18.41)	68.62 (46.35)	76.57 (54.38)
IX	3.62 (10.98)	87.18 (65.83)	9.21 (17.68)	70.98 (48.48)	79.08 (57.16)
CD at 5%	0.21		0.09		

*Figures in parenthesis are arc sine transformed values

Disease/ pest management in onion and garlic

Under disease/pest management and population dynamics/disease incidence in onion and garlic trial, the module (Mancozeb 0.25% + Methomyl 0.8 g/L as first spray, Tricyclazole 0.1% + Carbosulfan 2ml/L as second spray, Hexaconazole 0.1% + Profenofos 1ml/L recorded minimum disease incidence and severity.

IV Post Harvest Technology

Minimal processing and packaging of high value vegetables and fruits for quality maintenance and storage.

Response of early, mid and late season apple cultivars to storage behavior and quality attributes

Twenty two apple cultivars having different maturity season were evaluated for storage behavior which indicates that physico chemical characteristics of apple varieties varied significantly. Maximum size of fruit was recorded in variety Golden Spur (252 g), EC-239451 (236 g), Mollies Delicious (219g), and Granny Smith (215g), whereas, minimum size of fruit was recorded in variety Starkrimson Gold (40g), Well Spur (103 g). Maximum length of fruit was recorded in variety Mollie's Delicious (70.02 mm), Cooper IV (68.3 mm) while maximum diameter was recorded in Cooper IV (77.63 mm) and EC-239451 (84.06 mm). Maximum firmness of fruits at initial stage was recorded in variety Granny Smith and Golden Delicious (80RI), followed by CITH Apple-1 (72RI) and Jonica (71RI), whereas , least firmness was recorded in variety (EC 239451 (44.3 RI) and Starkrimson Gold (46.0 RI). Maximum TSS was recorded in variety Red Delicious and Red Chief (19.5o B in each). Maximum titrable acidity was found in variety Golden Delicious (0.51 %) followed by Granny Smith (0.50). Maximum ascorbic acid was recorded in variety Golden Delicious (27 mg/100g), Granny Smith (24 mg/100g) and Co Red Fuji (22.5 mg/100g). There was significant variation in colour value of the fruits. 'L' value indicating brightness was found maximum in variety Red Fuji (68.9), Golden Delicious (65.48), Red Spur (73.91); 'a' value indicating redness of fruits was recorded maximum in variety Red Chief (23.13). There was significant physiological loss in weight of different varieties of fruit during storage, however, after 30 days of storage minimum physiological loss of weight was recorded in variety Well Spur (4.8%), Oregon Spur (4.9 %), Red Fuji (5.0%), Granny Smith (5.2%) and Coe Red Fuji (5.3%), whereas, maximum was recorded in variety Golden Delicious (15.2%) and Mollies Delicious (8.8 %). Storage life of fruits of different varieties differed significantly and maximum shelf life of fruits was recorded in variety Granny Smith (60 days) and Well Spur (50 days), whereas, minimum storage life was recorded in EC-23941 (Khur) as 18 days, Mollies Delicious (21 days) and Golden Spur (21 days). Firmness of fruits of different apple varieties during storage reduced significantly and maximum firmness after 30 days of storage was recorded in variety Granny Smith (61.7 RI), Coe Red Fuji (56.0 RI), Well Spur (47.3RI), Red Fuji (40.0 RI) and Michael (47.3RI) while minimum firmness was recorded in variety EC 239451 (29.1 RI), Mollies Delicious (29.8 RI) and Starkrimson (30.0 RI). During storage TSS gradually increased in all the varieties up to 21st day of storage and thereafter decreased, however decreasing trend was not significant among the varieties. Maximum retention of TSS and ascorbic acid was recorded in fruits of variety Well Spur, Oregon Spur, Coe Red Fuji, Red Fuji, Michael, Red Fuji and Granny Smith and minimum retention was found in fruits of variety Mollies Delicious .Colour Studies indicates that maximum 'L' value indicating brightness of fruit was recorded in variety Gala Mast (65.9), Coe Red Fuji (65.0) and Red Fuji (59.1) ,and 'a' value indicating redness of fruit was recorded maximum in variety Red Chief (29.0), Red Delicious (32.02), Mollies Delicious (28.01) and Golden Spur (28.6. Study reveals that fruits of variety Granny Smith, Well Spur, Michael, Red Fuji, Coe Red Fuji and Oregon Spur are having maximum shelf life (50-60 days) with minimum loss of quality, texture and firmness when stored at 25±2C° and R H 70±5%.

Oregon Spur | Coe-Red Fuji | Red Fuji | Granny Smith

Retention of color properties by apple varieties during storage

Studies on effect of drying modes/ temperature and varieties on dehydration of plums

The effect of cultivars and dehydration temperature in plum drying was investigated. Under preliminary trial three varieties of plum/ prunes i.e. Grand Duke, President Plum and Italian Plum were taken for dehydration. Dehydration was done at 60, 70 and 80° C in cabinet cross flow dryer. Two types of fruit material i.e. with stone and without stone were taken for processing experiment. Plums dried at higher temperature (80° C) took minimum time for dehydration (14-16 hrs) for plums without stone and 17-18 hrs for plums with stone. In open conditions (sun drying) it took 38-42 hrs for material with stone and 30-36 hrs for prunes without stone depending upon the different varieties. Among the varieties Grand Duke took less time for dehydration. In varieties Grand Duke and President Plum dehydrated at 80° C, colour, ascorbic acid, carotenoids were intact to the maximum and also showed relatively higher rehydration ratio (RHR). Preliminary studies indicate that varieties Grand Duke and President Plum are ideal varieties for drying as prune when dried at the temperature of 80 °C in cross flow cabinet dryer.

Quality and storage study of blended juices of apricot and plum.

Due to perishable nature of plum and apricot, lack of cold storage facilities and awareness among the growers about its preservation, large quantities of these fruits goes waste/spoiled before reaching the consumers. Due to varied taste, colour, aroma/flavor and composition for nutrients and strong aroma different blended fruit juices are getting better market. Apricot and plum fruits are rich in vitamin A, C and various essential minerals. Besides having many dietary and medicinal properties juices of both these fruits are having high blending combination producing excellent taste, aroma and flavor. However, it is very much important to standardize the blending ratio of these fruit juices with due importance for taste, quality composition and acceptance. Under prelimary trial three blending ratio i.e., 25% apricot + 75 % plum, 50% apricot + 50 % plum, 75

Plum variety Grand Duke dehydrated in cross flow cabinet dryer at 80° C.

50% apricot + 50 % plum blend juices of apricot and plum

% apricot + 25 % plum with 100% each of apricot and plum juice stored at 4±2° C. Four months storage and compositional study reveals that blend ratio 75 % apricot + 25 % plum and 50% apricot + 50 % plum can be successfully prepared with maximum retention of nutrients, taste, flavor and aroma and acceptable for 3 months.

Development of technology for preparation of plum fruit bar

Technology was developed and standardized for making plum fruit bar having excellent texture, colour, taste and chewing quality with least browning and spoilage and can be stored for nine months without loss in nutrition, quality and appeal.

Preparation and evaluation of fruit wine from diffe rent cultivars of pear grown in Uttarakhand

The physico-chemical characters of sand pear fruit revealed that fruit contains 51.08% juice having a TSS of 9.40%, ascorbic acid of 7.64 mg/100g and titratable acidity of 0.302%. (Table 31)The TSS of the extracted juice was ameliorated to 20, 22 and 24°B by adding sugar syrup, Di-ammonium hydrogen phosphate (nitrogen source) and pectin esterase enzyme along with the ginger juice. The fermentation of the sand pear ginger must under three treatments (T_1=20°B, T_2=22°B+2.5% ginger juice and T_3=24°B+5.0% ginger juice) was carried out at a temperature of 25±2°C with yeast *Saccharomyces cerevisiase* var. *ellipsoideus*. The fermentation rate of different treatments has been shown in Fig 15. It revealed that the higher ginger juice reduced the fermentation rate of the must compared to control (T_1).

