Annual Report 2013-14

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Dr Yashwant Singh Parmar University of Horticulture & Forestry
Nauni, Solan (Himachal Pradesh) – 173 230



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FOREWORD



India has made a tremendous progress on the horticultural map of the world covering an area of 23.24 million hectares with a total annual production of all horticultural crops to the tune of 257.3 million tonnes during 2012-2013. The horticultural cover is about 6.5 percent of the total geographical area contributingabout 28 per cent of gross agricultural output of the country.The income elasticity for fruits is reportedto be 0.42%, against only 0.05%for rice and –0.06% for wheat. The annual growth rate indomestic demands for fruits and vegetable is estimatedat 3.34% and 3.03%, respectively. About 127.2 metric tonnes of vegetables and 86.2 metric tonnes of fresh fruits will be required by 2020–21, however, the estimated demand by 2050 will likely to be 199 and 146metric tonnes, respectively.

Horticulture and forestry play an important role in the economic prosperity of the Himalayan region. The fruit production in the temperate region has made significant stride, the yield levels however, are far below the international standards.Horticulture and forestry require greater attention in the hills after taking care of proper soil and water-conservation measures, climate-change adaptations, apart from special attention on pollination and orchard management, irrigation, biotic and abiotic stress management etc.

The Dr Y S Parmar University of Horticulture and Forestry, a leading research and development institution in Asia organized various activities during the year for the prosperity of farmers and human resource development through its cohesive, interdisciplinary and regional based programmes. The report provides research efforts of the faculty of horticulture and forestry for a period from April 2013 to March, 2014, to achieve higher production and productivity offruit crops and forest trees while safeguarding theenvironment and natural resources of the State. The research programmes were pursued through different departments at the main campus and regional stations throughout the State. Emphasis was also made on building desired human resource to strengthen research and teaching activities and transfer of appropriate technologies to the farmers for improving livelihood and economic welfare of the farming community in the remote villages of the hill state.

The unconditional patronage, guidance and encouragement received from the Chancellor, Her Excellency Smt. Urmila Singh during the year are duly acknowledged. Sincere gratitude is also expressed to ICAR, State Government and other funding agencies for their support. The support provided by Board of Management, Academic council, Research Council, Extension Council, Statutory officers, staff members is also acknowledged for their cooperation and sincere efforts in the progress of the University. The activities of the university are diverse and could not have been completed without the cooperation of everyone. I would appreciate the sincere and concerted efforts of Dr R C Sharma, Director of Research, Dr Kamlesh Kanwar, Joint Director Research (Horticulture), Dr Diwakar Tripathi, Joint Director Research (Forestry), Dr Manoj Vaidya, Joint Director Research (Planning) and Dr Satish K. Sharma, Associate Director (R&E), in compilation and editing of Annual Report.

(Vijay Singh Thakur)
Vice Chancellor





PREFACE

It is indeed a matter of great privilege to present the Annual Report of Dr YS Parmar University of Horticulture and Forestry for the year 2013-14. It contains the salient achievements/activities carried out by the university in fulfillment of its aims and objectives concerning research, teaching and extension. The university is planning, implementing, monitoring, evaluating and coordinating research through its Directorate of Research. The university has a unique distinction of having its research stations in diverse agroclimatic zones, i.e. sub-tropical, mid hills sub-humid, high hills wet temperate and dry temperate cold desert.

A number of new introductions of fruits, vegetables, floriculture, medicinal and aromatic plants and forest tree species have been made during 2013-2014. Nursery production technology of temperate and sub-tropical fruits developed and standardized by the university has revolutionized the fruit industry of the state. Besides nursery plants of various fruit crops, about 65,000 plants of apple varieties Jeromine, Red Vlox and Gala Redlum have been grafted/budded on MM-111 rootstock. Integrated spray schedules for the management of diseases and insect pests of apple, stone fruits, mango and citrus have been updated by incorporating highly effective new generation chemicals excluding those pesticides which have not been registered for these fruit crops. Machinery for the extraction of apple seed from the fruit (apple corer and apple seed separator) has been designed, developed and being commercialized. Technology for the development of osmo dried plum, apricot and sand pear products has been standardised.

During 2013-14, fourteen new research projects were sanctioned to the university by various external agencies such as Indian Council of Agricultural Research, Ministry of Agriculture and Cooperation, National Medicinal Plant Board, Ministry of Science & Technology, CSIR, UGC, PPV & FRA, DRDA, NCAP and Javico Bio-organic.

The technologies developed by the university are effectively disseminated to the growers and State Departments of Horticulture, Agriculture and Forestry by the extension personnels. The university is also rendering weather forecasting and agro-advisory services to the farmers and orchardists. During this year, the university organized conferences, seminars and symposia on important topics related to horticulture and forestry including Package of Practices workshops on fruits and floriculture crops.

The university under the able leadership of Dr Vijay Singh Thakur, Vice Chancellor, has made significant achievements in research, teaching and transfer of technology. I wish to express my sincere gratitude to the Hon'ble Vice Chancellor for his kind patronage and moral support in improving the quality of education, research and generating need based technologies. I am grateful to all Statutory Officers, Heads of Departments, Associate Directors (Research & Extension) of Regional Research Stations and Incharges of different Research Stations for providing input for the Annual Report. I appreciate the efforts of Dr Kamlesh Kanwar, Joint Director Research (Horticulture), Dr Diwakar Tripathi, Joint Director Research (Forestry) and Dr Manoj Vaidya, Joint Director Research (Planning) and Dr SK Sharma, Associate Director (R&E) for compilation of this Annual Report.

RCSharma

(R C Sharma)
Director of Research



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INTRODUCTION

Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan has its origin from Himachal Agricultural College and Research Institute, Solan, established in 1962 with its affiliation to Panjab University, Chandigarh. The College was raised to the status of Post Graduate College in 1965 with the introduction of M.Sc. (Agriculture) programme. It was affiliated to Himachal Pradesh University, Shimla in 1970 and thereafter it became Agriculture Complex in July 1971. It further became Horticulture Complex of Himachal Pradesh University and Himachal Pradesh Krishi Vishvavidyalaya, Palampur in 1976 and 1978, respectively. Later on, this complex was recognized as Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan on December 1, 1985. The university has now grown into its own kind, not only in India but in entire Asia with new dimensions of education, research and extension in horticulture, forestry and allied areas. The university has two constituent colleges viz., College of Horticulture and College of Forestry located at the main campus, Nauni, having nine and seven departments, respectively besides a new Institute of Biotechnology and Environmental Science at Neri, Hamirpur. In addition, there are five Regional Horticultural Research Stations, ten Research Sub-Stations and four Krishi Vigyan Kendras (KVKs) situated in different agroclimatic zones of the State.

The University is located at an elevation of about 1300 m above mean sea level. The total farm area of the university is spread over 545 ha at the main campus and 202 ha with the Regional Horticultural Research Stations/Sub Stations and the Krishi Vigyan Kendras (KVKs). The university is fully determined to impart quality education to its students and also to disseminate technical knowhow to end users for overall development of the rural masses with agro based livelihood security. Motivated and enterprising farming community, committed scientific and extension manpower of the university and appropriate policy planning are providing necessary impetus to achieve the university mission and goals.

Mission

- Strategic, need based and farmer oriented development of horticulture and forestry in Himachal Pradesh through excellence in education and research for food and ecological security, improved livelihood opportunities and economic prosperity of farming communities.

Goals

- Human resource development through excellence in education and skill upgradation with intensive practical trainings.
- Creation of sound scientific base for research and extension education in horticulture, forestry and allied sectors.
- Dissemination of generated technologies to farming community through region specific transfer of technology modules.
- Effective management of financial, structural and administrative resources of the University for competitive result oriented initiatives.

Objectives

- Human resource development in horticulture, forestry and allied sciences.
- Advancement of basic and applied research pertaining to horticulture, forestry and allied sciences.
- Extension and dissemination of scientific information among the rural masses of the state.
- Development of linkages with state, centre, international institutions, NGOs, orchardists, farmers and industrialists for ensuring nutritional, economic and ecological security in the state.



RESEARCH HIGHLIGHTS

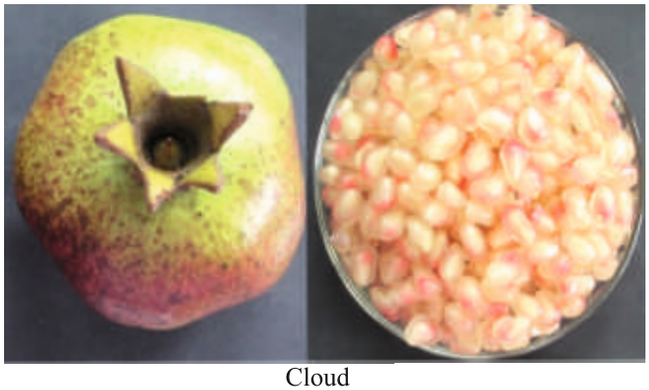
Horticulture

- Elite varieties of apple namely; Mollies Delicious, Gala Mast, Vesta Bella, Mayan, Red Delicious, Lal Ambri, and Golden Delicious (pollinizer) on MM106 rootstock and four varieties viz., Mollies Delicious, Gala Mast, Schelomit and Mayan on seedling stock were procured and planted at the university campus and other research stations for multi-locational testing under network project on out reach of technologies for temperate fruit production. Beside this, elite germplasm of apricot namely; CITH -1, CITH- 2, CITH-3 New Castle, and Irani and walnut namely; CITH-1, CITH-2, CITH-3, CITH-4, CITH-5, CITH-6, CITH-7, CITH-8, CITH-9, CITH-10, Hamdan and Suleiman were also procured and subjected to multi locational testing.
- The germplasm of different fruit crops including pomegranate (Haliatha and Russian Seedling), apricot (Tropic Gold, NJ-96 and IC-584510), nectarine (Fantasia), grapes (EC-772086, EC-772087, EC-772088, EC-772096, 772099, EC-772107, EC-772108), strawberry (Alexadria), apple (Transcendent Crab, EC-790620, EC-790621, EC-790622, EC-790623, EC-790624, EC-790625, EC-790626, EC-790627, EC-790628, EC-790629, EC-790630, EC-790631, EC-790632, EC-790633), red raspberry (Black Satin) and olive (Arbequina, Bernea, Coratina, Rantoio, Koroneiki, Picual and Picoline) were introduced and established in field gene bank *(FS, Nauni)*.



Flowering in CITH-1 and CITH-2

- A field repository consisting of 101 apple genotypes, collected from Himachal Pradesh, J&K and Uttarakhand was established at Nauni *(FS, Nauni)*.
- Horticultural performance studies on exotic cultivars of apple namely, Royal Gala on MM111, Compact Winter Banana, Early Red One, Golden Spur, Braeburn on EMLA111, Red Gravenstein, Spartan and Gold Spur on EMLA-7, Scarlet Spur, Gale Gala, Red Fuji, Coe-Red Fuji and Granny Smith budded on EMLA 111, EMLA 106 and EMLA 7 under dry temperate conditions revealed that the maximum plant height (376 cm) and tree girth (27.6 cm) was observed in Gale Gala on EMLA 111 and minimum (160 cm plant height and 13.3 cm girth) in Oregon Spur budded on BUD-9. The tree spread: E-W, N-S and annual shoot extension was recorded in the range of 53-181 cm, 62-232 cm and 31-123 cm, respectively, in various exotic apple cultivars. Maximum fruit yield was observed in Gale Gala (8.2 kg/tree) followed by Gold Spur (7.7 kg/tree), Early Red One (7.5 kg/tree) and Royal Gala (6.9 kg/tree) *(RHRTS, Sharbo)*.
- Performance of spur and standard varieties on four clonal rootstocks viz., M7, MM106, MM111 and Merton 793, revealed that the highest growth in terms of plant height, trunk girth and shoot length in all the varieties was recorded on MM111 followed by Merton 793. Spur variety Oregon Spur and standard variety Top Red recored the highest growth. The cultivars Red Fuji and Scarlet Gala gave highest growth and yield on MM111 rootstock followed by M7, MM106, EMLA 26 and M9 *(RHRTS, Bajaura)*.
- A promising apricot accession EC-198240 was identified for early maturity and large fruit size *(FS, Nauni)*.
- Cloud (sweet and hard, TSS 15-16°B, weight 210 g), Dewey (sweet and soft seeded, TSS 14.8, weight 287 g), Kara balamiursal (sweet and medium soft, TSS 14.8°B, weight 310 g) and Green Globe (sweet and hard seeded TSS 16.3°B, weight 411 g) were found to be promising germplasm accessions of pomegranate, for table purpose *(FS, Nauni)*.



Cloud



Dewey



Kara balamiursal



Green Globe

- A total of 2,08,000 plants of different fruit crops namely, apple, peach, plum, apricot, cherry, walnut, kiwifruit, pecan nut, strawberry, mango, litchi, aonla, papaya, pomegranate and apple rootstocks were produced at the main campus and other research stations of the university *(FS, Nauni)*.