Table 31. Physico-chemical characters of the sand pear fruits

S. No.	Character	Average value
1.	Fruit weight (g)	157.31±10.78
2.	Fruit length (mm)	67.76±3.47
3.	Fruit breadth (mm)	70.77±1.11
4.	Fruit pressure (lb/in^2)	22.08±1.03
5.	Fruit halves (g)	156.12±10.37
6.	Juice (%)	51.08±0.30
7.	Pomace (%)	48.92±0.30
8.	TSS (°B)	9.40±0.43
9.	Titratable acidity (%)	0.302±0.036
10.	pH	4.00±0.064
11.	Reducing sugars (%)	3.78±0.031
12.	Total sugars (%)	6.48±0.068
13.	Ascorbic acid (mg/100g)	7.64±0.206

Flow Chart for preparation of plum fruit bar

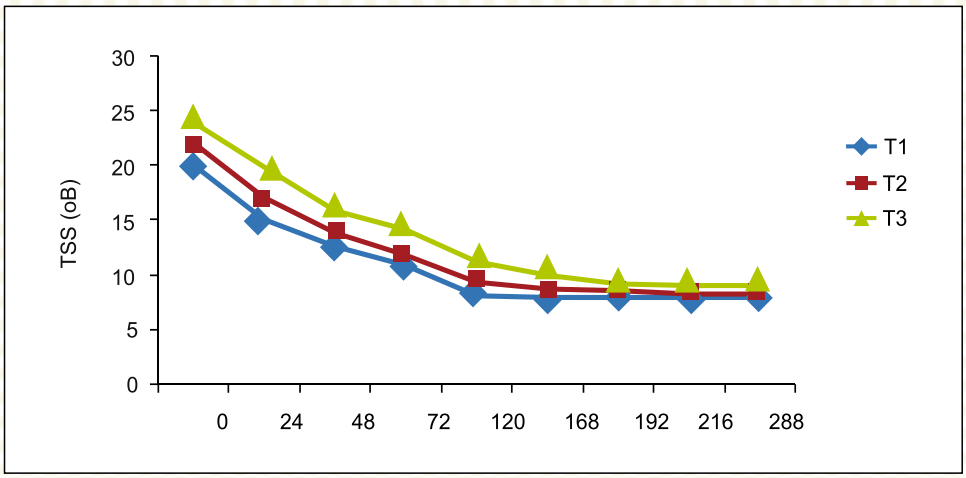


Fig 15. Fermentation rate of different treatments of sand pear and ginger juices

The sand pear ginger wine was analyzed for various physico-chemical and bio-chemical characters immediately after preparation and after 6 months of storage (Table 32 and 33). It was found that there was reduction in TSS (°B), acidity (%), ascorbic acid (mg/100g), aldehydes (mg/100g) whereas alcohol (%), volatile acidity (%), total phenols (mg/100g) and esters (mg/100g) registered a significant increase.

Table 32. Physico-chemical and bio-chemical characters of sand pear ginger wine immediately after preparation

Treatment	Character								
	TSS (°B)	Alcohol (%)	Acidity (%)	Volatile acidity (%)	pH	Ascorbic acid (mg/100g)	Total phenols (mg/100g)	Aldehydes (mg/100g)	Esters (mg/100g)
T_1	8.00	9.00	0.837	0.03	3.50	6.60	218.0	106.0	190.0
T_2	8.20	9.90	0.904	0.04	3.52	6.40	224.0	110.0	198.0
T_3	9.00	10.80	0.871	0.05	3.48	6.20	230.0	114.0	204.0
CD at 5%	0.11	0.95	0.55	0.027	0.12	0.59	1.79	1.19	0.74

Table 33. Physico-chemical and bio-chemical characters of sand pear ginger wine after 6 month of storage

Treatment	Character								
	TSS (°B)	Alcohol (%)	Acidity (%)	Volatile acidity (%)	pH	Ascorbic acid (mg/100g)	Total phenols (mg/100g)	Aldehydes (mg/100g)	Esters (mg/100g)
T_1	7.40	9.40	0.804	0.04	3.52	6.20	222.0	102.0	198.0
T_2	7.60	10.34	0.871	0.05	3.54	5.90	226.0	106.0	204.0
T_3	8.00	10.68	0.837	0.06	3.50	5.60	232.0	110.0	208.0
CD at5%	0.59	0.46	0.23	0.011	0.11	0.59	0.74	0.77	0.74

The sand pear ginger wine was also analyzed for sensory quality characters immediately after the preparation and after 6 months ambient storage. The colour, aroma, taste and overall quality of the wine was found to increase significantly whereas the body and appearance and astringency registered a significant decline during this period (Fig. 16).

The cost of production of the sand pear ginger wine also calculated which revealed that the prepared product can be sold in Rs. 64.40 with a profit of 20% . The cost of the product can further be reduced if it is prepared on commercial scale.

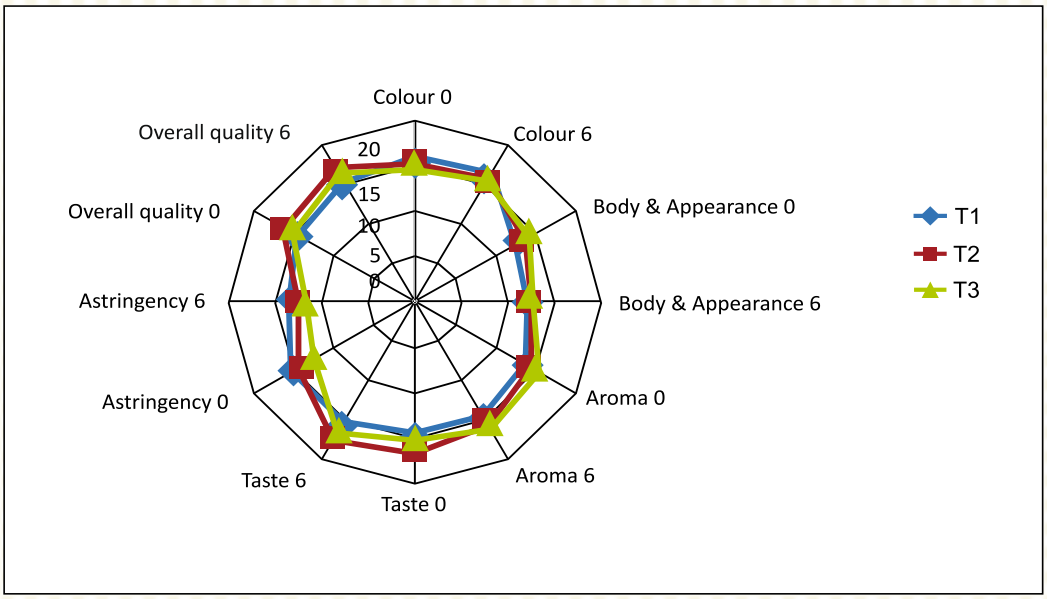


Fig 16. Sensory evaluation of different wines of sand pear and ginger at various stages

Inauguration of Biotechnology and Tissue Culture Laboratory

Dr. N.K. Krishna Kumar, Deputy Director General (Horticultural Science), Indian Council of Agricultural Research, New Delhi inaugurated Biotechnology and Tissue Culture Laboratory of Central Institute of Temperate Horticulture, Srinagar on 5th May, 2014, in presence of Prof. Nazeer Ahmed, Director, CITH, Srinagar. The laboratory is well equipped with need based equipments and other facilities for conduct of research on biotechnology and plant tissue culture. Studies on micropropagation, DNA fingerprinting, molecular disease diagnostics, virus indexing, gene expression studies, biochemical profiling and analytical chemistry, male sterility, biochemical and molecular aspects of pollination management, linkage mapping, association mapping etc. are being taken up in this laboratory using latest techniques for obtaining desired results in temperate horticultural crops.

12th Research Advisory Council Meeting

The 12th RAC meeting was held on 24th March, 2015 at main campus Srinagar under the chairmanship of Padmashri Dr. K.L. Chadha, Former DDG (Horticulture), ICAR, New Delhi.

The other members of RAC who attended the meeting were Dr. A. A. Sofi, Ex-Director, CITH, Dr. V.V. Ramamurthy, Professor, Division of Entomology, IARI, New Delhi, Dr. S. K. Tikoo, Director Research, Breeding and Development, Tierra Seed Science, Pune, Dr. Hina Shafi, Srinagar, J&K, Shri Desh Kumar Nehru, Baramullah, J&K, Prof. Nazeer Ahmed, Director, CITH, Srinagar and Dr. Dinesh Kumar, Pr. Scientist and Member Secretary RAC, CITH. The committee visited experimental farm and laboratories and had detailed discussion and interaction with the scientists and suggested recommendation after reviewing all the ongoing projects.

11th Institute Research Council Meeting

Institute Research Council Meeting was held on 24-12-2014, 26-12-2014 and 5-3-2015 at CITH, Srinagar under chairmanship of Prof. Nazeer Ahmed, Director, CITH, Srinagar. All scientists 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.

3rd QRT

Meeting of QRT members of Central Institute of Temperate Horticulture, Srinagar was held with DDG (Hort.) on 01.07.2014 at KAB-II New Delhi. QRT members visited CITH Regional Station, Mukteshwar on 2.7.2015 to review for the period 2009-2014. The chairman and members visited the research field, 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. The visit of QRT to main campus Srinagar is scheduled in August 2015.

Swachh Bharat Mission

In consonance with the call of Hon'ble Prime Minister and message from Secretary, DARE and DG, ICAR 'Swachh Bharat Mission' was launched on second October, 2014 on birth anniversary of Mahatma Gandhi who dreamt for Swachh and Vikasith Bharat. On this auspicious day all the employees of ICAR-Central Institute of Temperate

Horticulture, Srinagar took 'Swachhta Shapath'. During the occasion, Director CITH Prof. Nazeer Ahmed administered "Swachhta Shapath' and requested all the employees to sincerely follow and adhere to the contents of the shapath to fulfill the dream of Mahatma Gandhi and vision of our dynamic Prime Minister for Swachh and Vikasith Bharat.

Rastriya Ekta Diwas

Central Institute of Temperate Horticulture, Srinagar organized the Rashtriya Ekta Diwas commemorating the birth anniversary of Sardar Vallabhbhai Patel on 31st October, 2014. During the event Prof. Nazeer Ahmed, Director, CITH enlightened the role of Sardar Vallabhbhai Patel in India's Independence and his contribution in unification of India. He asked every staff to work as a sincere citizen of India and contribute to the unity, integrity and security of the country. He also administered Rashtriya Ekta Diwas pledge to all the staff members of the Institute followed by a collective singing of the national anthem.