Grafted plants of apple



Peach plants in the nursery



Chip budded plants of walnut



Grafted plants of pear



Multiplication of Kiwifruit

- A variety Kagzi Kalan of citrus was found to be promising under Dhaulakuan, Sirmour conditions of Himachal Pradesh *(RHRTS, Dhaulakuan)*.
- A study on the effect of plant growth promoting rhizobacteria (PGPR) and IBA treatment on the rooting of kiwifruit cuttings indicated that IBA @ 5000 ppm recorded best for root, shoot and leaf characteristics. However, the results obtained on different root characteristics of cuttings treated with PGPR-I (*Bacillus subtilis*) + IBA @ 4000 ppm showed similar results. Among two types of cuttings, hardwood cuttings exhibited best results with respect to root characteristics, however, semi-hardwood cuttings gave better results with respect to shoot and leaf characteristics *(FS, Nauni)*.



IBA 5000 ppm PGPR-I + IBA 4000 ppm

- The studies on water relations and deficit irrigation in kiwifruit revealed that Bruno, followed by Allison cultivar tolerate water stress better than other cultivars. Under moderate water stress condition, the use of black plastic mulch was proved to be beneficial as it mitigated the symptoms of water stress and resulted 50 per cent saving of water with better fruit yield and quality *(FS, Nauni)*.
- Rejuvenation of senile apricot plants of New Castle cultivar by 40 per cent heading back of scaffolds and application of 750 g nitrogen/plant exhibited best growth, yield and fruit quality *(FS, Nauni)*.
- Foliar spray of NAA at 40 ppm or Ethrel at 300 ppm 2 weeks after petal fall caused satisfactory fruit thinning and significantly improved the fruit yield and quality of two important cultivars of nectarine namely; May Fire and Snow Queen *(FS, Nauni)*.



Irrigation at 60% FC + black polythene mulching (healthy leaves and larger fruit size)

- Effect of organic and inorganic mulches on growth and yield of apple cv. Super Chief showed that black polythene mulch was found to improve the growth

and yield in comparison to other mulches *(RHRSS, Tabo)*.

- Out of imported apple plants on different clonal rootstocks introduced at RHRSS Tabo, it was found that plants on EMLA-111 recorded the significant growth and yield per plant as compared to other rootstocks *(RHRSS, Tabo)*.
- Six walnut selections viz. CITH-1, CITH-2, CITH-4, CITH -8, CITH -9, CITH -10 have been planted at Bajaura under medium density plantation and the variety CITH -2 had shown maximum plant height, plant girth and plant spread three years after planting. The different varieties of apricot introduced from CITH-Srinagar the variety CITH-3 showed maximum plant height and plant girth *(RHRTS, Bajaura)*.



Snow Queen

Growth characteristics and yield of imported apple vareities under cold desert condition of Spiti valley

Variety	Fruit Colour	Fruit Size	Trunk Diameter (mm)	Shoot Length (cm)	Yield/Plant (kg)
Gale Gala					
EMLA-7	Crimson red	Medium	49.3	9.8	4.2
EMLA-106	Crimson red	Medium	39.6	11.3	4.9
EMLA-111	Crimson red	Medium	41.3	12.4	5.3
Super Chief					
EMLA-7	Dark red with stripe	Large	42.6	8.3	5.3
EMLA-111	Dark red with stripe	Large	36.4	12.9	6.1
Scarlet Spur					
EMLA-7	Dark red	Large	43.2	10.3	4.8
EMLA-111	Dark red	Large	39.1	14.9	5.1
Oregon Spur-II					
EMLA-7	Deep red stripes	Large	32.8	14.3	3.9
EMLA-106	Deep red stripes	Large	39.8	16.8	4.3
EMLA-111	Deep red stripes	Large	37.9	18.2	4.9
Granny Smith					
EMLA-7	Dull green with crimson red blush	Medium	36.9	9.8	3.8
EMLA-111	Dull green with crimson red blush	Medium	38.2	12.6	4.6
Coe Red Fuji EMLA-7	Red blush on dull green background	Medium	39.8	15.3	4.6
Red Fuji					
EMLA-7	Red stripes with yellow background	Medium	33.9	14.3	4.1
EMLA-106	Red stripes with yellow background	Medium	40.5	18.6	4.9
CD(0.05)	-	-	6.8	3.4	0.7



CITH-3

- Adaptive trials conducted on foliar application of specialty soluble N:P:K fertilizers viz., 19:19:19, 13:0:45, 0:0:50 applied @ 0.25 per cent (3 sprays) at 15 days interval at Yuvarangi and Telangi village of district Kinnaur on Royal delicious apple starting at vegetative (half inch green leaf stage), flowering (pink bud stage) and fruit set stage along with 62.5 per cent of recommended dose of soil application of fertilizers resulted in better cropping behaviour, flowering, fruit set, yield and quality characteristics compared to traditional system of only soil application of fertilizers *(RHRTS, Sharbo)*.
- Varietal performance of three cultivars of hazelnut revealed that maximum plant height (415.0 cm) was noticed in Tonda-de-Giffoni followed by Tonda-delle-Gentile Langhe (375.0 cm) and Tonda Romana (352.0 cm), whereas, tree spread: East-West; North-South and annual shoot extension was recorded in the range of 150-245 cm, 135-238 cm and 25-95 cm, respectively, in various hazelnut cultivars *(RHRTS, Sharbo)*.
- Horticultural performance studies on exotic cultivars of apricot imported from Armenia revealed that Sateni recorded the highest TSS (21.5°Brix), while, it was least in Yerewani (15.1°Brix). The highest yield was observed in Yerewani (5.5 kg/tree) as compared to Sateni (4.8 kg/tree) *(RHRTS, Sharbo)*.
- Horticultural performance of three French cultivars of walnut viz., Meylannaise, Lara-Pieral and Ronde-de-Montignac Infel are being evaluated. The maximum plant height (315.0 cm) was noticed in Lara Pieral followed by Meylannaise (250.0 cm) and Ronde-de-Montignac Infel (225.0 cm), whereas, tree spread: East-West; North-South and annual shoot extension was recorded in the range of 48-235 cm, 46-228 cm and 8-127 cm, respectively, in various almond cultivars *(RHRTS, Sharbo)*.
- The research trial on elite production of apple nursery planting material was conducted to study the effect of foliar application of different N:P:K (19:19:19 and 13:0:45) applied at weekly intervals after true leaf stage upon seed germination starting in the month of March-April has resulted in improved and better vegetative growth, increased plant height and stem girth which ranged from 8.0-10.5 cm and 0.03 to 0.05 cm respectively, as compared to control under open field conditions *(RHRTS, Sharbo)*.
- The field experiment was conducted to evaluate the effect of gibberellic acid on plant growth, fruit yield and quality parameters on grapes cv. Thompson Seedless in dry temperate climate. Gibberellic acid applied at full bloom stage and at fruit set stage increased cropping behaviour of the grape vine trees. Application of GA @ 50 ppm resulted in an improved vegetative growth characters, flowering parameters (number of flowers per cluster and per cent fruit set), berry weight, berry dimension, average bunch weight, bunch dimension and juice content of berries of grapevines *(RHRTS, Sharbo)*.
- Floral malformation is an important problem in mango, considering this fact a study was conducted and it was found that the cultivars Anmol, Samar Bahist, Bombay Green, Fazli,

Baramasi, Lucknow Safeda, Totapari are resistant for floral malformation under sub-montane low hill zone of Himachal Pradesh *(RHRTS, Jachh)*.

- Queen Rosa Plum ripening in the third week of July, with highest fruit weight of 120 g and TSS of 11.2°B appear to be suitable for cultivation in Himachal Pradesh *(RHRTS, Bajaura)*.
- Top working in bearing trees of Royal Delicious apple with Golden Delicious variety improved the fruit set of Royal Delicious apples. Red Bartlett pear has been grafted on three rootstocks viz. Kainth, Jarenth and interstock Beurre Hardy/Quince. The highest growth in terms of plant height, trunk girth and shoot length was recorded on Kainth rootstock and the highest yield was recorded in plants on interstock of Beurre Hardy/Quince *(RHRTS, Bajaura)*.



Queen Rosa (Plum)

- Pomegranate plantation at 4 m (row to row) x 2 m (plant-to-plant) has been established on raised beds having 1.25 m (top) and 2 m (at base of raised bed) wide and 0.50 m height. Plants were trained on single stem. This will protect trees from collar rot of pomegranate which has become serious problem in Kullu valley *(RHRTS, Bajaura)*.



Top working in Royal Delicious with Golden Delicious



Raised bed plantation of pomegranate



Pomegranate cv. Kandhari Kabuli

- Trial on evaluation of different nectarine/peach varieties revealed that peach variety Glow Haven exhibited significantly higher fruit size

and weight, however, fruit firmness and total soluble solids were recorded highest in Silver King nectarine variety *(TH&FRTS, Kotkhai)*.

- Studies on the performance of different walnut varieties, it was observed that trunk diameter, tree height, tree spread, fruit length, breadth, weight and shell thickness were significantly greater in cultivar Pratap. However, highest nut yield, yield efficiency and kernel recovery were recorded in cultivar Lara, which makes this variety comparable with existing cultivars like Govind, Pratap and Kotkhai Selection *(TH&FRTS, Kotkhai)*.
- Among the rootstocks, plants on MM111 had higher plant height and annual extension growth but trunk diameter was recorded higher on M7 rootstock. Among the interaction effects of scion and stock, Granny Smith on MM 111 had higher plant height and same variety on M7 rootstock had highest trunk diameter, however, Gale Gala grafted on M111 exhibited the significantly higher annual extension growth, whereas, Scarlet Spur-II on M7 rootstock exhibited least growth *(TH&FRTS, Kotkhai)*.
- Exotic plum varieties Shiro, Black Amber, Duarte and Friar are being evaluated. Shiro matures in the second week of June along with Frontier but 4-5 days after Santa Rosa. Black Amber matures in the first week of July, 4-5 days before Mariposa. While, Duarte and Friar matures in mid July along with Mariposa. Compared to the Santa Rosa, Frontier and Mariposa, these varieties are smaller in size under Kandaghat conditions but Black Amber, Duarte and Friar may prove economically beneficial due to their late bearing habit *(HRTS & KVK, Kandaghat)*.
- Low chilling peaches namely Early Grande, Pratap and Early White Giant have been found promising in Kandaghat conditions. Early Grande and Pratap matures in the second week of May while Early White giant matures in the first week of July. The fruit size in case of Early White Giant and Pratap is excellent varying from 88-117 g while, Early Grande is comparatively smaller in size ranging from 64-70 g but having very attractive red skin colour. The earliness in these low chilling peaches can fetch a good price in the market *(HRTS & KVK, Kandaghat)*.



Peach cv Early grande



Peach cv Early White Giant

- Performance study of newly introduced cultivars of nectarines viz., May Fire and Snow Queen being evaluated at farmers' fields in Solan district revealed that the trees attained an average height of 1.80 m and 1.58 m, respectively with an average girth of 21.28 mm and 21.10 mm, respectively *(HRTS & KVK, Kandaghat)*.
- Newly introduced cultivars of peaches viz. Sun Crest and Glo haven being evaluated in Solan district attained an average height of 1.52 m and 1.83 m, respectively and an average girth of 20.49 mm and 20.63 mm, respectively *(HRTS & KVK, Kandaghat)*.



Peach cv Glo haven



Peach cv Sun Crest

- In order to enhance shelf-life and quality of the nectrine fruits, sprays of calcium nitrate and calcium chloride at three concentrations 0.50, 0.75 and 1.00 per cent each were carried out on 'Silver King' trees at 20 days before the tentative harvest date. Fruits were harvested randomly and stored at ambient condition for further analysis. Calcium chloride sprayed fruits retained higher overall acceptability than calcium nitrate and untreated fruits. Among calcium chloride sprays, 1.00 per cent had retained highest fruit firmness and overall acceptability and lowest physiological loss in weight than 0.75 per cent sprayed fruits, respectively *(RHRTS, Bajaura)*.
- On farm trials on the response of different apple varieties for crop diversification in Kandaghat area revealed that all the four cultivars of apple viz. Early Red One, Red Chief, Oregon Spur and Golden Spur exhibited a 100 per cent survival with an average height of 120 m, 99 m, 79 m and 97 m, respectively and an average girth of 21.28 mm, 12.85 mm, 13.11 mm and 13.67 mm, respectively *(HRTS & KVK, Kandaghat)*.
- To harvest a good commercial crop of quality litchi fruits, irrigation is essential. Among the three irrigation schedules (twice in a week, once in a week and fortnightly) tested at Jachh, the irrigation applied twice in a week has significantly reduced the fruit cracking and enhance the production of quality litchi fruits. Irrigation twice a week resulted in the highest fruit yield (33.7 kg/tree) which was observed significantly higher over the other irrigation schedules. Unirrigated plants resulted in the lowest (8.7 kg/tree) fruit yield *(RHRTS, Jachh)*.



Unirrigated Plants Irrigated Plants

Effect of irrigation regimes on fruit yield (kg/tree) in litchi

Cultivar	Irrigation regimes				Effect of cultivar
	Twice a week	Weekly	Fortnightly	Control	
Dehradun	43.7	32.7	26.1	10.8	28.3a
Calcuttia	39.9	24.2	21.1	5.9	22.8b
Large Red	45.3	38.4	20.3	8.4	28.1a
Rose Scented	23.6	17.7	11.4	8.9	15.4c
Mclean	16.2	13.4	09.0	09.4	12.0d
Effect of irrigation regime	33.7a	25.3b	17.6c	8.7d	

C.D.(P=0.05) Cultivars: 1.59, Irrigation intervals: 1.43, Interaction: 1.59

- High density mango orcharding with the dwarfing cultivar Amrapali is a successful venture for the low hills sub-montane zone of Himachal Pradesh. High density orcharding is more suitable for the small land holding and the production can be obtained as high as 48 t/ha with the plant population of 2500 trees per hectare *(RHRTS, Jachh)*.



High density mango cultivar Amrapali

- The studies on the performance of different pomegranate cultivars under sub-tropical conditions in sub-montane low hill zone of Himachal Pradesh revealed that most suitable cultivars are Kandhari Kabuli, Kandhari Hansi and Ganesh. These cultivars have significantly thicker rind in comparison to small fruited cultivars - Bhagwa and Mridula *(RHRTS, Jachh)*.



Kandhari Hansi

- A study on drip irrigation in strawberry revealed that drip irrigation at 100 per cent ET registered 16 to 18 per cent increase in plant height, 16 to 30 per cent increase in yield and 8 to 12 per cent increase in fruit size and weight over furrow irrigation with 'V' volume of water. This irrigation treatment also gave 14.27 per cent higher water use efficiency than furrow irrigation with 'V' volume of water *(FS, Nauni)*.



Fruit size under drip irrigation at 100% ET



Fruit size under conventional furrow irrigation

- Preliminary observations on the effect of plant growth promoting rhizobacteria and GA_3 in strawberry (*Fragaria* x *ananassa* Duch.) cv. Chandler revealed that root dip + foliar application of PGPR and GA_3 @ 75 ppm in combination with PGPR was most effective in enhancing fruit growth, yield and quality *(FS, Nauni)*.
- A low chill peach variety Tropic Sweet was found to be promising under Nauni, Solan conditions *(FS, Nauni)*.
- The results on the performance studies on seven cultivars of litchi under Nagrota conditions

revealed that cultivar Dehradun attained maximum tree girth and tree spread, whereas Rose Scented produced tallest trees. In term of fruit quality cultivar Dehradun was observed to the best for fruit yield and most of the quality parameters like fruit size and TSS content. Maximum per cent fruit cracking of 21.1 per cent was recorded in cultivar Dehradun while the least (7.2%) in Calcuttia. However, cultivar Dehradun was observed to be early maturing than other cultivars *(LMRTS, Nagrota Bagwan)*.

- Nursery of Litchi Mango Research Station, Nagrota Bagwan is accredited and rated by NHB, Gurgaon, Ministry of Agriculture, Govt. of India for mango and litchi nursery plants *(LMRS, Nagrota Bagwan)*.
- Pre- harvest application of calcium chloride at 0.75 and 1.0 per cent concentration after 60 days from full bloom had significantly enhanced shelf-life and maintained fruit quality with respect to fruit firmness and physiological loss in weight of Vance Delicious apple up to 42 days



Litchi Nursery











of storage period. The soluble solids concentration of untreated fruits decreased significantly after 28th day of storage interval which affect quality and shelf-life of the fruits *(RHRTS, Bajaura)*.



Boric acid + NPK treated Pistachionut

- Varietal performance of Kerman (female) and Peter (pollinizer) cultivars of Pistachionut, showed the highest average plant height (335 cm), tree girth (44.7 cm), tree spread: East-West (340 cm); North-South (320 cm) with Kerman, whereas, Peter had attained highest plant height of 295 cm, tree girth of 41.4 cm and spread: East-West 328 cm; North-South 325 cm. Further, nutritional studies revealed that the foliar application of boric acid @ 0.5 per cent starting at early bud break to flowering stage, leafing out stage and fully expanded leaf stage along with soil application of NPK fertilizers @ 600 g $tree^{-1}$ CAN, 600 g $tree^{-1}$ SSP and 800 g $tree^{-1}$ MOP in the month of February resulted in improved (75%) fruit set and yield in Pistachio nut cv. Kerman *(RHRTS, Sharbo)*.
- Single application of carbosulphan 0.025% (Marshal 25EC) at initiation of pink bud stage provide excellent control of apple blossom thrips at par with the already recommended thiamethoxam (0.025%) and chlorpyriphos (0.04%). Two applications each of fenzaquin (0.0025%) and fenpyroximate (0.0025%) at 15 days interval provided complete control of the mite populations on apple in Naggar areas of Kullu district of Himachal Pradesh *(RHRTS, Bajaura)*.
- The sub-montane sub-tropical climate of Zone-1 provide best growing condition for litchi cultivation. Among the cultivar Early Large Red is in the offing. Its fruits mature in June yielding around 21.40 kg/20 years old tree *(HRRTS, Dhaulakuan)*.



Cv. Early Large Red

- Meadow orcharding in guava seems advantageous with the planting of layered plants, than budded or inarched plants *(HRRTS, Dhaulakuan)*.



Meadow orcharding in guava

- Enrichment of maintenance breeding blocks at RHRTS, Mashobra was done by addition of 14, 5 and 10 new varieties of apple, pear and sweet cherry, respectively. Characterization of apple (80 varieties) and sweet cherry (24 varieties) was carried out for vegetative, flowering and fruiting character *(RHRTS, Mashobra)*.
- Canopy management of dwarf apple trees for enhancing quality production of apple, highest fruit set, weight, per cent fruit surface red colour was recorded with mini centre leader system in comparison to palmette leader system and single conic shaped tree system *(RHRTS, Mashobra)*.
- The studies on bio-efficacy of Elanta Super (Amino acid derivative of L Cystine (N-ATCA) in apple cv. Royal Delicious revealed that highest fruit set and yield was recorded with Elanta Super applied at petal fall and one month after petal fall. Fruit weight, size and better colour was observed higher at petal fall and 15 days after petal fall @ 1 ml/l and 1.5 ml/l of water, respectively *(RHRTS, Mashobra)*.
- "Bush Large" was evaluated and identified as promising variety of pomegranate for anardana making *(FS, Nauni)*.
- Preliminary observation on the fruit quality of New Castle apricot revealed that application of Triacontanol @ 7.5 ppm or Biozyme/Cytozyme @ 3 ml/l improved fruit size, pulp to stone ratio, TSS and sugar contents when applied at pink bud and pit hardening stage *(FS, Nauni)*.
- The treatments consisting of 1.5 per cent $CaCl_2$ in combination with 750 ppb1-MCP proved to be the most effective treatment in reducing PLW

Effect of canopy management techniques on fruiting parameters of Delicious apple trees

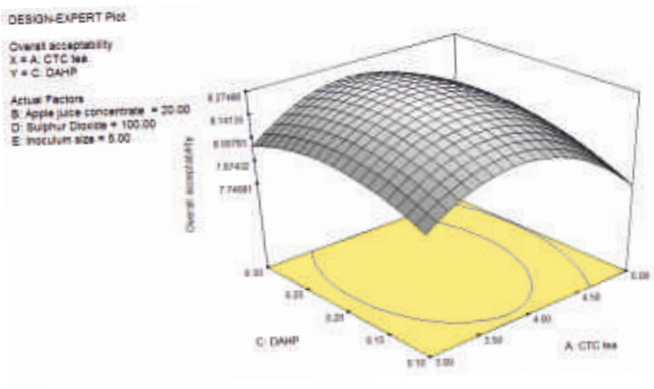
Treatment	Tree height (m)	Tree spread (m)	Tree canopy vol.(m^3)
Mini centre leader system	3.37	2.87	15.2
Palmette leader system	3.33	2.75	13.9
Simple conicshaped tree system	3.48	3.11	19.7
$CD_{0.05}$	NS	NS	2.5

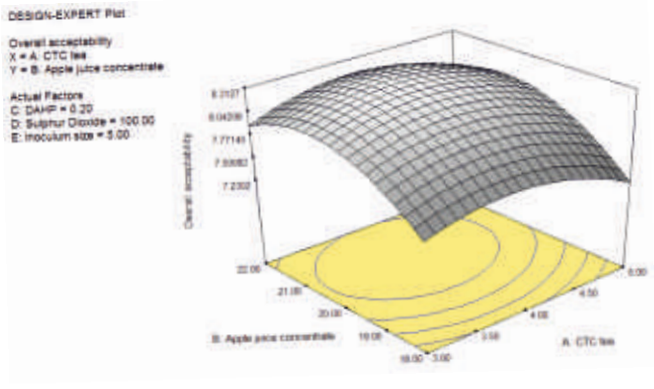
Effect of different canopy management techniques on vegetative growth parameters of Delicious apple trees

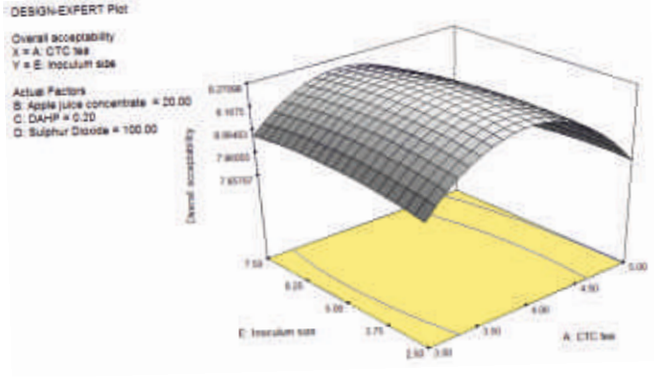
Treatment	Fruit yield (kg/tree)	Yield efficiency (g/cm^2)	Crop load (no. of fruits/cm^2)
Mini centre leader system	34.0	297.0	1.92
Palmette leader system	28.0	255.0	1.77
Simple conicshaped tree system	29.0	246.0	1.64
$CD_{0.05}$	NS	NS	NS

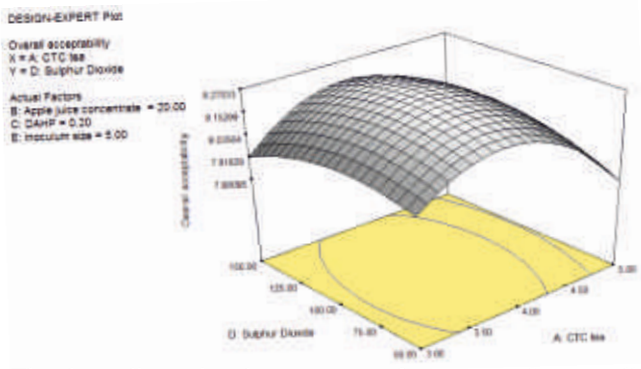
and retaining firmness of nectarine fruits during storage *(FST, Nauni)*.

- Standardization of the technology for the production of base wine for cider vinegar production showed that run having 14.0°B initial TSS, 0.1 per cent DAHP and 50 ppm sulphur dioxide gave highest ethanol content, phenol content and lower volatile acidity *(FST, Nauni)*.
- Apple tea wine prepared by ameliorating the apple tea with apple juice concentrate as a sugar







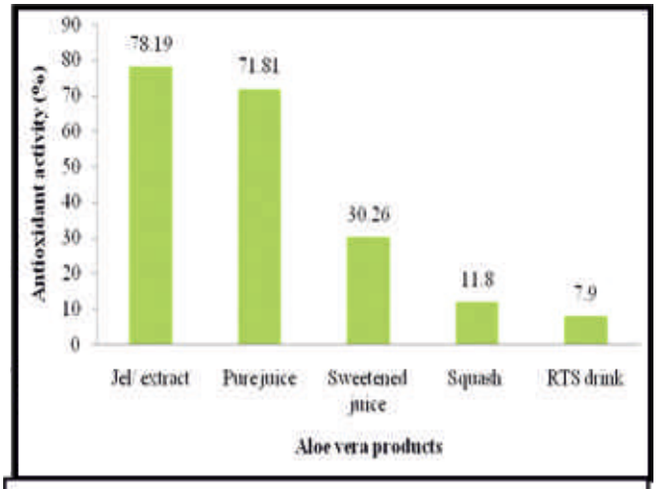


The three dimensional response surface curves for overall acceptability plotted between (a) CTC tea (g) and DAHP (%), (b) CTC tea (g) and apple juice concentrate (°B) (c) CTC tea (g) and inoculum size (%), (d) CTC tea (g) and sulphur dioxide (ppm)

source, DAHP as a nitrogen source and inoculated with *Saccharomyces cerevisiae* var. *ellipsoideus* was rated the best. Runs having 4 g CTC tea, 20°B TSS, 0.2 per cent DAHP, 100 ppm SO_2 and 5 per cent inoculum were rated as the best. Apple tea wine matured with *Quercus* sp. wood chips was the best, while tea cider prepared with 40 per cent apple juice was rated best *(FST, Nauni)*.