Vigilance Awareness Week

ICAR-Central Institute of Temperate Horticulture and its Regional Station, Mukteshwar

observed vigilance awareness week from October 27 to November 1, 2014 for combating corruption, promote transparency, probity and integrity in public life. Director ICAR-CITH emphasizes that the efficiency and objectivity in governance hold the key to eradication of corruption from public life and for this purpose it has to be ensured that transparent and fool proof systems and procedures are put in place which provide for appropriate accountability at every level of hierarchy.

Parthenium Awareness Week

ICAR-Central Institute of Temperate Horticulture and its Regional Station, Mukteshwar organized "Parthenium Awareness Week" from 16-22 August, 2014 for control of this weed. To facilitate the event, posters and extension material especially developed for this occasion were distributed with an appeal to develop more such material in regional languages and distribute among stakeholders for generating awareness about this weed.

Communal Harmony Week

The Communal Harmony Week of National Foundation for Communal Harmony (NFCH) was observed from 19-25 Nov. 2014 by ICAR-CITH, Srinagar and its Regional Station, Mukteshwar. Campaign for inculcating the noble ideas of communal harmony and national integrity among the staff members was held and as part of the week activities a fund raising and person-to-person interaction campaign was also observed.

Hindi Week

Hindi week was observed by ICAR-Central Institute of Temperate Horticulture, Srinagar and its Regional Station, Mukteshwar from 15-20th September, 2014 for compliance of official language policy. Institute organized an essay writing and poster drawing competition for students, staff members and their children. Several other literary events and awareness programmes for the promotion of Hindi language were also organized by the Institute.

Extension and Trainings

Extension Activities

The production and productivity of quality produce of temperate horticultural crops in India is low as compared to advance countries. The Central Institute of Temperate Horticulture, Srinagar and its Regional Station, Mukteshwar are putting continuous efforts to make the farmers/ officers of line departments aware of various new technologies in temperate horticultural crops for improving productivity and quality. The Institute is organizing 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, radio talk, TV shows and display of exhibitions in various occasions and participation in farmer fairs etc. The list of beneficiaries at CITH is continuously increasing year after year. The environmental conditions plays important role in the production of temperate horticultural crops. The adverse climate conditions during flowering to harvest leads to great loss to the farmers. During 2014 the flood in most part of J&K had led to a great loss to the farmers as well as for the state. The extension activities of CITH were also hampered during 2014 and the figure of beneficiaries could not be so high but even then Institute had organized following extension activities on various aspects. The scientists adopted different modes of dissemination for various technologies for the benefit of many farmers. The detail of various extension activities carried out during 2014-15 are mentioned below:

Saffron Day

A saffron day was organized on 1st November, 2014 at CITH, Srinagar where saffron growers from different saffron growing areas of Kashmir participated. They were taken around the CITH Farm where they were shown various saffron experiments like intercropping of saffron with olive & almond, intensive saffron production technology trial augmented with drip & sprinkler irrigation on raised beds, organic saffron production etc. Great interest was shown by the saffron farmers about the technologies developed by CITH on intensive saffron production which has shown excellent results even under adverse climatic conditions during the current year

Director CITH highlighting the technologies involved in intensive saffron production

Olive Day

The Institute organized olive day on 2nd December, 2014. Farmers from different districts of Jammu and Kashmir and officers of development departments took part in the event. The participants were very much impressed with the success and performance of olive cultivation under temperate conditions of Kashmir. Olive and saffron intercropping experiments was also shown to the farmers and officers who showed very good interest for adopting the technologies in their fields.

Discussion and field visit during olive day

Training Programmes at CITH, Srinagar

Training programme organized for progressive farmers of Tamil Nadu

Ten days training programme on "Advance cultivation practices of temperate horticultural crops" was organized to the progressive farmers of Tamil Nadu w.e.f. 21st to 30th April, 2014 at CITH, Srinagar in which 19 farmers participated. During the programme trainees were taught on latest

Director CITH interacting with progressive farmers of Tamilnadu

developments in cultivation practices of temperate horticultural crops and hands on training to the farmers on practices like orchard management, training, pruning, grafting, budding, plant tissue culture etc.

In Plant Training for Students of B. Tech

In Plant Training on "Post Harvest Technology, quality control in agriculture, marketing and servicing of agricultural produce" to B. Tech. Students of SKUAST (K) was conducted from 26th April to 7th June, 2014.

Dr D B Singh showing functioning of grading machine to B. Tech students

Training programme to Air Force Wives Welfare Association (AFWWA)

Training on "processing and preservation of horticultural produce" was given to Air Force Wives Welfare Association (AFWWA) from 29 & 30th August, 2014.

Trainings on temperate fruit production and PPV&FRA

One day training programmes were organized on temperate fruit production and farmers rights at Gurez area of J&K on20 &21.8.214 where 80 farmers participated in each programme.

Training Programmes at Regional Station, Mukteshwar

- Organized three days training programme on protected cultivation of vegetables and flowers and nursery raising techniques w.e.f. 22-24 Sept., 2014 at CITH-RS, Mukteshwar in which 40 farmers/orchardists from nearby villages participated.
- Delivered lectures on one day training programme on scientific training and pruning of the temperate fruit crops (apple, peach, pear, plum, apricot, kiwi fruit) at Odakhan (Mukteshwar) organized by CHIRAG on 13th Jan., 2015 in which 20 farmers/orchardists and farmwomen participated.
- One day training programme on production of horticultural crops, planting, after care, training/pruning and protection measures was organized at Gajar (Mukteshwar) on 30th Jan., 2015 in collaboration with Gene Campaign, Odakhan in which 25 farmwomen participated.
- One day training programme on scientific training and pruning of the temperate fruit crops (apple, peach, pear, plum and apricot) was organized at Darim (Mukteshwar) on 11th Feb., 2015 in which 10 farmers/orchardists participated.
- One day training programme on vegetable nursery raising was organized on 28th Feb., 2015 at CITH-RS, Mukteshwar in which 20 farmers/orchardists from Sasbani, Letibunga, Parbada, Kasialek and Bhateliya participated.
- One day training programme on planting, training/pruning, protection and post harvest management of temperate horticultural crops on 24th Jan., 2015 at Mukteshwar in collaboration with CHIRAG in which 40 farmers form Nathuakhan and Kasilek participated.
- Delivered lecture on activities and services of CITH during Kisan Goshthi on Disaster management along with animal health camp organized by IVRI Campus in collaboration with PDFMD, Mukteshwar at Padampuri & Gajar (Pokhrad) on 7th & 30th Aug., 2014.
- Organized a kisan goshthi in collaboration with IVRI, Mukteshwar at Shehar phathak (Almora) on 16th Sept., 2014 in which more than 40 farmers/orchardists participated.
- organized a kisan goshthi at Naukana, Talla Ramgarh (Nainital) on 19th Sept., 2014 in which more than 20 farmers/orchardists participated

Farm Visits

The CITH has emerged as one of the mega technological hub for temperate horticultural crops. A large number of farmers visited CITH individually for solution of their problems as well as for want of quality planting material during whole year. Besides this, number of farmers group visited CITH and its regional station and they were made aware of various technologies generated at CITH which are available for farmers to enhance their productivity in different horticultural crops (Table 34).

Table 34. List of farm visits at CITH, Srinagar and Regional Staion, Mukteshwar

Sr. No.	Date	Place	No. of farmers
		CITH, Srinagar	
1.	17.6.2014	District Kupwara (J&K)	18
2.	6.8.2014	Karsog District Mandi (H P)	35
3.	12.8.2014	Awantipora, Pulwama and Sumbal, District Pulwama (J&K)	8
4.	28.8.2014	Nyoma , Distict Leh(J&K)	11
5.	26.11.2014	Sopor,District Baramulla (J&K)	41
6.	13.1.2015	District Kulgam (J&K)	50
7.	16.1.2015	District Reasi (J&K)	30
8.	26.3.2015	district Srinagar (J&K)	30
9.	27.3.2015	District Badgam (J&K)	20
10.	27.3.2015	Tral and Lurgam, District Pulwama (J&K)	70
		CITH, Regional Station Mukteshwar	
1.	28.1.15	Bhowali, Bhateliya and Piyura of l district Nainital	80
2.	29.1.15	Bhimtal, Satbunga and Padmpuri of l district Nainital	70
3.	6.2.15	Talla Ramgarh of district Nainital	25
4.	18.2.15	Nathukhan (Mukteshwar) Nainital	25
5.	27.5.14	Galla Lodh, Supi, Satbunga and Ramgarh villages of district Nainital	35
6.	7.6.14	Trainees from DCFR, Bhimtal	20

Scientist- farmers discussions during farm visits at CITH

Awareness programmes for students on temperate horticultural research activities

The various research activities going on CITH on like vermitechnology, post harvest technology, plant tissue culture, biotechnology, floriculture, vegetables, soil science, entomology, plant architectural engineering, high density plantation, protected cultivation and drip irrigation were demonstrated to the students groups who visited CITH (Table 35).

Participation in Kisan Mela/ Exhibition

To demonstrate various technologies in different areas, CITH participated in number of farmer fairs as well as on other occasions and displayed exhibits of CITH which were appreciated very much by the farmers and researchers. Thousands of farmers were benefited and were made aware of various research activities and technologies available for them. The details of exhibitions attended are presented in Table 36.