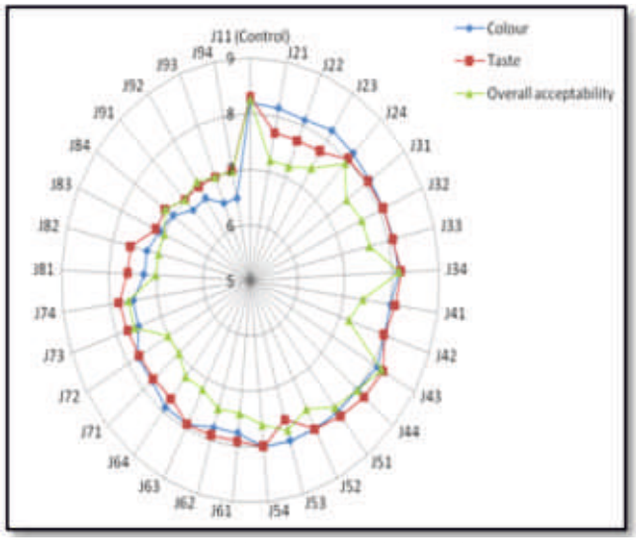
- The mushroom supplemented pasta, papad and warian from fresh as well as from dried mushrooms has been developed *(FST, Nauni)*.
- Supplementation of fresh mushrooms up to 20 per cent for the preparation of macroni and warrian and dried mushrooms upto 10 per cent for bread and pappad was adjudged better on the basis of physico-chemical and sensory properties *(FST, Nauni)*.
- A complete technology package for the development of anardana from wild pomegranate has been developed *(FST, Nauni)*.
- Bitter gourd based vitamin C enriched spiced squash (appetizer) can be prepared by using 27.5 per cent juice, 45°B TSS, spice extract and fortification with 0.5 per cent ascorbic acid. The product was found to be the rich source of ascorbic acid, phenolic and had good antioxidant potential *(FST, Nauni)*.

- Antioxidant rich aloe based beverages like sweetened juice, squash and RTS have been developed *(FST, Nauni)*.



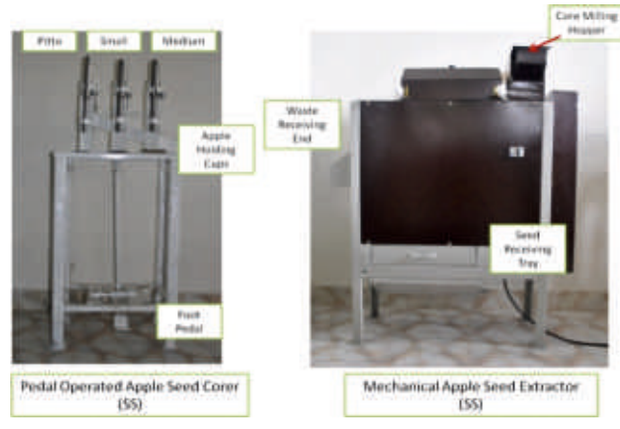
Antioxidant activity(% DAHP) of *Aloe vera* based food products

- Vitamin C enriched jamun based health drink (RTS) developed using jamun 70 per cent + aonla 20 per cent + *Aloe vera* 10 per cent for the benefit of health conscious people *(FST, Nauni)*.



Sensory evaluation of jamun based blended RTS beverages

- Among the different ginger peeling methods, use of mechanical peeler and polisher procured from Maharana Pratap University of Agriculture and Technology, Udaipur was found best in terms of minimum peeling losses, ease of handling, cost effective and efficiency of operation *(FST, Nauni)*.
- The bell pepper chutney with mushroom chunks (70:30) possessed substantial ascorbic acid antioxidant activity and protein content *(FST, Nauni)*.
- Drying of apple pomace followed by grinding into powder form and rehydration was optimized for extraction of pectin. Further, eco-friendly methods viz., autoclaving of apple pomace flour at 121°C for 15 minutes was found as the best method for production of pectin on the basis of quality (methoxyl and anhydrogalacturonic acid contents) *(FST, Nauni)*.
- Designed and fabricated a apple mechanical corer and mechanical seed separator with stainless steel material. The apple seed extractor is operated with 1 HP motor. The efficiency of machine is 100 kg/h *(FST, Nauni)*.



Apple seed corer and apple seed extraction machine



Solar tunnel drier

- Technology for the development of osmo dried plum, apricot and sand pear has been standardized and commercialized. The syrup left over after osmotic dehydration of apricot and pear was utilized for development of different value added products viz., squash, RTS, appetizer etc *(FST, Nauni)*.



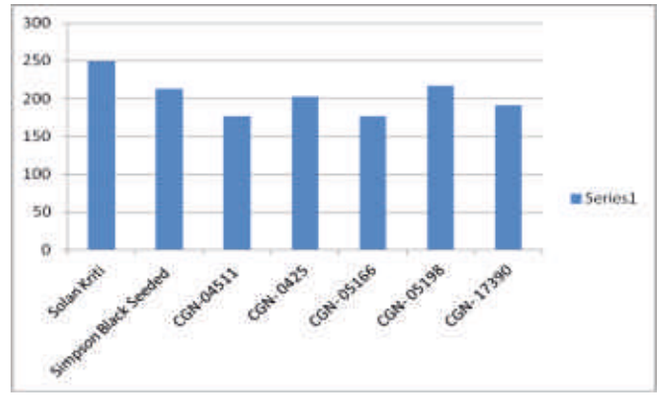
Complete technology for the value addition of plum fruits

- Okra genotypes of LC-13, LC-11, BLC-19, NS-29, IC 58235 and IC 212267 gave higher green fruit yield and found promising for most of the important horticultural traits. A highly significant positive genotypic and phenotypic correlation of yield was found with number of marketable fruits per plant, average fruit weight and harvest duration, whereas, negative genotypic and phenotypic correlation was found with days to 50% flowering, first fruiting node, internodal length and days to first harvest *(VS, Nauni)*.





- Pre emergence application of Lasso (Alachlor 50 EC) @ 1.50 kg a.i./ha produced maximum seed yield (34.12 q/ha) of okra cv. P-8 under mid hill conditions of Himachal Pradesh *(HRTS & KVK, Kandaghat)*.
- Solan Kriti variety of lettuce developed and released for cultivation in Himachal Pradesh



were evaluated along with seven other recently introduced elite germplasm. The highest yield per hectare was recorded in genotype Solan Kriti (248.90 q/ha) followed by CGN-05198 (217.56 q/ha) *(VS, Nauni)*.

- Under protected conditions refined growing module consisting of Vermicompost: Soil (2: 1) + *Trichoderma viride* (500 g/50 kg FYM) + cabbage leaves (200 q/h) + neem manure (250 g/m^2) recorded 17.25 fruits per plant, 222 g fruit weight and 3.37 kg furit yield per plant in sweet pepper *(VS, Nauni)*.



Environment friendly plant protection



Good quality fruit production

- In germplasm conservation and evaluation, various entries of cabbage, capsicum, carrot (temperate), cauliflower (late), tomato (indeterminate) and cucumber were evaluated. Amongst various crops, genotype AC-27 (cabbage), Rotin (European carrot), Purple of Sicily (cauliflower), LE-79-5 (tomato) and LC-40 (cucumber) performed better for various horticultural traits and recorded maximum yield over standard check *(VS, Nauni)*.
- Amongst the various trials on varietal performance, the genotype 2012-TOINDVAR-2 of tomato (406.3 q/ha), 2011/KLVAR-5 of kale (368.33 q/ha), 2011/CAPVAR-1 of capsicum (413.00 q/ha) and 2012/PEVAR-2 of garden pea (101.22 q/ha) gave highest yield over their respective standard check variety *(VS, Nauni)*.
- In hybrid evaluation trials conducted during the period, the hybrid 2012-TOINDHYB-1 (544.6 q/ha) of tomato, hybrid 10/CAPHYB-3 (457.03 q/ha) of capsicum, hybrid 2011/CUCUHYB-2 (422.83 q) for AVT-I and hybrid 10/CUCUHYB-4 (484.70 q) for AVT-II, both of cucumber performed better over other hybrids. In case of cabbage, Hybrid 2012 /CABHYB-3 with a highest yield outlay of 317.14 q/ha out yielded other hybrids *(VS, Nauni)*.
- In disease resistance trials on garden pea against powdery mildew, the entry 2012/PMPM-5 recorded the highest yield of 121.6 q/ha with a disease severity of 16.7 per cent. The resistant check recorded minimum disease severity of 9.7 per cent. Similarly, in AVT-II, the entry 2011/PMPM-3 recorded the highest yield of 131.4 q/ha with a disease severity of 16.0 per cent. The resistant check recorded minimum disease severity of 14.3 per cent *(VS, Nauni)*.
- Different genotypes of cucumber were evaluated under protected conditions in mid-hills of Himachal Pradesh. The genotype Kian recorded maximum yield and was found superior to check variety Pusa Sanyog in naturally ventilated polyhouse *(VS, Nauni)*.

- In capsicum crop grown under protected cultivation, an application of imidacloprid 200SL @ 0.5 ml/l was found superior over its individual treatments in terms of crop protection as well as higher fruit yield under mid hill conditions of Himachal Pradesh *(VS, Nauni)*.
- In an OFT on testing of improved varieties of capsicum, hybrid Indira performed well for yield and other horticultural traits. It produced 77.7 per cent more yield than local variety. Another hybrid, Bharath recorded 66.66 per cent more yield, whereas Solan Bharpoor recorded 41.66 per cent more yield than the farmers' variety under mid-hill conditions *(HRTS & KVK, Kandaghat)*.
- In peas, Punjab-89 (180 q/ha) variety recorded 50 per cent more yield over farmers' variety (120 q/ha). Another variety Azad Pea-1 (150 q/ha) recorded 25 per cent more yield over farmers' variety *(HRTS & KVK, Kandaghat)*.
- Five hybrids of different vegetables viz., brocolli cv. Fiesta; okra cv. Hybrid-10; cucumber cv. Sedona; tomato cv. Ramganga; cabbage cv. Field Rocket were evaluated for different horticulture traits and all the hybrids performed better as compared to respective checks under low hill conditions of Himachal Pradesh *(IBES, Neri)*.
- In organically grown cabbage an application of imidacloprid 200SL @ 0.5 ml/l at 20 DAT followed by spray of indoxacarb 14.5 SC @ 0.5 ml/l prior to transplanting and at 30 and 60 DAT and spray of rynaxpyr 18.5 SC @ 0.3 ml/l at 15, 45 and 75 DAT resulted maximum crop protection as well as higher yield (25.26 t/ha) *(VS, Nauni)*.
- By using cuelure and bait spray in bitter gourd trial, installation of cuelure baited traps @ 10 traps/acre and application of bait spray (jiggery solution (100 g jiggery+ malathion @ ml/l at 250 spots/ha) at 15 days interval from flowering in bitter gourd crop could reduce the fruit fly damage to 18-20 per cent as compared to control which recorded 47.7 per cent damage during kharif at Solan *(VS, Nauni)*.
- In seed pelleting, seeds coating with micronutrient mixture @ 20 g/kg or carbendazim @ 2 g/kg + imidacloprid @ 2 ml/kg + micronutirent mixture @ 20 g/kg found best in improvement of various horticultural traits of cabbage *(VS, Nauni)*.
- Seed treatment with vermicompost @ 4 g/kg, or cow urine @ 20 per cent or *Trichoderma harzianum* @ 4 g/kg as seed coating with 1 per cent CMC and dip for one hour followed by three sprays of Neem Raj @ 0.3 per cent effectively reduced the *Alternaria* leaf spot and downy mildew disease under field conditions. The seed yield was also enhanced maximum in treatments of vermicompost @ 4 g/kg and cow urine @ 20 per cent followed by *T. harzianum* and *T. viride* treatments @ 4 g/kg, where seed yield was recorded between 393 to 430 kg/ha compared to 358 kg/ha in untreated seeds of cauliflower *(VS, Nauni)*.
- In genetic resources of ginger, two hundred and thirty one ginger collections were evaluated for rhizome yield and other horticultural traits. The yield range of 21 best genotypes varied from 114.15 q/ha (SG-1045) to 161.10 q/ha (SG-857). Yield of three lines viz., SG-857 (161.10 q/ha), SG-12-04 (145.50 q/ha) and SG-1134 (138.40 q/ha) excelled the check Himgiri which yielded 122.00 q/ha. The rhizome rot disease incidence varied from 10.00-27.41 per cent with 10.00 and 14.50 per cent in SG-857 and Himgiri, respectively *(VS, Nauni)*.
- In genotype x environment interaction of ginger, average yield varied from 81.50 q/ha to 211.70 q/ha. The local check SG-26-04 recorded maximum yield 211.70 q/ha followed by Himgiri 122.00 q/ha. The rhizome rot disease incidence varied from 9.75-19.55 per cent with minimum in SG-26-04 *(VS, Nauni)*.

- In quality evaluation of ginger, forty six best performing genotypes were analyzed. The dry matter content (%) and crude fibre (%) ranged between 17.75 (SG-1118) to 24.15 (SG-247) and 4.10 (SG-04-04) to 5.31 (Himgiri), respectively. Essential oil (%) and oleoresin contents (%) varied from 0.70 (Varada) to 1.66 (SG-26-04) and 3.02 (SG-929) to 4.48 (SG-857), respectively. The high yielding genotype SG-26-04 was found superior/ comparable for dry matter content, essential oil, oleoresin and crude fibre contents to the check Himgiri *(VS, Nauni)*.



SG10-11 (SG26-04) IC-593889



Check Himgiri

Harvested rhizomes of elite genotype of ginger along with Check Himgiri

- Pea germplasm consisting of 20 cross combinations and 25 genotypes was evaluated and it was found that the cross combination Palam Priya x VL-7 and 'Green Pearl' x 'VL-7' gave the highest pod yield per plant along with maximum pod length and number of grains per pod. New pure lines Arka Kartik and Arka Ajit also gave higher pod yield under the prevailing conditions *(RHRTS, Bajaura)*.
- Highest gherkin fruit yield of 61.48 q/ha was observed through an early planting on 1st May, 2013 @ 46.31 fruits per vine and each fruit measuring 7.85x3.04 cm, weigh 18.50 g. High density planting @ 100x50 cm yielded significantly high (59.60 q) vis-a-vis 125x75 cm (47.12 q/ha). The highest lettuce head yield (204 q/ha) was registered through 30th September planting. A high density planting at 30x30 cm was observed to be appropriate as it recorded significantly high yield vis-a-vis wider spacing(45x30 cm). Lettuce responded significantly to the application of chemical fertilizers (NPK) as no nutrient application registered lowest head yield (132 q/ha) *(VS, Nauni)*.
- Bell pepper genotypes were collected from different agricultural institutes of the country and with in the state and evaluated for different horticultural traits in kharif season, 2013. Maximum yield per plant (976.20 g) and per hectare (290.24 q) was recorded in genotype UHFBP-7 followed by UHFBP-10 with 940.00 g per plant yield and 278.52 q yield per hectare *(VS, Nauni)*.
- In broccoli, black polythene has resulted in early primary curd initiation (7.3 days), 40.3 per cent higher curd weight as well as 60 per cent higher yield over control under low hill sub- tropical zone of Himachal Pradesh *(IBES, Neri)*.
- An application of poultry manure @ 3.5 t/ha + vermi-compost @ 3 t/ha at the time of field preparation to obtain best results in terms of higher seed yield and other seed characters in indeterminate tomato under mid-hill conditions *(VS, Nauni)*.
- Integrated nutrient management plays a very important role in enhancing the productivity of

the various crops and it makes growing crops more sustainable and reduces the economic losses. On the basis of one year study in okra (Variety P-8) and brinjal (Pusa Purple Long) it was found that application of 75 per cent inorganic fertilizers + vermicompost + biofertilizers gave higher yields. While, in French bean (Contender) and cauliflower (Pusa Sharad), the higher yields were obtained with 50 per cent inorganic fertilizers + vermicompost + biofertilizer + FYM *(RHRTS, Jachh)*.





75% inorganic fertilizers + vermicompost (25% on N equivalence) + biofertilizers + FYM) in okra

- Six varieties of crops viz. coriander, pea, cabbage and cauliflower were tested at RHRTS, Jachh. The results revealed that varieties KSP-110 (pea), Caribe (coriander) produced yield to the tune of 174.2 and 8.4 q ha^{-1}, respectively. The



75% inorganic fertilizers + (FYM + PM) - 25% on N eq. + BF+ FYM in brinjal

variety Megha (cauliflower) and No. 49 (cabbage) produced average curd/head weight of 876.26 g and 1.45 kg, respectively *(RHRTS, Jachh)*.

- Genic male sterility is being incorporated from chilli line DKC-12 (MS-12) into bell pepper cvs. California Wonder (CW) and HC-201. All the progenies have been selfed and the seed collected and BC_5 populations have been achieved. The morphological characteristics of these plants have been also tested *(HRRTS, Dhaulakuan)*.
- In the process of incorporating CMS, 5 progenies have shown promise in producing 100 per cent male sterile plants. The recovery of lobbing, bell shaped and sweetness characteristics have been found exceptionally remarkable in the BC_5 population. In developing inbred lines in chilli RK-1040 have shown promise in resisting wilt and viruses, whereas this line was found tolerant to anthracnose *(HRRTS, Dhaulakuan)*.
- Cucumber seed primed with disodium hydrogen phosphate @ 10^{-3} M for 24 hours may be used to get higher yield with more germination percentage, seedling length, seedling dry weight, seed vigour index- I and II under mid-hill conditions *(VS, Nauni)*.





50% inorganic fertilizers + vermicompost + BF+ FYM in French bean





50% inorganic fertilizers + FYM+PM in cauliflower

- In tomato 60 genotypes, 12 hybrid combinations along with the hybrids of private companies were evaluated during 2013 kharif. The results revealed that 3 cross combinations have given better fruit yield as compared to the genotypes and the yield was also found to be statistically at par with the hybrids of private sector companies *(RHRTS, Bajaura)*.
- In broccoli, three varieties viz., Palam Samridhi, Palam Vichitra and Green Head were evaluated under dry temperate conditions of Himachal Pradesh. Out of all the varieties under study maximum production per hectare was obtained in variety Palam Vichitra (236 q/ha) *(RHRTS, Sharbo)*.
- Tomato hybrids Naveen 2000 and Ramganga were found to be highly suitable for cultivation under the Kullu valley conditions as they gave high fruit yield of 600 q/ha during the kharif season *(RHRTS, Bajaura)*.
- The capsicum hybrid Mahabharat was tested along with the check hybrid Bharat and it was found to give significantly higher fruit yield (360.6 q/ha) as compared to the check with higher number of fruits plant and high average fruit weight *(RHRTS, Bajaura)*.



CMS lines in the offing



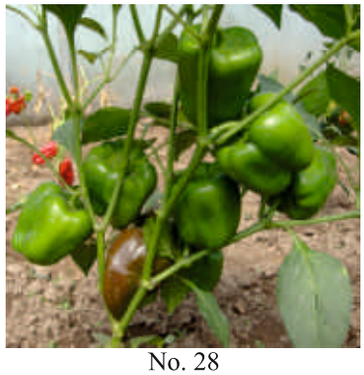
No. 12



CWP -3



CWP-2



No. 28

Maintainer lines carrying *Nmsms* gene

- Cucumber hybrid Sedona was put under testing along with the check variety K-75 and it was found that the hybrid Sedona gave a higher yield (3.055 kg/plant) as compared to K-75 which could produced only 2.309 kg/plant *(RHRTS, Bajaura)*.
- Lettuce variety/hybrid Ryder was found to be the best suited for commercial cultivation through its crisp head yield (580.5 g/plant) *(RHRTS, Bajaura)*.



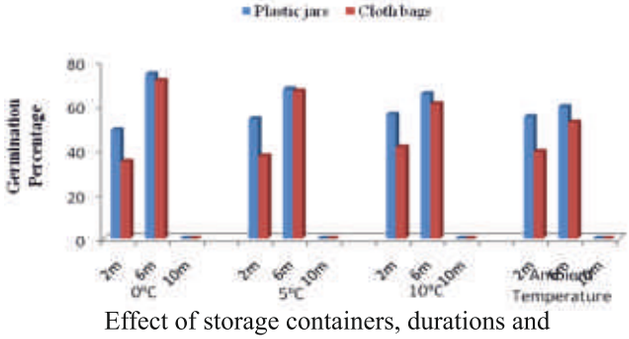
Field demonstration of Lettuce (Ryder)

- Broccoli hybrid Fiesta was found to give better yield in the farmers fields when planted during January with net head weight of 435.0 g/head *(RHRTS, Bajaura)*.



Field demonstration of Broccoli (Fiesta)

- An application of 0.50 cm irrigation at alternate day after the establishment of seedlings (15 days) through drip is found quite produtive and economical for capsicum and lettuce cultivation in naturally ventillated polyhouses in mid-hills *(VS, Nauni)*.
- In case of edible podded peas the earliest flowering was observed in Swarna Tripti i.e. 112.67 days after sowing, whereas the Arka Sampoorna took longest time (114 days) to flower. The maximum pod weight at harvest maturity was attained by the Toledo Sugar (300.60 g/100 pods), however it was loosely followed by the Swarna Tripti (291.56 g/100 pods) and Mithi Phali (286.67 g/100 pods) *(STPC, Nauni)*.



Effect of storage containers, durations and temperatures (CxDxT) on germination percentage

- Tomato cv. Solan Lalima plants should be trained to two stem and should be planted in double row at a distance of (60+30) x 15 cm to get maximum seed yield *(STPC, Nauni)*.



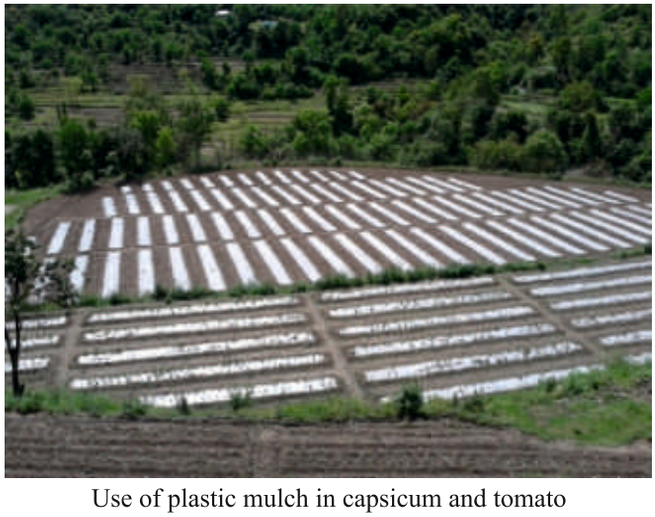
Tomato var. Solan Lalima fruits ready for seed extraction



Ripe fruits of bell pepper cv. Solan Bharpur ready for harvesting and seed extraction



Sowing of pea cv. Pb-89 in double row for seed production



Use of plastic mulch in capsicum and tomato for quality seed production



Coriander cv. Solan Selection in flowering

- The shading of lilium cv Bright Diamond and Golden Tycoon with 75 per cent plastic shade net resulted in the tallest stems (108.9 cm), longest lower flower buds (7.70 cm) and largest flowers (14.65 cm). The time of application of shade had no effect on the number of flower buds produced per plant and number of bulblets produced per plant *(RHRTS, Bajaura)*.



Cultivars Bright Diamond and Golden Tycoon under 75% shade level and without shade

- Total germplasm collection of 60 cultivars of carnation was enriched by adding 4 from local sources and 4 cultivars from Rise and Shine Biotech, Pune to make total collection of 68 cultivars. Maximum percentage of A grade flowers was recorded in cultivar Kelios (86.67%) which was found to be statistically at par with cultivars Golem (82.29%), Snow Storm (75.56%), Happy Golem and Diana Yellow (68.89%), followed by Angelica (66.67%) and Kelios (64.44%) *(FLS, Nauni)*.
- Under crop improvement programme of chrysanthemum, 40 new seedlings were selected for further growth and flowering studies. Testing of new cultivars of chrysanthemum reveals cultivar Vijay Kiran as earliest flowering followed by Pusa Anmol and UHFSChr-44 *(FLS, Nauni)*.
- Studies on the standardization of media and growth regulator for propagation of chrysanthemum cultivars revealed that rooting can be enhanced with vermiculite media after treating with NAA 500 ppm *(HRRTS, Dhaulakuan)*.



Some new selections of Chrysanthemum



Screening of different chrysanthemum cultivars/selections for off season cut flower production

- Three new cvs. of tulip namely Christmas Negrita, Golden Oxford and Bleeding Heart were procured from DFR under germplasm enrichment to make a total collection of 8. Based on the performance of cultivars, it was observed that cultivars namely; Red Impression, Benja Luka, American Dream, Rui-di-Midi and White Dream were found suitable under Solan, Nauni conditions for the vegetative, floral and bulb parameters *(FLS, Nauni)*.



Newly introduced cultivars of tulips

- Ten cultivars of daffodils were evaluated for growth and flowering parameters. Based on the performance it was found that cultivars Ice Follies, California Sun among the large flowered types and Geranium and Sir Winston and Local Collection among the small flowered types performed better as compared to other cultivars *(FLS, Nauni)*.