Table 35. List of student groups who visited CITH, Srinagar

Sr. No.	Date	School / College	No. of students
1.	18 &19.5.14	Army School, Air Force Station, Rangreth	95
2.	27.8.2014	DPS, Srinagar	280
3.	12.8.2014	Govt Degree College, Sopore	23
4.	2.9.14	Govt Degree College, Tral	72

Students of different Schools during their visit to CITH

Table 36. Details of participation in exhibitions

Date	Occasion	Organizer	Place	Scientists involved
3.2.2015 to 6.2. 2015	Agri Expo 2015 in XII Agricultural Science Congress	NDRI, Karnal	Karnal (Haryana)	Dr D B Singh & Dr J I Mir
29.8.2014	Kisan Mela 2014	CAZRI Regional Station, Leh	Shynum Hall, Sakara, Leh (J&K)	Dr O C Sharma & Dr Alok Gupta
30.8.2014	Vegetable cum Fruit Expo, 2014	LAHDC, Deptt. of Agriculture and Horticulture, Leh	Indoor Stadium, Leh (J&K)	Dr O C Sharma & Dr Alok Gupta
30.9. 2014	Kisan Mela	VPKAS, Almora	Hawalbagh,Almora (Uttarakhand)	Dr B L Attri & Sovan Debnath
28.10. 2014	Kisan Mela	IVRI, Muktehswar	Reetha Pokhra (Nathukhan) Uttarakhand	Dr B L Attri & Dr Arun Kishore

View of exhibition and discussions during Agri Expo 2015 at NDRI, CAZRI Kisan Mela and Vegetable cum Fruit Expo, 2014 at Leh

Diagnostic visits, publications and Radio/ TV programmes

The scientist of CITH and its Regional Station regularly visited farmers field to suggest immediate measures for their problems. During the year more than 20 diagnostic visits were conducted to solve the farmers problems in J &K and Uttarakhand. Besides this, more than 15 radio/ TV talks were delivered on various season based issues. The scientists of CITH published 25 research papers, one book, 7 book chapters, 7 popular articles and 8 extension bulletin/ folders for the benefit of researchers, extension functionaries and farmers.

Scientists interacting with farmers during diagnostic visits

Tribal Sub Plan Scheme

During 2014-15 eight districts viz Leh, Kargil, Bandipora, Ganderbal, Ramban, Poonch, Rajouri, and Srinagar were covered under TSP scheme. Technological and varietal demonstrations were laid with complete package and practice developed by ICAR-CITH, Srinagar for the benefit of tribal farmers. About 800 families were benefitted through this scheme. Training and awareness on canopy management, high density plantation, protected cultivation, PPV & FRA, registration of farmer's varieties, grafting & budding etc were provided to the tribal farmers of these districts. Scientists from CITH, Srinagar are regularly visiting the identified tribal villages to observe the performance and give technical advice for success of the programme. Four low cost polyhouses were also constructed at Gurez region of district Bandipora and demonstrations on protected cultivation of vegetables and nursery raising are being imparted.

Planting material distribution among tribal farmers in Bandipora and Gandharbal districts

Construction of low cost polyhouses at Gurez, Bandipora for protected cultivation of vegetables

Awareness and training to tribal farmers of Gurez, Bandipora

Supply of fruit plants to the farmers of Leh and Kargil districts

View of demonstration on vegetable and fruits planted during 2014 at Leh

Awards and Recognitions

Dr R. S. Paroda Award for 2014 conferred to Prof. Nazeer Ahmed, Director CITH

Confederation of Horticulture Associations of India, New Delhi conferred the prestigious Dr R. S. Paroda Award for 2014 to Prof. Nazeer Ahmed, Director, Central Institute of Temperate Horticulture, Srinagar during "Global Conference on Technological Challenges and Human Resources for Climate Smart Horticulture" held at NAU, Navsari, Gujarat from 28-31st May 2014. The award was conferred to Prof. Nazeer Ahmed in recognition of his outstanding contributions made in the field of horticultural research and development in the country. Prof. Ahmed is also bestowed earlier with several other national awards such as Dr M. H. Marigowda National Endowment Award, Dr Kriti Singh Gold Medal, Vijay Shree Award and Glory of India Gold Medal for his excellent and valuable contribution to agricultural research, education and extension in temperate region of the country.

Prof. Nazeer Ahmed, receiving Dr R. S. Paroda Award for 2014

Best Technocrat Award- 2014 conferred to Dr B L Attri, Principal Scientist

Dr B L Attri,Received Best Technocrat Award- 2014 from EET CRS, Science & Technology Award-2014, Noida (U.P.) for devising the technology of Rhododendron and ginger blended squash as well as postharvest management, storage and value addition of Horticultural crops.

Young Scientist Award-2014 conferred to Dr Raj Narayan, Sr Scientist

Received Young Scientist Award-2014 by SEEA during 7th NEEC-2014 at ICAR Research Complex for NEH, Umiam (Individual).

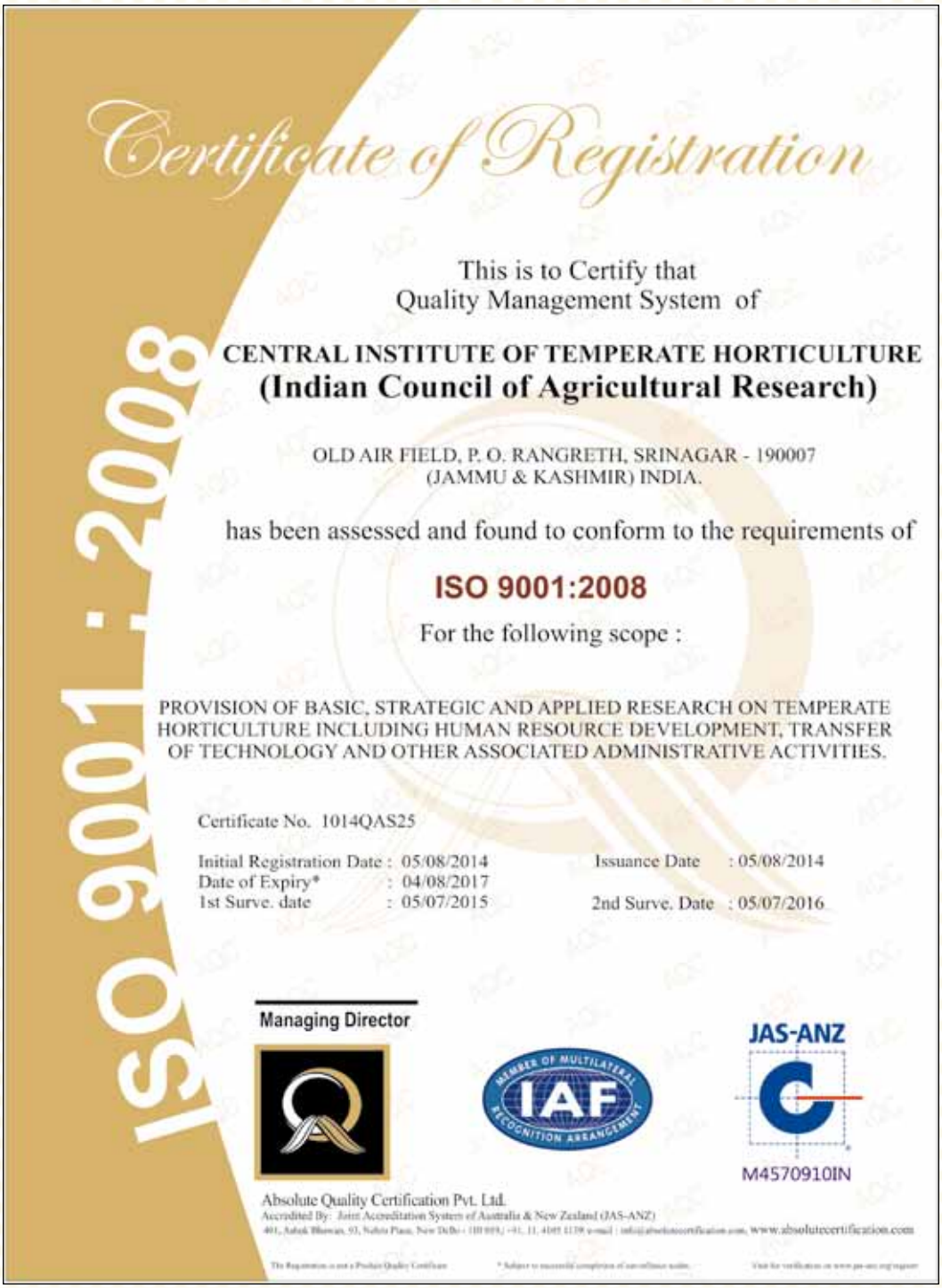
Dr B L Attri and Dr Raj Narayan receiving their Awards

ISO Certifiaction

Central Institute of Temperate Horticulture, Srinagar got ISO 9001: 2008 certification on 5th August, 2014 vide Certificate No. 1040QAS25 for Provision of basic, strategic and applied research on temperate horticulture including human resource development, transfer of technology and other associated administrative activities

Copyright

Dr Anil Sharma, Prof. Nazeer Ahmed and Dr Sarvendra Kumar of Central Institute of Temperate Horticulture, Srinagar got copyrights for software application "Predictor and Planner for Almond (PPA)" on 14th July, 2014 (Registration No. SW-8054/2014).



Certificate of Registration

ISO 9001 : 2008

This is to Certify that
Quality Management System of

CENTRAL INSTITUTE OF TEMPERATE HORTICULTURE
(Indian Council of Agricultural Research)

OLD AIR FIELD, P. O. RANGRETH, SRINAGAR - 190007
(JAMMU & KASHMIR) INDIA.

has been assessed and found to conform to the requirements of

ISO 9001:2008

For the following scope :

PROVISION OF BASIC, STRATEGIC AND APPLIED RESEARCH ON TEMPERATE HORTICULTURE INCLUDING HUMAN RESOURCE DEVELOPMENT, TRANSFER OF TECHNOLOGY AND OTHER ASSOCIATED ADMINISTRATIVE ACTIVITIES.

Certificate No. 1014QAS25

Initial Registration Date : 05/08/2014
Date of Expiry* : 04/08/2017
1st Surve. date : 05/07/2015

Issuance Date : 05/08/2014
2nd Surve. Date : 05/07/2016

Managing Director

IAF MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT

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Publications

Research Paper (International/ National)

- Ahmed N, Singh SR, Lal S, Mir KA, Amin A, Habib, KK and Salmani M. 2014. Assessment of genetic diversity in brinjal genotypes using multivariation analysis. *Indian J. Hort.* 71(4): 494-498.
- Attri BL, Krishna H, Ahmed N and Kumar A. 2014. Effect of blending and storage on the physico-chemical, antioxidants and sensory quality of different squashes. *Indian J. Hort.* 71 (4): 546-53.
- Attri BL, Krishna H, Das B, Ranjan JK, Pragya and Ahmed N. 2014. Effect of salicylic acid and calcium on the shelf life of peach cultivars. *Indian J. Hort.* 71 (1): 92-98.
- Gupta V, Sharma A, Kumar J, Abrol, V, Singh B and Singh M. 2014. Effects of integrated nutrient management on growth and yield of Maize (Zea mays)-Ghobi sarson (Brassica napus) cropping system in sub-tropical region under foot hills of north-west Himalayas. *Bangladesh Journal of Botany.* 43(2): 147-155.
- Krishna H, Attri BL. and Kumar A. 2014. Improvised Rhododendron squash: processing effects on antioxidant composition and organoleptic attributes. *J. Food Sci. Tech.* 51(11):3404-10.
- Krishna H, Grover M, Das B, Attri BL, Maheshwari SK. and Ahmed N. 2014. Antagonistic activity of Pseudomonas isolate against stem bark canker and white root rot of apple. *Annals of Plant Protection Science.* 22 (2): 452-54.
- Kumar A and Sharma JN. 2014. Host plant cultivar, leaf positions and nutrition affect the expression of Marssonina blotch resistance in apple. *Pl. Dis. Res.* 29(1): 1-5.
- Kumar A and Sharma JN. 2014. Monitored control of Marssonina blotch of apple caused by Marssonina coronaria. *Indian Phytopathology* 67(1): 70-76.
- Kumar D, Ahmed N and Hassan A. 2014. Impact of rain water harvesting and mulching on growth and yield of apple (Malus domestica) under rainfed condition. *Indian J. Soil Conser.* 42(1): 74-79.
- Kumar R, Ahmed N, Shiv Lal and Mahendiran G. 2014. Evaluation of gerbera genotype for cut flower production under different growing conditions of Kashmir. *Indian J. Hort.* 71(1): 138-141.
- Mer MS, Tripathi S, Attri BL, Kumar A and Sah VK. 2014. Effect of plant geometry on vegetative growth, tuber and seed yield of burdock (*Arctium lappa* L.). *Prog. Agri.* 14 (1): 30-36.
- Mir JI, Ahmed N, Khan MH, Mokhdomi TA, Wani SH, Bukhari S, Amin A and Qadri RA. 2014. 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 on saffron crop improvement. *African J. Agric. Res.* 10:970-974
- Mokhdomi TA, Bukhari S, Wani SH, Amin A, Wafai AH, Mir JI, Chowdri NA, Qadri RA. 2014. Diagnostic Relevance of Primary Investigations in Early Referral and Management of Colorectal Cancer Patients. *American J. Clin. Cancer Res.* 2:7
- Narayan S, Raihana HK, Narayan R, Khan FA, Saxena A and Hussain T. 2014. Effect of planting dates and integrated nutrient

management on productivity and profitability of potato (*Solanum tuberosum*) in Kashmir valley. *Indian J. Agron.* 59 (1): 145-150.

- Nawsheeba Wani, Feza Ahmad M, Ashraf Bhat M, Shabir A. Wani, Javid Iqbal, Nageena Nazir and Rizwan Rashid (2014). Diversity analysis in walnut (L.) using morphological and RAPD markers *Juglans regia. Green Farming* 5 (4): 533-537
- *Singh DB, Ahmed N, Singh SR, Mir KA and Shiv Lal.* 2014. Variation in chlorophyll and carotenoid contents in kale as influenced by cultivars and harvesting dates. *Indian J. Agri. Sci.* 84. (10):1178-81
- Singh DB, Lal S, Ahmed N and Pal AA. 2014. Genetic diversity, heritability, genetic advance and correlation coefficient in cape gooseberry (Physalis peruviana) under temperate environment. *Current Horticulture.* 2(2):15-20
- Singh P and Attri BL. 2014. Survey on traditional uses of medicinal plants of Bageshwar valley (Kumaun valley) of Uttarakhand, India. International *J. Conser. Sci.* 5 (2): 223-34.
- Singh P, Attri BL and Das B. 2014. A comparative study on plant biodiversity of oak (Quercus semicarpifolia Smith.) and mixed oak-deodar (Cedrus deodara Don.) forests in central Himalayan region of Uttarakhand. *Indian Forester* 140 (4): 368-73.
- Srivastava KK, Ahmed N, Dinesh Kumar and Bhat SK. 2015. Rejuvenation techniques for revival of senile and old almond (*Prunus dulcis*) orchards in north western Himalayan region. *Indian J. Agric. Sci.* 85(1):28-31
- Srivastava KK, Verma MK, Ahmed N, Razvi SM and Ahmad S. 2014. Genetic variability divergence analysis in sweet cherry (Prunus avium L.). *Indian J. Hort.* 71(2): 156-161.
- Verma MK, Lal S, Mir JI, Bhat HA and Sheikh MA. 2014. Variability of Kashmiri Nakh Pear (*Pyrus pyrifolia*); A local variety grown in North West Himalayan region of India. *African J. Biotech.*13(33): 3352-59
- Verma RK, Ahmed N, Mir JI, Verma MK, Srivastava KK, Focktoo SZ, Rashid R, Andrabi M and Shafi W. (2014). Detection of apple mosaic and chlorotic leaf spot viruses by DAS-ELISA from farmer's orchards of Kashmir valley. *Indian J. Hort.* 71(4) : 567-570
- Wilson D, Sharma SK and Attri BL. 2013. Evaluation of suitability of different media for drying of chrysanthemum flowers in mechanical dehydrator. *J. Hill Agri.* 4 (2): 94-97.

Books

- Anil Sharma, Nazeer Ahmed, Sarvendra Kumar and Javid Iqbal Mir 2015. Soil management strategies: Thriving to optimize fruit Production.Ludhiana, Kalyani Publishers, 199p

Book Chapters

- Arora S and Sharma A. 2015. Eco-friendly soil management approaches to optimize horticultural production. In : Soil Management Strategies-thriving to optimize fruit production. Edited by A Sharma, N Ahmed, S Kumar, and JI Mir. New Delhi, Kalyani Publishers, pp 115-144
- Kumar S, Ahmed N, Sharma A and Sharma OC 2015.In: Maintaining soil microbial balance in fruit growing soils-a challenge. In: Soil Management Strategies-thriving to optimize fruit production Edited by A Sharma, N Ahmed, S Kumar, and JI Mir. New Delhi, Kalyani Publishers, pp 171-194
- Mir JI, Ahmed N, Singh DB, Sharma A and Shafi W. 2015. Biotechnological interventions for soil health improvement. *In* :Soil Management Strategies-thriving to optimize fruit production. Edited by A Sharma, N Ahmed, S Kumar, and JI Mir. New Delhi, Kalyani Publishers, pp 145-157
- Narayan R, Narayan S, Choudhary S and Ara A. 2014. Precision farming in vegetables. *In*: Precision Farming: A New Approach. Edited by T. Ram, S.K. Lohan, R. Singh and P. Singh. Delhi, Daya Publishing House, Astral International Pvt. Ltd., pp. 383-409.
- Sharma A, Kumar S, Ahmed N, Sharma OC and Debnath, S. 2015. Protection of fruit growing soils from the threats on the mark. In: Soil Management Strategies-thriving

to optimize fruit production. Edited by A Sharma, N Ahmed, S Kumar, and JI Mir. New Delhi, Kalyani Publishers, pp 158-170

- Singh DB and Ahmed N. 2014. Almond. In: Managing post harvest quality and losses in Horticultural Crops edited by K.L. Chadha and R.K. Pal. Delhi, Daya Publishing House, pp 253-267
- Singh DB and Ahmed N. 2014. Walnut.In: Managing post harvest quality and losses in Horticultural Crops edited by K.L. Chadha and R.K. Pal. Delhi, Daya Publishing House, pp 561-579

Popular articles

- Attri BL, Kumar A, Kishor A and Ahmed N. 2014. Reaping disease-free stone fruits. *Indian Hort*. 59(2): 17-19.
- Bhatt SC, Debnath, S. 2014. Soil aggregation and role of soil micro-organisms. *Agrobios Newsletter* XIII (3): 53.
- Debnath S, Bhatt SC. 2014. Carbon sequestration: potential of Indian soils. *Agrobios Newsletter* XIII (2): 68-69.
- Debnath S, Mondal T, Bhatt SC. 2014. Application of radioactivity in the study of heavy-metals in soil-plant system. *Agrobios Newsletter* XIII (3): 50-51.
- Debnath S, Pachauri SP. 2014. Soil sampling in horticultural crops and routine soil testing. *Indian Farmers Digest*, 47: 19-22.
- Kumar A, Attri BL, Kishor A and Ahmed N. 2015. Manage leafy Mistletoes for quality apples. *Indian Hort*. 60 (1): 5-6.
- हरे कृष्णा व बृज लाल अत्री । 2011 । सेब में तना कैंकर का बढ़ता प्रकोप । *उन्नत कृषि,* अक्तूबर–दिसम्बर (4): 22-23.