Newly introduced cultivars of daffodils

- Evaluation of cyclamen, gloxinia, rannanculus, tulip and tuberous begonia were done successfully and propagation techniques were standardized for these crops *(RHRTS, Mashobra)*.
- The studies on the introduction and evaluation of chrysanthemum germplasm revealed that cv. 'SL Red' (standard type) has been found promising w.r.t height, flower size, number of flowers and flowering duration. Cv. DKCS-Yellow (spray type) was excelling in plant height, flower size, earliness and flowering duration *(HRRTS, Dhaulakuan)*.
- Eighteen cultivars of dahlia were evaluated for their performance under sub-montane, sub-tropical low hill zone at Dhaulakuan of Himachal Pradesh. The results revealed that dahlia cultivars Maa Sharda and Giani Zail Singh excelled in stem sturdiness and produced attractive flowers *(HRRTS, Dhaulakuan)*.
- The experiment on the standardization of growing media in gerbera indicated that cv. Dana Ellen responded well to rice husk +soil media for producing good quality flowers w.r.t early flowering, number of flowers and vase life *(HRRTS, Dhaulakuan)*.
- Fifty four cultivars of gladiolus were evaluated for growth and flowering parameters. Different cultivars like, Thumbolina, White Prosperity, Punjab Dawn, Pricilla, Bis-a-Bis, Australian Fair, Darshan, Arka Kesar, Tilak, Eurovision, Suchitra, Novelty, Apowre, Novalux, Top Brass, Red Beauty, Spic and Span were found suitable for commercial cultivation *(FLS, Nauni)*.
- Hb1-8, Hb1-15-4, Hb2-52 and Hb15-B cultivars of gladiolus performed better for vegetative and floral traits and suitable for commercial cultivation under low hill conditions of Himachal Pradesh *(IBES, Neri)*.
- Pollyana and Alliana and White Casnada cultivars of lilium performed better for growth and quality of flowering traits and are suitable for commercial cultivation under low hill areas of Himachal Pradesh. Likewise, Purnima and Baggi cultivars of chrysanthemum performed





Vegetative stage of gladiolus



Hb-1-8



Hb-2-52



Hb-1-28

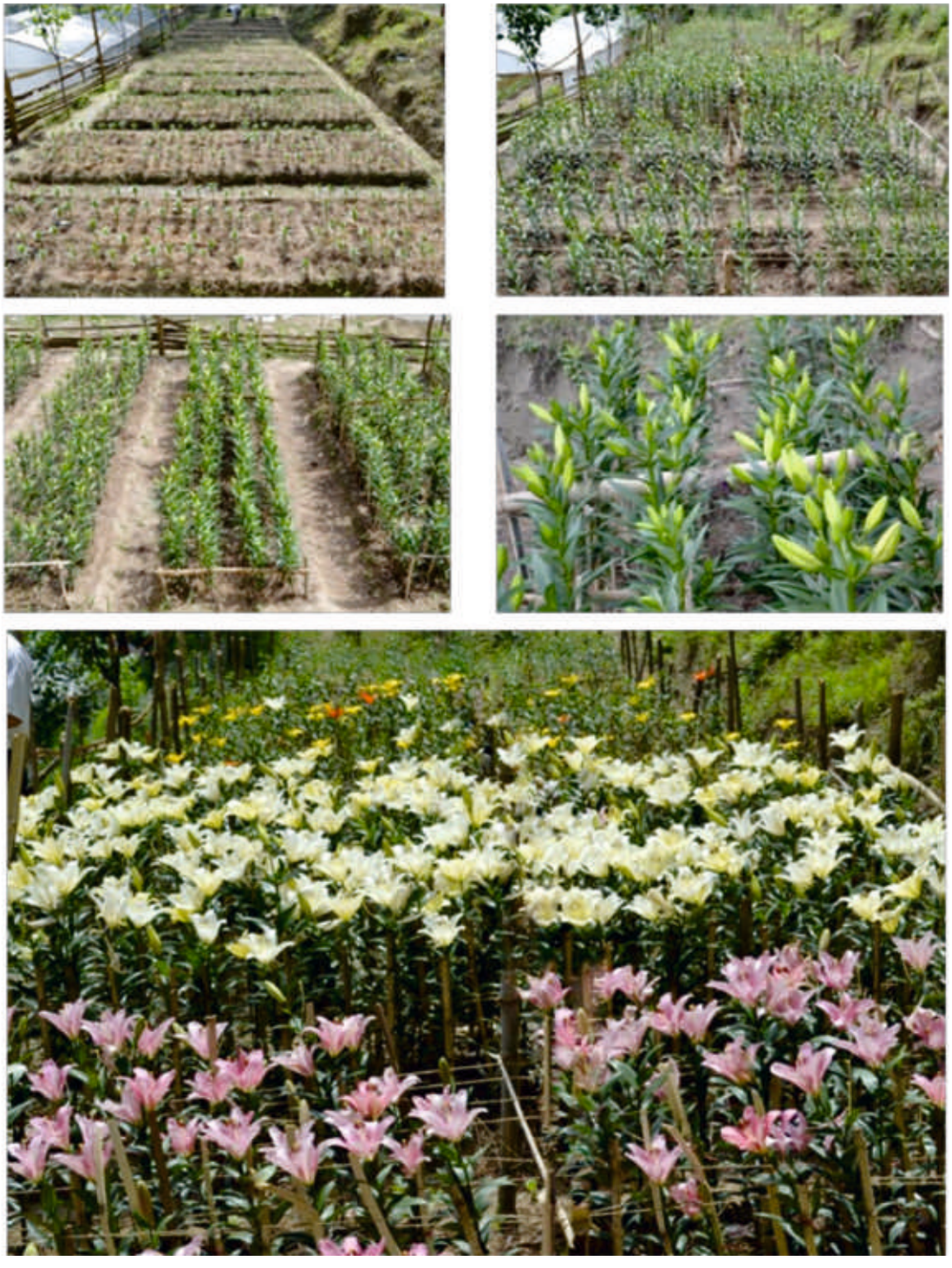


Hb-15-A

Cultivars of gladiolus

better for growth and quality of flowering traits and are suitable for commercial cultivation under low hill areas *(IBES, Neri)*.

- Among the existing seven cultivars of alstroemeria, it was found that cultivars Serena and Pluto and Cinderella performed better with respect to plant height. Maximum number of inflorescence was recorded in Pink Panther



Different stages of lilium

(55.00) followed by Serena (51.67). Maximum floret size (6.00 cm) was recorded in cultivar Cinderella and Riana followed by Serena (5.87 cm) and Pink Panther (5.70) *(FLS, Nauni)*.

- Over 50 crosses in gladiolus were attempted in the year 2013 involving different parents. However, evaluation of existing hybrids evolved showed the superiority of Hb 3-5, Hb 3-10, Hb 6-31, Hb 11- 17, Hb 1-8, Hb 2-50, Hb 3-28, Hb 1-24 and Hb 2-22 for most of the important parameters *(FLS, Nauni)*.
- Among different genotypes of marigold, in terms of flower production maximum was observed in Spary Max (125.20) which was found to be at par with Safari Queen (124.80), Sunkist (118.60) and French Bonita (118.80) *(FLS, Nauni)*.
- Different genotypes of marigold were evaluated and observed that plant height of different marigold inbred lines ranged between 35.80 cm to 53.20 cm. It was recorded maximum in Harmony Boy (53.20 cm) followed by Cupidon Orange (47.40 cm) and Safari Queen (46.60 cm). On the other hand, minimum plant height was recorded in French Bonita-6 (35.80 cm). It was however found to be at par with Double Dwarf Lemon (39.40 cm), Sunkist (38 cm), Spray Boy (39 cm) and French Bonita (35.80 cm). As regards plant spread, maximum plant spread was found in Single Petal Red (44.20 cm) which was found at par with Spray Boy (41.80 cm). Spread of the plant was found minimum in FM-786 (30.80 cm) *(FLS, Nauni)*.
- Studies conducted on planting density of carnation reveals that maximum 'A' grade flowers were produced at a planting density of 25 plants/m^2 followed by 35 plants/m^2 *(FLS, Nauni)*.

Evaluation of newly developed F_1 hybrids of marigold for growth and flowering during 2013

Hybrids	Plant height (cm)	Plant spread (cm)	Days taken to flowering	No. of flowers per plant	Flower yield per plant (g)	Flower diameter (cm)
ms_7 x Bonita Bolero	74.33	52.67	42.00	119.00	486.67	5.24
ms_7 x Spray Max	74.33	48.67	42.33	115.67	474.00	4.82
ms_9 x Bonita Bolero	69.33	47.67	40.33	140.00	550.00	4.71
ms_{10} x Spray Boy	65.33	53.33	46.33	129.67	527.00	5.13
ms_{10} x Bonita Bolero	70.67	49.67	45.33	114.33	493.33	5.17
ms_6 x French Bonita	51.67	50.33	42.67	143.00	553.33	4.87
ms_9 x Sunkist	53.67	52.33	44.67	138.67	581.67	4.87
ms_9 x Spray Max	42.33	56.33	43.67	147.67	558.33	4.80
ms_8 x Bonita Bolero	51.00	50.00	44.67	166.33	681.67	4.93
ms_{10} x French Bonita-6	49.00	47.67	45.33	133.67	676.67	4.90
ms_{12} x Harmony Boy	52.00	50.33	43.00	136.33	520.33	4.27
ms_9 x Pusa Narangi Gainda	45.00	48.67	42.83	131.33	565.00	4.83
ms_9 x Spray Boy	48.00	50.33	45.67	120.00	563.33	4.63
ms_8 x Spray Max	51.00	44.00	45.67	142.00	545.00	4.83
ms_4x FM -786	45.67	44.33	46.00	126.33	483.33	4.80
ms_4 x Harmony Boy	54.33	46.33	44.33	128.67	558.33	5.03
ms_9 x Bonita Bolero	53.00	46.67	44.33	126.00	508.33	4.93
ms_7 x Sunkist	51.67	49.00	47.33	129.00	521.67	4.87
ms_{10} x Harmony Boy	46.67	44.67	47.67	143.00	573.33	4.43
$CD_{0.05}$	3.85	3.58	2.39	3.07	13.70	0.14





View of the evaluation experiment on marigold

- It was found that the programmed bulbs of daffodils flowered slightly earlier, produced more number of leaves and longer scapes as compared to non-programmed bulbs *(FLS, Nauni)*.
- In chrysanthemum during off season production among different cultivars, Fiji Yellow took minimum number of days taken for bud showing colour and flowering (95.20 and 109.50 days), respectively. Whereas, maximum number of days taken for bud showing colour and flowering was taken by UHFSChr - 82 (130.60 and 140.40 days), respectively *(FLS, Nauni)*.
- Cut stems of Bird of Paradise when kept in holding solution containing 2 per cent sucrose + 300 ppm $Al_2(SO_4)_3$ resulted in increased number of florets open/stem (2.47), vase life (15.87 days), amount of vase solution consumed (25.67 ml/stem), increased reducing sugar content (438.40 mg/g), minimum non-reducing sugar content (87.18 mg/g) and minimum per cent weight loss (7.70) *(FLS, Nauni)*.
- Apart from recommended red coloured varieties in gladiolus, newly developed hybrid Solan Mangla is also recommended for commercial cultivation in Himachal Pradesh *(FLS, Nauni)*.
- Newly developed open pollinated hybrid of chrysanthemum Solan Shringar (white) among standard and, Solan Gaurav (yellow) and Solan Swarnima (yellow) among spray are also recommended for commercial cultivation in Himachal Pradesh *(FLS, Nauni)*.
- In carnation, cultivar Riberra (red) is also recommended for commercial flower production in mid-hills *(FLS, Nauni)*.
- Wrapping of cut stems of Asiatic hybrid lily cv. Apeldoorn with butter paper/cellophane sheet for six days at 4°C in cold store improved their longevity without losing potential vase life and quality of flowers *(FLS, Nauni)*.
- There were no significant differences among the propagation media with respect to the number of days to first visible leaf sprout and percentage of bulb scales developing bulblets. The largest bulblets measuring 1.56 cm in circumference were recorded in a propagation medium consisting of sand + soil + FYM (1:1:1 v/v) and leaf mould *(RHRTS, Bajaura)*.



Propagation of lilium using bulb scales
In different propagation media



Bulblets developed using bulblet scales

- The treatment of bulb scales with IBA generally reduced the number of days to first visible leaf sprout above the surface of the propagation medium and lower number of days were recorded when the scales were treated with 75 ppm IBA concentration The number of bulblets produced per scale and number of roots produced per bulblet increased with increasing IBA concentration up to 50 ppm (2.74) *(RHRTS, Bajaura)*.



Bulblet development using bulb scales with 50 ppm IBA



Bulblet development using bulb scales with 75 ppm IBA

- The dried materials of locally available flowering plants were given various treatments like bleaching, dyeing, colouring and painting to enhance their beauty. The dried material was painted and/or dyed and used for making different floral craft items like dry flower sticks, pot-pourries, greeting cards and birds *(FLS, Nauni)*.
- Beautiful value added products of *Acer oblongum* like dry flower sticks, dry flower arrangements, pot pourri, pomander etc. which possess commercial potential were prepared using these coloured samara. Value added product like dolls, gift items and key rings were prepared using these coloured maize sheaths *(FLS, Nauni)*.
- Work is continuing on major problems of apple like premature leaf fall caused by *Marssonina coronaria*, collar rot (*Phytophthora cactorum*) and core rot. As apple re-plant is a major problem, recommendations have been made on this important problem. Viruses are emerging as a potential threat in apple, indicators have been developed for the biological detection of four apple viruses. Work has also been carried out on green (*Penicillium digitatum*) and blue mould (*P. italicum*) rot in citrus. In ornamental crops, recommendations have been made for the management of diseases in marigold, carnation, chrysanthemum and rose. In evaluation of different strains of *Agaricus bisporus*, maximum yield was recorded in the strain AVT-13-01 *(PP, Nauni)*.
- Twenty one locations surveyed in Hamirpur, Bilaspsur, Una and Kangra districts of the state for recording the prevalence of mango decline. The results revealed that the disease severity ranged between 25.73 per cent (Bairi Rajdiyan, Bilaspur) to 64.68 per cent (Mataur, Kangra) while, disease incidence ranged between 50.0 per cent at Salauni in district Hamirpur and Nagrota Bagwan in district Kangra to 100 per cent at various locations in all the four districts.

Die back, gummosis and bark splitting symptoms and two fungal pathogens were found to be associated with the disease *(IBES, Neri)*.