Extension Bulletins/ Folders

- Satyagopal K, Sushil SN, Jeyakumar P. Shankar G, Sharma OP, Boina D. Sain Lavanya SK, Rao N, Sunanda NS, Ram Asre Kapoor BS, Sanjay Arya Subhash Kumar KS, Patni CS, Gupta V, Devinder Kumar, Razdan, VK, Mahendiran G, Patnik H P, Sahu KC, Mohapatra S N, Patel B R, Surajit Khalko, Nripendra Laskar , Ayon Roy, Tapan Kumar Hath and Yadava H.S. 2014. AESA based IPM package for Apple. pp 50.
- Sharma A, Ahmed N and Hadin RHS. 2015. Sampling of soils for fertility management. Extention Pamphlet. Published by KVK, Baramulla (CITH).
- Sharma A, Ahmed N and Hadin RHS. 2015. Training and pruning of temperate fruits. Extention Pamphlet. Published by KVK, Baramulla (CITH).
- Singh DB, Ahmed N, Lal S, Sharma OC, Mirza A and Pal AA. 2014. Production and Processing of Cape gooseberry. CITH Tech. Bulletin 01/2014
- अनिल कुमार, बृज लाल अत्री, अरुण किशोर, पुष्कर सिंह बिष्ट एवं मुकेश मेर. 2014. मटर एक लाभप्रद फसलः किट्ट रोग (Rust) से करें बचाव. *विज्ञान क्षितिज,* 1(1): 31-33.
- अनिल कुमार, बृज लाल अत्री एवं नजीर अहमद. 2014. सेब का असामयिक पतझड़, कैंकर तथा सफेद चूर्ण को मुख्य रोग मानते हुए सेब क रोगों के नियंत्रण हेतु छिडकाव सारणी. राज्य बागवानी मिशन उद्यान, खाद्य प्रसंस्करण विभाग, उत्तराखण्ड एवं केन्द्रीय शीतो÷ण बागवानी संस्थान, (भारतीय कृ÷ि अनुसंधन परिषद्) क्षेत्रीय केन्द– मुक्तेश्वर (कुमाऊँ) पिन–263 138, जिला– नैनीताल (उत्तराखण्ड) के सांझे कार्य के अंतर्गत प्रकाशित हिन्दी तकनीकी फोल्डर शीर्षक "उत्तराखण्ड के सेब उद्यानों में पौध सुरक्षा हेतु छिडकाव कार्यक्रम".
- अनिल कुमार, बृज लाल अत्री, नाजीर अहमद राज नारायण एवं अरुण किशोर. 2014. सेब का असामायिक पतझड़ (Marssonina blotch) रोग एवं रोकथाम. आई.सी.ए.आर.सी.आई.टी.एच.आर.एस. मुक्तेश्वर, तकनीकी फोल्डर संख्याः 15.
- अनिल कुमार, बृज लाल अत्री, अरुण किशोर एवं नजीर अहमद. 2014. उत्तराखण्ड के कुमाऊँ क्षेत्र में सेब के मुख्य रोग व उनकी रोकथाम. आई.सी.ए.आर. सी.आई.टी.एच.आर.एस. मुक्तेश्वर, हिन्दी तकनीकी संख्याः 2.

Participation in Workshops/ Conferences/Trainings/ Meetings

Prof. Nazeer Ahmed, Director

- Attended Director's Conference on 28th April, 2014 at NASC, ICAR, New Delhi.
- Attended Global Conference on Technological Challenges and Human Resources for Climate Smart Horticulture and presented lead paper on plant architecture and its management w.e.f. 28 to 30th May, 2014 at NAU, Navsari, Gujarat.
- Attended Director's Conference on 5 & 6th June 2014 at NASC, New Delhi.
- Attended XXIII Meeting of ICAR, Regional Committee No.I on 18 & 19th June, 2014 at CSWCRTI, Dehradun.
- Attended 3rd Quinquennial Review Team (QRT) Meeting on 1st & 2nd July 2014 at CITH, RS, Mukteshwar.
- Attended EFC meeting from 13th to 15th July, 2014 at ICAR, New Delhi.
- Attended Task Force Meeting of DUS test guidelines for Strawberry, peach & Plum on 21st Oct., 2014 at NASC Complex, New Delhi.
- Attended Brain Storming Session on garlic on 29th Nov., 2014 at NHRDF, Nasik.
- Attended Board of Management Meeting of SKUAST(J), Jammu on 22nd Dec., 2014.
- Attended National Meet on Distant Hybridization in Horticultural crops and discussed different net work projects w.e.f. 21st to 24th January at IIHR, Bangalore.
- Attended Vision-2050 meeting on 26th & 27th March, 2015 at Krishi Bhawan, New Delhi.

Dr D B Singh, Principal Scientist and Head, Division of VS&F

- Participated in 6th Horticultural Congress 2014 w.e.f. 6-9th Nov., 2015 held at Coimbatore, Tamil Nadu.
- Participated in XIIth Agricultural Science Congress w.e.f. 3 to 6th Feb, 2015 organized at NDRI Karnal.
- Attended Training cum Workshop of HRD Nodal officers held at NAARM on 26th Feb., 2015.
- Participated and attended International Conference on Natural Resource Management for Food Security and Rural Livelihood w.e.f. 10 to 13th February, 2015 held at NASC Complex, New Delhi.
- Attended the Review Meeting of Vigilance Officers held at ICAR HQR New Delhi on 31st March, 2015.

Dr Dinesh Kumar, Principal Scientist and Head, Division of Fruit Science

- Attended and presented lead paper in National Seminar cum Workshop on Physiology of flowering in perennial fruit crops at ICAR-CISH, Lucknow from 24-26th May, 2014.
- Attended and presented paper in Asian Plant Science Conference at Bhairahawa, Nepal w.e.f. 1st to 3rd Nov., 2014.
- Attended midterm RFD review meeting at NASC complex,New Delhi organized by Horticultural Science Division on November 24th , 2014.

- Attended and presented paper in International Conference on Natural Resource Management for food security and livelihoods at NASC Complex, New Delhi, Feb 10-13, 2015.
- Attended Vision document-2050 meeting on 26th & 27th March, 2015 at Horticultural Science Division, Krishi Anusandhan Bhavan-II,New Delhi.

Dr B. L. Attri, Principal Scientist

- Attended 5th foundation day of Community Radio Station, Kumaon Vani on 11th March, 2015 as special guest.
- Attended workshop on Protection of Plant Varieties and Farmer's Right (PPV&FR) Act organized by KVK (VPKAS, Almora) at Kafligair (Bageshwar) on 30th March, 2015.

Dr Raj Narayan, Sr Scientist

- Attended National Seminar on Precision horticulture for small and marginal farmers held at IGKVV, Raipur, w.e.f. 24 to 27th June, 2014.
- Attended Workshop on Intellectual Property Management in Fisheries & Agriculture Sector on 19th July, 2014 at DCFR, Bhimtal
- Attended International Symposium on Innovation in horticulture for nutritional security, conserving biodiversity and poverty alleviation held at BBA University, Lucknow, w.e.f. 16 to 18 Oct., 2014.
- Attended 7th National Extension Education Congress on Translational research-extension for sustainable small farm development held at ICAR Research Complex for NEH, Umiam, w.e.f. 8 to 12th Nov., 2014.
- Attended AINRP (onion & garlic) meeting at Davengere w.e.f. 6 to 7th Feb., 2015
- Attended National Seminar on 'Managing crop productivity for food security in changing climatic scenario' held at Janta College, Bakewar, Etawah (CSJM University, Kanpur) w.e.f. 28 to 29 March, 2015.

O C Sharma, Senior Scientist

- Attended workshop on Priority setting, monitoring and evaluation in National Agricultural Research system: Status, Experience and Way Forward at NASC, Pusa, New Delhi on 27th May,2014

Anil Sharma, Senior Scientist

- Attended two days national symposium on Natural Resource Management and Sustainable Hill Farming System for Livelihood Security at SKUAST-Jammu on 23 to 24th July, 2014.
- Attended silver jubilee symposium on Strategic Approaches for Horticulture Research, Education and Development- Way forward w.e.f. 26 to 27th , December, 2014 at New Delhi.
- Attended International conference on Natural Resource Management for Food Security and Rural Livelihoods' w.e.f. 10 to 13th February, 2015 at New Delhi.

J I Mir, Scientist

- Attended and delivered oral presentation in international conference on "Molecular and Cellular Mechanisms of Disease Processes" organized by department of biotechnology, university of Kashmir, Srinagar w.e.f. 13 to 16th April, 2014.
- Attended one day "Training-cum-Awareness workshop on J-gate@CeRA" at NASC Complex on 29th September, 2014.
- Attended and presented final DUS guidelines of peach and plum during DUS task force meeting at New Delhi on 21st Nov., 2014.
- Attended and presented DUS Guidelines in Indo-German bilateral cooperation meeting on protection of plant varieties, Plant Breeder's Right and DUS testing and capacity building on 16th December, 2014 at ICAR, Board Room, IGH, NASC Complex, New Delhi.

- Participated in 12th Agriculture Science Congress w.e.f. 3 to 6th , Feb. 2015 at NDRI, Karnal.
- Attended and presented Maintenance of reference collection for DUS testing at CITH during 9th Review Meeting of DUS test centers at JAU on 9th March, 2015.

G. Mahendiran, Scientist

- Attended launching programme of Consortium Research Platform on (CRP) on Borers and technical programme finalization during 18 &19th August, 2014 at IIHR, Bengaluru.
- Attended ICAR sponsored CAFT programme on "Agricultural web application development using content management tools" at the Division of computer Application, ICAR-IASRI, New Delhi w.e.f. 24th September to 14th October, 2014
- Attended Annual review meeting and technical programme finalization for XIIth plan for the project Outreach programme o management of Sucking pests in Horticultural crops, on 3rd November, 2014, at IIHR, Bengaluru.

Geetika Sheemar, Scientist

- Attended winter school on Advanced Statistical Techniques in Horticulture Science Research under Centre of Advanced Faculty Training (CAFT) w.e.f. January 2 to 22nd Jan, 2015.

Anil Kumar, Scientist

- Attended International Symposium on New Dimensions in Agrometeorology for Sustainable Agriculture (NASA-2014) w.e.f. 16 to 18th October, 2014 held at G.B.P.U.A.&T, Pantnagar.
- Attended 21 days training course on Advances in omic data analysis: Learning by examples w.e.f. 3rd to 23rd December, 2014 at Indian Agricultural Statistical Research Institute, New Delhi.

Sovan Debnath, Scientist

- Attended winter school on Waste Recycling and Resource Management through Rapid Composting Techniques w.e.f. 3-23rd December, 2014 at IISS, Bhopal.

Dr K L Kumawat

- Attended National Meet on Distant Hybridization in Horticultural Crop Improvement at ICAR-IIHR, Bengaluru on 22nd and 23rd January, 2015.
- Successfully completed three month Professional Attachment Training at ICAR-IIHR, Bengaluru w.e.f 1st Dec. 2014 to 6th March, 2015
- Attended workshop on NICRA Technical Programme at ICAR-CRIDA, Hyderabad on 24th and 25th March, 2015.

List of Ongoing Projects

I. Institute Based Research Projects	
A. Project: Crop improvement and Biotechnology Sub projects:	
1	Survey, collection, characterization and documentation of temperate horticultural crops (CITH-01)
2	Breeding for development of superior varieties/ hybrids in temperate vegetables (CITH-07)
3	Development of superior cultivars/hybrids in temperate fruits through conventional and non conventional methods (CITH-40)
4	Studies on improvement and production of saffron (CITH-6)
5	DNA finger printing of apple, walnut, apricot and others (CITH-47)
6	Standardization of micro-propagation protocol for apple, walnut, saffron and lilium (CITH-48)
7	Development of CMS lines in long day onion (CITH-70)
B. Project: Crop production and Propagation Sub projects:	
1	Energy harvest through plant architectural engineering for increasing source and sink relationship in apple and other temperate fruit crops (CITH-31)
2	Effect of various training and pruning systems in Persian walnut (CITH-54)
3	Standardization of integrated nutrient management of vegetables as intercrop in apple orchard (CITH-57)
4	Enhancing alstroemeria production involving different growing condition and nutrient management (CITH-58)
5	Divulging the adept mode of fertilizer application to optimize saffron yield (CITH-60)
6	Fertigation: An efficient soil management stratagem for escalating nutrient and water use efficiency in apple (CITH-61)
7	Aquatic dissipate management (ADM) through vermitechnology (CITH-62)
8	Development of intensive cropping system involving almond and saffron (CITH-11)
9	Standardization of intensive agro techniques for maximization of saffron productivity (CITH-41)
10	Characterization of soil Nutritional survey in Apple and Peacch Growing Areas of Uttrakhand . (CITH-64)
11	Standardization of growing /nutrients media and growing conditions for the cost effective production of quality vegetables and their seedlings(CITH-65)
12	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 (56)
3	Study of bio-ecology and management of aphid and mite in temperate fruits (59)
	D. Project: Post Harvest Management **Sub Projects:**
1	Minimal processing, packaging and storage study of high value vegetables and fruits for quality maintenance and storage (CITH-30)
2	Preparation and evaluation of fruit wine from different cultivars of pear grown in Uttarakhand (CITH-62)
3	Studies on dried prunes in relation to cultivars and drying technology (CITH-67)
4	Standardization of technology for blending of temperate stone fruit juice(CITH-68)
5	Assessment of Kashmiri chilli for commercial traits(CITH-69)
	E. Project: Inter-institutional projects **Sub-Projects:**
1	Survey, collection, evaluation and conservation of temperate pomegranate genotypes/ wild species/varieties under NWH region with NRC (P), Sholapur.
2	Development of Horti-postural cropping system in temperate region with IGFRI, Srinagar
	External funded Projects **I AICRP/ Network Projects** **Sub Projects**
1	Network project on outreach of technologies for temperate fruit crops (Main Centre)
2	Network project on onion and garlic (Co-operating centre)
3	Intellectual property management and transfer/ commercialization of agricultural technologies.
4	AICRP in vegetables (Voluntary centre)
5	Outreach programme on management of sucking pests in horticultural crops
6	Consortium research plateform on borers
7	National initiative on climate resilient agriculture (NICRA)
8	Micronutrient management in horticultural crops
9	Consortia research plateform on fungal foliar diseases
	II Validation of DUS International guidelines under Indian conditions funded by PPV&FRA **Sub projects:**
1	Development of DUS guidelines in strawberry
2	Development of DUS guidelines in peach and plum
3	DUS test centre for temperate fruits and nuts
	III Project: Challenge/ Flagship Programme **Sub projects:**
1	Challenge project on plant architectural engineering and canopy management in temperate fruits (Main centre)
	National Saffron Mission funded by DAC
1	National Saffron Mission for revival of saffron industry in J & K

Research Review and Management Committees

Research Advisory Committee (RAC)

S. No.	Name of Officer with Designation and address	Designation
1.	Padma Shri Dr. K. L. Chadha, H. No. 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, Professor, Division of Entomology, ICAR-IARI, New Delhi.	Member
5.	Dr. S. K. Tikoo, Director Research, Breeding and development at Tierra Seed Science, Pune, India	Member
6.	Dr. J. L. Karihalloo, 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 (Near Hurriyat Office), 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.	Prof. Nazeer Ahmed, Director, CITH, Srinagar	Member
11.	Dr. Dinesh Kumar, Pr. Scientist & Head Div. of Fruit Crops	Member Secretary

Institute Management Committee (IMC)

S. No.	Name of Officer with Designation and address	Designation
1.	Prof. Nazeer Ahmed, Director, CITH, Srinagar	Chairman
2.	Dr S K Malhotra Asstt. Director General (Hort. I) ICAR, KAB-II, Pusa, New Delhi-110012	Member
3.	Director (Horticulture) Govt. of J&K, Rajbagh, Srinagar (J&K)-190008	Member
4.	Director (Horticulture & Food Processing) Department of Horticulture, Chabuthai Ranikhet, Almora (Uttarakhand)	Member
5.	Dr F A Bandey Prof & Head Division of Pomology, SKUAST- K, Shalimar, Srinagar 191121	Member
6.	Shri Syed Altaf Bukhari Progressive Orchardist and Managing Director Fill Industry, Kohinoor House, Srinagar-190001	Member
7.	Shri Thakur Randhir Singh Former Minister, 298 EP Flat, Wazarat Nagar, Jammu -Tawi	Member
8.	Dr. A.K. Singh Head, Fruit and Horticulture Technology IARI, New Delhi - 110012	Member
9.	Dr. Sanjay K Dwivedi Joint Director Defence Research and Development Organization (DRDO) CEPTAM, Metcalfe House, Delhi-110054	Member
10.	Dr. Shant Lal Prof and head Horticulture, GBPAUT, Pantnagar (Uttrakhand)	Member
11.	Dr. Dinesh Kumar Incharge Head Division of Fruit Science CITH, Srinagar	Member
12.	Finance and Account Officer CIPHET,Ludhiana (Punjab)-141004	Member
13.	Asstt. Admn. Officer, CITH, Srinagar	Member Secretary

Central Institute of Temperate Horticulture, Srinagar

Maiden visit of Honourable Union Minister for Agriculture

- Honourable Union Minister for Agriculture, Govt. of India, Shri Radha Mohan Singh, visited ICAR-Central Institute of Temperate Horticulture, Srinagar on 24th August, 2014. Prof. Nazeer Ahmed, Director and staff of CITH welcomed the Hon'ble Minister and thereafter there was an interaction meeting where Director, CITH highlighted the achievements of the Institute and gave an account of new varieties and technologies developed and also draw the attention of Hon'ble Minister about major constraints faced by the institute and the temperate horticulture in particular. The Hon'ble Union Minister for Agriculture, during his address spoke on the importance of horticulture sector for livelihood security of farmers in the country in general and valley in particular. He emphasized the need for soil and water testing, soil health cards, strengthening of extension activities for transfer of technologies like intercropping, high density plantations, integrated farming system, speedy supply of quality planting material, introduction of mobile labs etc for enhancing horticulture productivity and farm returns in collaboration with state development departments and KVKs. He assured full support to CITH for strengthening research and extension activities at Srinagar, Mukteshwar and new centre at Arunachal Pradesh. The Union Minister asked the scientists to visit and have direct interaction with farmers for identifying problems and effective transfer of technologies.
- Dr. S. Ayyapan, Secretary DARE and Director General ICAR visited CITH, Srinagar on 27th September, 2014 to enquire the well being of flood victims and damage assessment.