Die back symptoms on mango trees



Gummosis and bark splitting symptoms on mango trees

- *Fusarium* sp. was found to be associated with stem rot and wilt disease of carnation in district Bilaspur. Mancozeb and combi formulation of hexaconazole + captan completely inhibited the growth of the fungus exhibiting 100 per cent growth inhibition while, carbendazim proved next best fungicide in terms of growth inhibition *(IBES, Neri)*.
- Baseline sensitivities of *Marssonina coronaria* causing premature leaf fall of apple to sterol inhibiting and strobilurin fungicides were established and observed in terms of mean EC_{50} values *in vitro* against the wild isolate. In sterol inhibitors, the baseline sensitivity for flusilazole, hexaconazole and difenoconazole was 0.075, 0.027 and 0.031 mg/l, respectively. For strobilurin fungicides, mean EC_{50} values observed for azoxystrobin, kresoxim- methyl and pyraclostrobin were 0.053, 0.036 and 0.012 mg/l, respectively. As far as the monitoring for fungicide resistant strains is concerned, mean EC_{50} value for the entire test population of *Marssonina coronaria* observed for dodine, mancozeb and carbendazim was 0.038, 0.237 and 0.096 mg/l, respectively. Highest mean resistance factor was observed for carbendazim (2.48) followed by 1.56 in dodine fungicide, thus showing no alarming situation in this regard up till now *(PP, Nauni)*.
- Out of ten new fungicides evaluated against collar rot (*Phytophthora cactorum*), three soil drenchings with Curzate (0.3%) during April, June and August were highly effective both under nursery (96.6 PDC) and orchard conditions with increased shoot length 36.2 cm against 5.7 cm in control untreated *(PP, Nauni)*.
- Biocontrol agents viz., *Trichoderma hamatum* - 2, *T. harzianum*-5 and *Bacillus* sp.-4 were found effective against collar rot pathogen (*Phytophthora cactorum*) and were also found compatible with effective fungicides Curzate and Cabrio top and provided enhanced (>98%) disease control when applied in combination with bio-control agents *(PP, Nauni)*.
- Addition of cow urine decoction (cow urine + *Melia azedarach* seed + *M. koeningi* + *Vitex* leaf) thrice @ 7.5 per cent (10 l/tree) during March, June and August accompanied with approach grafting (AG) was most effective against collar rot in apple and increased the shoot growth up to 39.1 cm against 6.8 cm in untreated plants *(PP, Nauni)*.
- Incidence of green (*Penicillium digitatum*) and blue mould (*P. italicum*) rot in kinnow fruits varied between 12.1 to 25.9 per cent. Maximum

incidence of green mould rot was recorded at Paonta Sahib (25.9%) in district Sirmour, whereas blue mould rot was highest at Nurpur (17.5%) in district Kangra. Combined application of difenoconazole + mustard oil (0.01% + 500 ppm) was most effective by exhibiting complete control followed by carbendazim + mustard oil (0.04% + 500 ppm) with 2.40 PDI. Pre and post inoculation applications of yeast antagonist *Pichia anomala* were quite effective (4.37-6.23 PDI) in controlling the green mould rot of Kinnow fruits under storage conditions *(PP, Nauni)*.

- Nine combinations of treatments were evaluated for the management of apple re-plant problem and out of them five combinations viz. (1) formaldehyde soil fumigation + wheat as cover crop + soil application with AM fungi and BCA formulation + M-793 rootstock, (2) formaldehyde soil fumigation + wheat as cover crop + soil application with AM fungi and BCA formulation + MM-111 rootstock, (3) soil bio-fumigation with brassicas + wheat as cover crop + soil application with AM fungi and BCA formulation + M-793 rootstock, (4) Soil bio-fumigation with brassicas + wheat as cover crop + soil application with AM fungi and BCA formulation + MM-111 rootstock, and (5) soil bio-fumigation with brassicas + wheat as cover crop + MM-111 rootstock + Ridomil MZ (0.4%) soil drench were found effective with no mortality in plants in comparison to 60 per cent in control. Annual shoot growth of the apple plants in different treatment combinations was 62.1 to 332.4 per cent more in comparison to untreated control and the maximum annual shoot growth was observed in the treatment combination 1, 4 and 5 *(PP, Nauni)*.
- Water-based and cow urine-based bio-formulations with six botanicals namely, Artemisia (*Artemisia roxburghiana*), tulsi (*Ocimum sanctum*), karvya (*Roylea elegans*), darek (*Melia azedarach*) and bana (*Vitex nigundo*) were found effective with 66.3 and 72.7 per cent reduction of *Botryosphaeria dothidea* causing white rot in apple *(PP, Nauni)*.
- Simultaneous detection of four major viruses of apple (mosaic, chlorotic leaf spot, stem pitting and stem grooving) by employing Direct Antigen Coating (DAC) and Double Antibody Sandwich (DAS) forms of ELISA has been standardized for the detection of two new viruses of apple namely apple stem pitting virus and apple stem grooving virus *(PP, Nauni)*.
- A technology for the biological detection of four apple viruses namely apple mosaic virus, apple chlorotic leaf spot virus, apple stem pitting virus and apple stem grooving virus using four indicators viz. Virginia crab, *M. platycarpa*, Spy 227, Jay Darling and Russian Clone has been standardized for the first time and this technology is economic and simple in comparison to the serological detection and can be used by the farmers at their own level *(PP, Nauni)*.
- Fungicides IIF 311 (0.1%, 0.125%) and IIF 411 (0.45% and 0.50%) were found effective in control of buckeye rot, late blight, fruit rot and *Alternaria* blight of tomato and increased the yield *(PP, Nauni)*.
- Application of Acibenzolar-S-methyl (10µM) resulted in the highest reduction in downy mildew (*Pseudoperonospora cubensis*) diseases incidence and severity in cucumber plants grown under plastic house as well as open field condition followed by DL-β-amino-n-butyric acid (BABA) at the low concentrations (10 mM, 20 mM) and oxalic acid (20 mM). However, all the treatments increased the yield significantly compared to un-treated control *(PP, Nauni)*.
- During the month of March-April, 2013 wherein, nine different materials viz., fallen and dried leaves of *Salix fragilis* (willow vern. changma), *Lactocera sericola* (vern. nechaapa), *Populus ciliata* (poplar) and *Malus domestica*

(apple); whole aerial plant parts of *Pisum sativum* (pea), *Iris* sp. (vern. thehma) and one local grass called Congsasa grass as well as dried straw of *Hordeum* sp. (vern. Gandhum), used and dried tea leaves were tested as substrates for the cultivation of *Pleurotus sajor-caju, P. ostreatus, P. florida* and *P. eryngii*. On an average, wheat straw supported the production of maximum number of sporocarps (82.61) followed by gandhum, changma and poplar species, irrespective of *Pleurotus* spp and method of sterilization. Significantly higher number of sporocarps were recorded in *P. sajor-caju* (60.30) followed by *P. florida* (50.91) and *P. ostreatus* (47.90). The maximum average yield (0.831 kg) was recorded in *P. sajor-caju* significantly followed by *P. florida* (0.741 kg) while, minimum (0.085 kg) yield was recorded in *P. eryngii,* irrespective of different substrates *(RHRSS, Tabo)*.

- During studies on cultivation of oyster mushroom with supplementation of waste paper in different substrates. The waste paper was supplemented @ 6 per cent (on dry weight basis) at the time of spawning in all the treatment combinations along with the standard check. The fastest mycelia development (26 days), pin head formation (32 days) , fruit body formation (36 days) and the highest yield (1.847 kg) were observed with the substrate composed of poplar + wheat straw supplemented with waste paper @ 6 per cent, while, lowest yield (0.860 kg) was recorded in the substrate composed of fungma (local wheat) alone *(RHRSS, Tabo)*.



Oyster cultivation at RHRSS, Tabo

- The conjoint use of Rhizobium+ PSB+ organic manure in French bean cultivar Contender recorded highest number of pods per plant (22), pod length (15 cm) and pod yield (165 q/ha). Different treatment combinations were also screened for angular leaf spot and anthracnose. Disease incidence of Angular leaf spot and Anthracnose was found lowest with treatment consisting of Rhizobium+PSB+ organic manure *(RHRTS, Sharbo)*.
- Among various non-chemical practices for the management of *Fusarium* wilt of pea (*Fusarium oxysporum* f. sp. *pisi*) under field condition, seed treatment with talc based formulation of *Trichoderma viride* was effective *(PP, Nauni)*.
- The field evaluation of brand name fungicides against Alternaria leaf spot of apple, twelve new fungicide formulations were tested and observed lowest per cent disease severity against Alternaria leaf spot of apple with fungicide formulations namely Nativo (0.04%), Fil 001 (0.06%), Maccani (0.1%), Caviet (0.025%), Mact-01 (0.175%), Avtar (0.3%), Manfil (0.3%), Pristine (0.03%), and BAS 703 01F (0.015%) in comparison to control *(TH&FRTS, Kotkhai)*.
- Trial on field evaluation of brand name fungicides against powdery mildew of apple revealed that out of twelve new fungicide formulations tested, fungicide formulations namely Nativo (0.04%), Fil 001 (0.06%), Maccani (0.1%), Vivando (0.015%), Caviet (0.025%) and Mact-01 (0.175%) had lowest per cent disease severity against powdery mildew of apple in comparison to control *(TH&FRTS, Kotkhai)*.
- Different brand name fungicide formulations namely Zed-78, MACT-01, Vivando SC, BAS7030 1F, Pyraclostrobin, Fluxapyroxada, Fluxapyroxed + Pyroclostrobin, Nativo and Contaf were tested in which; Vivando (0.15%) gave maximum control of apple powdery

mildew where 84.99 per cent control was achieved. This was followed by Nativo (0.05%) and Contaf (0.03%), where 83.54 and 79.87 per cent control was observed. The least control of 44.44 per cent was recorded, where Z-78 was applied *(RHRTS, Mashobra)*.

- Fungicide formulations namely BAS 70301F, Maccani 16 WG, Zed 78, Trifloxystrobin 25 per cent + Tebuconazole 50 per cent were tested against Marssonina blotch of apple. BAS 703 1F, Avtar and Trifloxystrobin 25 per cent + Tebuconazole 50 per cent gave maximum control of disease i.e. 96.33, 91.58 and 90.18 percent followed by Maccani and Antracol *(RHRTS, Mashobra)*.
- DAS-ELISA protocol has been standardized for the serological detection of a new type of virus producing ring spots on capsicum fruits and leaves. The causal virus has been found to be infecting tomato and a wide range of ornamental plants under open and protected conditions *(PP, Nauni)*.
- In the management of leaf spot and flower blight disease of marigold, spraying with non-systemic fungicides mancozeb, captan, zineb and thiram @ 0.2 to 0.3 per cent was found effective with per cent disease control ranging between 60.96 to 74.10 per cent. In systemic fungicides, disease severity was reduced up to 61.71 per cent by difenoconazole (0.03%) *(PP, Nauni)*.
- Score was found most effective for the management of powdery mildew of rose (*Sphaerotheca pannosa*) in the poly-house with 100 per cent reduction in the disease index followed by Contaf and Tilt with 98.0 and 93.7 per cent reduction, respectively *(PP, Nauni)*.
- Quintal was found the best for the management of black spot of rose (*Diplocarpon rosae*) with 97.3 per cent reduction in the disease index followed by Saaf and Indofil M-45 with reduction of disease index by 96.3 and 94.5 per cent, respectively *(PP, Nauni)*.
- In the management of wilt (*Fusarium oxysporum*) and collar rot (*Rhizoctonia solani*) in chrysanthemum, soil solarization along with neem cake amendment was found at par with soil solarization followed by drenching with Quintal providing 100 per cent disease control *(PP, Nauni)*.
- Cabrio Top followed by Indofil M-45 was found most effective for the management of Alternaria blight (*Alternaria dianthi*) of carnation with 97.9 and 95.6 per cent reduction in disease index, respectively in comparison to control. Cabrio Top also resulted in 175 per cent increase in the flower yield and 522 per cent increase in A- Grade flowers over control. Field formulation comprising of botanicals and cow urine was found effective with 78.3 per cent reduction in disease index, 137.5 per cent increase in the total flower yield and 377.7 per cent increase in A-Grade flowers over control *(PP, Nauni)*.
- Screening of different cultivars of chrysanthmum revealed virus like symptoms under field conditions and DAS-ELISA based serological detection has resulted in the detection of chrysanthemum B carlavirus *(PP, Nauni)*.
- Two new pathogens of medicinal plants, viz. *Botrytis cinerea* and *Phyllosticta minima* were recorded on *Canna edulis* and *Catharanthus roseus*, respectively causing leaf blight symptoms *(PP, Nauni)*.
- Different strains of *Agaricus bisporus* viz. AVT-13-01, AVT-13-02, AVT-13-03, AVT-13-04, AVT-13-05 and AVT-13-06 were evaluated and maximum yield of 20.34 kg per 100 kg compost was recorded in the strain AVT-13-01 followed by 19.4 kg of AVT-13-02. Highest average fruit body weight of 12.85 g was in AVT-13-01 *(PP, Nauni)*.
- The survey and surveillance of Paonta valley has revealed that the powdery mildew disease has

been noted in various crops e.g., vegetables: capsicum (*Laveillula taurica*), flowers: Dahlia (*Erysiphe cichoracearum*) and frutis: mango (*Oidium mangeferae*). Disease incidence for dahlia was highest (100%), whereas in capsicum it was observed to be 70 per cent and mango has registered 20 per cent disease incidence *(HRRTS, Dhaulakuan)*.