Honourable Union Minister for Agriculture, Govt. of India Shri. Radha Mohan Singh during his visit to CITH, Srinagar

Dr. S. Ayyapan, Secretary DARE and Director General ICAR with staff of CITH

- Dr. S.D. Shikhamani, Former Vice-Chancellor, A.P. Horticultural University & Project Advisor Administration Staff College of India Hyderabad visited ICAR-CITH, Srinagar on 7th April, 2014.

Dr. S.D. Shikamani seeing canopy architectural engineering in apple

- Dr. R.R. Hanchinal, Chairperson PPV & FRA (MOA) visited CITH on 27th April, 2014.
- QRT of IGFRI visted CITH on 4thSeptember,2014.
- Secretary Horticulture, J&K visited CITH, Srinagar on 4thSeptember, 2014.

Central Institute of Temperate Horticulture, Regional Station Mukteshwar

- Dr S.K. Bandopadhyay, Member, ASRB, N. Delhi visited the station on 21st April, 2014.
- Sh. S. Abbasi, Joint Secretary, Ministry of Steel, Govt. of India visited the station on 6th May, 2014.
- Dr S. Solomon, Director, IISR, Lucknow along with other scientists visited the station on 4th July, 2014.
- Dr P.K. Mishra, Director, CSWCR&TI, Dehradun visited on 29th Sept., 2014.
- Sh. P.K. Pujari, IAS, Special Secretary DARE and Financial Advisor (ICAR) from Delhi visited the station on 21st Nov., 2014. Sh. G.P. Joshi along with Mrs Joshi, IAS visited the station on 21st Feb., 2015 who was shown the various research programmes of the station.

VIPs/Farmers/Students Visit at CITH, RS Mukteshwar

Personnel

CITH Head Quarter, Srinagar

RMP

- Prof. Nazeer Ahmed, Director

Scientific

- Dr. D. B. Singh, Principal Scientist cum Head Division of Vegetable Science & Floriculture
- Dr. Dinesh Kumar, Principal Scientist cum Head Division of Fruit Science
- Dr. K.K. Srivastava, Senior Scientist, Hort-Fruit Science
- Dr. S.R. Singh, Senior Scientist, Hort-Vegetable Science
- Dr. O. C Sharma, Senior Scientist, Hort-Floriculture
- Dr. Anil Sharma, Senior Scientist ,Soil science
- Dr. J.I. Mir, Scientist, Plant Biotechnology
- Mr. Shiv Lal, Scientist, Fruit Science
- Mr. Ramesh Kumar, Scientist, Floriculture.
- Dr. G. Mahendiran, Scientist, Agri. Entomology
- Dr. Sarvendra Kumar, Scientist ,Soil Science
- Dr. Geetika Shameer, Scientist, Vegetable Science
- Dr. Krishan Lal Kumawat, Scientist, Fruit 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 Ahmed Mir, Assistant
- Sh. Mukhtar Ahmad, Assistant
- Sh. Mehraj-ud-Din Meer, LDC
- Sh. Tariq Ahmad Mir, Jr. Stenographer

Technical

- Eshan Ahad, Tech. Officer
- Sh. Brijendra Kumar, Tech. Officer
- Sh. Muneer Ahmad Sheikh, Senior Technical Assistant
- Mrs. Mubeena, Technican (Computer / data operator)
- Sh. Mohammad Ramzan Wani, Senior Technician (Lab.)
- Sh. Mushtaq Ahmad Khan, Senior Technician (Lab.)
- Sh. Ajaz Ahmad Wani, Technician (Field)
- Sh Ishtiyaq Ahmad Sheikh, Technician (Field)
- Sh. Mehraj-ud-din Bhat, Technical Assistant (Driver)
- Sh. Farman Ali, Technical Assistant (Driver)

Supporting Staff

- Sh. Bashir Ahmad Dar,SSS
- Sh. Abdul Rashid Bhat,SSS
- Sh. Showkat Ahmad Dar, SSS.
- Sh. Bashir Ahmad Ganai, SSS.
- Sh. Zubair Swathi, SSS
- Sh. Madan Lal, SSS.
- Sh. Khushi Ram, SSS
- Sh. Abdul Rashid Dar, SSS
- Sh. Ghulam Mohd Rather, SSS
- Sh. Ghulam Nabi Bhat, SSS
- Sh. Ghulam Hassan Mir, SSS

Personnel at CITH-RS, Mukteshwar

Scientific staff

- Dr B.L. Attri, Principal Scientist, Fruit Science & Head, Regional Station
- Dr Raj Narayan, Senior Scientist, Vegetable Science
- Dr Anil Kumar, Scientist, Plant Pathology
- Dr Arun Kishor, Scientist, Fruit Science
- Shri 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 Man Mohan Singh, Technical Assistant (Driver)
- Sh Puran Chandra, Senior Technician (Field Asst.)

Supporting staff:

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

Appointments/Promotions/ Transfers/Retirements

New Joining

- Dr. Kishan Lal Kumawat, Scientist (Fruit Science) joined CITH, Srinagar on 13.10.2014 (F/N).

Retirements

- Shri Gh. Hassan Mir, SSS superannuated from Council's service w.e.f. 30.04.2014 (A/N)

Transfers

- Dr. K.K. Srivastava, Senior Scientist (Fruit Science) relieved on 11.08.2014 (A/N) consequent upon his transfer from CITH, Srinagar to CISH, Lucknow.
- Dr. S.R. Singh, Senior Scientist (Veg. Science) relieved on 03.12.2014 (A/N) consequent upon his transfer from CITH, Srinagar to CISH, Lucknow.
- Shri Ramesh Kumar, Scientist (Floriculture) relieved on 13.10.2014 (A/N) consequent upon his transfer from CITH, Srinagar to CIAH, Bikaner.
- Dr. Sarvendra Kumar, Scientist (Soil Science) relieved on 03.06.2014 (A/N) consequent upon his transfer from CITH, Srinagar to IARI, New Delhi
- Dr. Alok Kumar Gupta, Scientist relieved on 14.01.2015 consequent upon his transfer from CITH, Srinagar to NRC Litchi. Muzaffarpur.
- Dr. Dinesh Kumar, Principal Scientist (Fruit Science) relieved on 07.04.2015 (A/N) consequent upon his transfer from CITH, Srinagar to CISH, Lucknow.

Rescue and relief during devastating flood

ICAR-CITH showed solidarity/ unity in rescue and relief during devastating flood in Kashmir valley

A weeklong heavy rains and cloud bursts in first week of September 2014, brought massive devastating flood in J&K inundating major parts of the Kashmir valley killing several hundreds of people and rendering hundreds of thousands homeless. The flood completely paralyzed and effected entire telecommunication, roads, electricity, water supply, food, health care, offices, business establishments, education, etc. and damaged thousands of crores worth infrastructure, crops, animals, vehicles etc. During this natural calamity about seventy percent of the staff of CITH got affected with inundation of flood water. Many of them lost their whole belongings including valuable and certificates. Their houses got damaged resulting in shifting to makeshift camps, guest houses and other safer places. Some of the staff with their family and children were on roof tops for days without water and food.

When most of the areas were dangerously inundated with deep flooded water, but our brave CITH staff especially the contractual field staff alongwith labour contractor in this hour of need showed solidarity and unity and did commendable work with courage by rescuing not only our own staff but rescued hundreds of lives from nearby flooded areas. The gallant effort of CITH staff was also lauded by national media civil societies, prominent citizens and local population. After rescue, the staff were brought to Institute guest house and provided food and all other required help like transport, money etc. for reaching to their safer destinations. Beside rescue, the institute also deployed two tractor trolleys for ferrying people from inundated to safer places and provided continuously 8-10 water tankers of safe drinking water to the flood affected areas alongwith fresh apples and vegetables to the rehabilitation camps. CITH has also opened technical cell for helping affected orchardists and vegetable growers for reviving their crops and fields and providing planting material and seeds on reasonable rates. We feel proud of our staff for showing solidarity and unity and doing commendable work with courage during difficult times and also our sincere gratitude to Dr. S. Ayyappan, Hon'ble Director General, ICAR, for personally visiting and showing sympathy and offering all possible help to effected staff and farming community of the state. We appreciate our colleagues from sister institutes and well wishers for giving moral support and showing concern for our lives and safety.

Evacuation of peoples through tractor and supply of drinking water in affected area by CITH

Hon'ble Secretary (DARE) and Director General, ICAR visited flood affected Srinagar and showing sympathy and solidarity with CITH Staff

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद
Agrisearch with a human touch