Dahlia





Capsicum
Powdery mildew symptoms

- Apple scab (*Venturia inaequalis*) was found to occur in Manikaran valley in three pockets of Kullu district during the period under report. The incidence of the disease was recorded to the tune of 13.3, 13.9 and 12.3 percent on leaves and 4.3, 4.5 and 6.1 per cent on fruits in Barshaini, Tahuk and Tosh areas, respectively. There was no occurrence of the disease in other areas of Kullu *(RHRTS, Bajaura)*.
- Out of eight new brand fungicides tested for apple scab, the fungicides Maccani (0.1%), difenoconazole (0.04 & 0.06%), Mact-01 (0.17%), Zed-78 (0.2 & 0.25%) and flusilazole (0.004%) provided complete control. BAS 703 at 0.15 per cent provided 88.6 per cent control of apple premature leaf-fall *(RHRTS, Bajaura)*.
- For the control of leaf curl disease of peach nectarine application of captan (0.3%) at bud swell stage showed better efficacy (98.5%) as compared to carbendazim (0.05%) which provided only 76.43 per cent disease control *(RHRTS, Bajaura)*.
- A general spray schedule has been formulated for the control of different diseases of pomegranate. Out of three schedules tested, two schedules were found highly effective and economical with high C: B ratio (1:3.4) as compared to farmer's practices (1:1.68). Spray should be initiated during 1st week of June and in total 6-7 sprays were needed to be done at 12-15 days intervals along with suitable sticker as carbendazim + mancozeb (0.25%)/propineb (0.3%) - hexaconazole (0.05%)/Difenoconazole (0.02%) - copper oxychloride + streptocycline (0.2+0.01%)/Bactinash (0.05%) - captan (0.3%)/captan+hexaconazole (0.15%) - zineb + hexaconazole (0.3%)/cumin L (0.3%) - carbendazim (0.05%)/captan (0.3%) *(RHRTS, Bajaura)*.
- For managing wilt disease in pomegranate which is mainly caused by *Ceratocystis fimbriata* and *Fusarium oxysporum* an effective

package has been developed after testing in the farmers fields. In a bush always keep 3-4 stems, raise the beds towards stems to avoid stagnation of water near the collar region. As and when wilting symptoms (yellowing of leaves and drooping of branches of affected stem) appears, immediately cut the affected stem at the soil level. Displace the soil around the stems to make a shallow pit and drench three times at 12-15 days interval with either propiconazole (0.2%) or carbendazim (0.1%). Apply 7-8 L of solution per plant and cover with soil. In the solution also add chlorpyriphos (0.1%) to check the manifestation of stem borer (*Xyloborus* spp.) as it helps in the development of the disease *(RHRTS, Bajaura)*.

- For the control of bacterial blight disease on soft seeded cvs. such as Sindhuri, Arakta and Mridula, three applications of mixture of streptocycline (0.015%) + copper oxychloride (0.25%) at 12-15 days interval were highly effective. Three applications of Panchgavya (cow urine preparation) @ 15 per cent were also found quite effective *(RHRTS, Bajaura)*.
- Severe outbreak of phytophagous mites was observed in all the apple growing belts of Kullu valley due to high temperature during mid May to mid June during 2013. *Helicoverpa* spp. larvae and mealy bug were found to damage fruits of the pomegranate in Kullu. High populations of woolly apple aphid were observed in upper valley areas of Kullu district *(RHRTS, Bajaura)*.
- New pesticides Athena(R) and Bifenthrin(R) at 0.006%, 0.008% and 0.01% and Propargite(R) at 0.057% concentration were found effective against the phytophagous mites on apple for 21 and 14 days, respectively *(RHRTS, Bajaura)*.
- A natural hut made up of bamboos, covered with jute cloth and internally lined with black polythene sheet with two vents at front and back was constructed for the cultivation of button and oyster mushrooms and both types of mushrooms were cultivated successfully in this structure *(IBES, Neri)*.



Crop of AVT-13-01

- Indoor compost production using thermophillic fungi like *Scytalidium thermophilum* (X-21 strain) and *Humicola insolens* (I-33) was found better with 18.92 kg yield per 100 kg compost as compared to 14.97 kg in short method of composting *(PP, Nauni)*.

- Studies on the management of bacterial spot of tomato revealed that foliar spray of combination of streptocycline (0.01%) and copper oxychloride (0.3%) at an interval of 7-10 days reduced bacterial spot effectively and exhibited 77.30 per cent disease control followed by bactrinashak (0.03%) which gave 70.06 per cent disease control over farmer's practice (copper oxychloride @ 0.03%) *(HRTS & KVK, Kandaghat)*.
- Pre sowing disinfection of nursery beds with 5 per cent formalin prior to tomato sowing was found to be most feasible and effective measure to produce nematode free healthy nursery. These healthy tomato seedlings, when root dipped in carbosulfane neem formulation for 1-2 hours prior to transplantation in nematode infected field amended with neem cake 15 days prior to transplanting produced better fruit yield and plant status as compared to untreated control. Cucumber transplants also produced better yields in neem cake amended field/poly house. Heavy galling and high nematode count at the termination however, indicated that the applied organic amendments improved the yields by improving the plant status and had little impact on nematodes *(Ento, Nauni)*.
- Studies on the activity and emergence of apple root borer, *Dorysthenes huglii* adults revealed that first apple root borer adult emergence was observed on 26th July, 2013 which further continued up to 30th August, 2013. The maximum emergence of root borer adults was observed on 20th July, 2013. The beetle emergence was more on the rainy day. The continuous installation of light traps over three years revealed a decline in total number of adult beetles trapped as well as infestation of plants. *Streblote siva* Lefebvre, 1827 (Lasiocampidae: Lepidoptera), originally a insect pest of Drumstick trees and rose, was for the first time observed infesting apple plants at the Sharbo farm as leaf feeder. There are two generations in a year and activity in the orchard occurs during May-September *(RHRTS, Sharbo)*.



Egg mass



Caterpillar



Adult female

- Studies on control of woolly apple aphid by soil-root drenching at petal fall stage with imidacloprid at two different concentrations along with carbofuran and chlorpyriphos as standard checks revealed that 3 and 5 ml/plant doses were found quite effective for the management of woolly aphid on 15 years old Oregon Spur apple plantation *(RHRTS, Sharbo)*.
- Studies were carried out on the foraging activity, density and diversity of insect pollinators on apple bloom. These studies revealed that *Eristalis tenax* was the most abundant among insect pollinators followed by *Apis cerana, Anderina* sp. and *Apis mellifera* among others. The foraging rate i.e. the number of flowers visited/minute was maximum in *A. mellifera* followed by *A. cerana* and *E. tenax*. The foraging constancy i.e., time spent per flower in seconds were maximum in *E. tenax* (15.8 sec.) followed by *A. cerana* (5.3 sec.) and *A. mellifera* (4.4 sec.) *(RHRTS, Sharbo)*.



Defoliator of pista seedling

- Heavy infestation of the processionary caterpillar *Thaumetopoea cheela* Moore (Notodontidae : Lepidoptera) was observed as defoliators of pista seedling plantations at RHR&TS, Sharbo. Its original known host is *Cotinus coggygria.* The number of eggs per field collected cluster ranged from 93 to 236 with an average of 179. Each female lays only one cluster of eggs on the bark of the branches and remains there for several years after hatching *(RHRTS, Sharbo)*.
- Cent per cent pista seedling plants were found infested with processionary caterpillar. However, the grafted pista plants imported from USA were rarely attacked by this moth, although some egg masses or clusters were observed on these plants also, but either egg hatching was very less or larval development could not take place. Another insect recorded on pistachionut plantation during May-June for the first time is *Autographa* cf. *purpureofusa* (Hampson, 1894) Noctuidae : Lepidoptera, originally a pest of cabbage or sugar beet *(RHRTS, Sharbo)*.



Eggs



Caterpillar



Adult mot

- In an experiment conducted on effect of horticultural mineral oil (HMO) and acaricide on the activity of pollinator on apple bloom, it was found that HMO and acaricide decreased the bee activity by 33-40 and 16 per cent, respectively but miticides fenezaquen was able to increase the bee activity by 35 per cent *(RHRTS, Mashobra)*.
- Yellow sticky traps have been found to be effective in oyster mushroom cropping rooms to reduce the incidence and damage caused by dipteran *Sciara* flies *(Ento, Nauni)*.
- Among five intercrops tested viz., sesame, marigold, maize, soybean and chinopod, the fromer three did not allow the root- knot nematode; *Meloidogyne incognita* (major nematode) to appear in the rhizosphere of tomato *(Ento, Nauni)*.
- The nematode *Pratylenchus coffeae* was recorded as the most prevalent in all the ginger growing localities of Himachal Pradesh (with its frequency of occurrence and population density up to 83 per cent and 5600/200 cc soil, respectively), followed by *M. incognita* (frequency of occurrence and population density up to 67 per cent and 4200/ 200 cc soil, respectively) *(Ento, Nauni)*.





Crop status of tomato and cucumber when transplanted in nematode infected polyhouse soil amended with neem cake

- For the first time in the country, bumble bee colonies were established in the field successfully and maintained round the year. Worker bee population was upto 200 bees/colony. This step is a major breakthrough in the country and will useful in the commercialization of bumble bee colonies for the pollination of protected crops *(Ento, Nauni)*.



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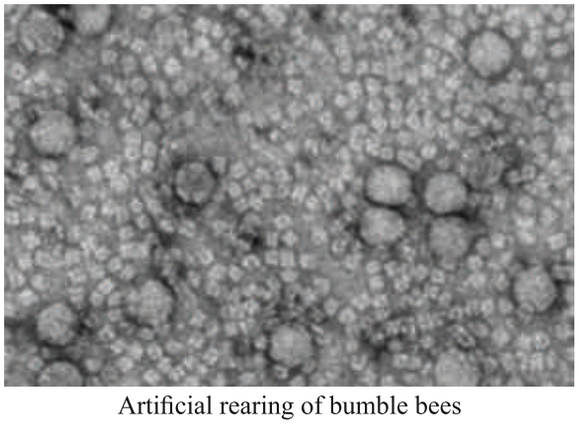


Artificial rearing of bumble bees (*Bombus haemorrhoidalis)*



Bumble bee colony kept in the field



Well developed colony in the field
mud hive placed in the field



Mating of bumble bee queen and drone



Domiciles of bumble bee colonies
kept in newly created facility

- Formic acid and thymol are more effective against the mite infestation in the broods of honey bee colonies, whereas, lactic acid is more effective when the mite population is more on adult bees *(Ento, Nauni)*.
- There was significant difference in the abundance of insect visitors with respect to time i.e., the pollinators were most abundant during morning hours with an average of 0.53 and 0.44 at 60 and 100 m distance as compared to 0.32 and 0.33 pollinators during evening hours, respectively *(Ento, Nauni)*.
- Among different biopesticides evaluated against apple root borer, *Dorysthenes hugelii* under field conditions, *Metarhizium anisopliae* (10^6 conidia/cm^2) was the best resulting in 82.6 per cent control of the pest which was at par with chlorpyriphos (0.06%) where 87.5 per cent control was achieved *(Ento, Nauni)*.



Fungus infected apple root borer larvae

- The predatory mite, *Neoseulus longispinosus* when released at 1:10 ratio against two spotted spider mite, *Tetranychus urticae* on rose resulted in 91.2 per cent reduction of the pest over untreated control which was statistically at par with fenazaquin (0.0025%) which resulted in 92.1 per cent reduction *(Ento, Nauni)*.
- *Neoseiulus longispinosus* was evaluated at predator: prey ratio of 1:10, 1:20 and 1:30 in comparison with Neem Baan (1500 ppm; 3 ml/l) and fenazaquin (0.0025%) which is a standard recommended insecticide for the control of phytophagous mites. Among different bio-

pesticides or bio-agents, *N. longispinosus* at 1:10 predator: prey ratio was the best resulting in 91.2 per cent reduction in mite population over untreated control which was also at par with the chemical treatment of fenazaquin (0.0025%) which caused 92.1 per cent reduction of the mite population over control *(Ento, Nauni)*.

- White scale, *Chlidaspis asiatica* infestation in apple was recorded in the samples provided by the farmers of Kotkhai and Ratnari areas of district Shimla. The new growth and branches were found to be covered with the scale. The extent of infestation was around 40 per cent, during February-March, 2014 *(Ento, Nauni)*.
- In cherry growing (Thanedhar and Bahli) areas, the fly infestation in ripening fruits was recorded during May-June, 2013. The extent of infestation ranged between 30-50 per cent. The affected fruits harboured larvae of the fly and were not fit for human consumption. These affected fruits fell off the trees and also got shrivelled on the trees itself *(Ento, Nauni)*.
- A field trial laid out at Thanedhar for evaluation of acaricides namely propargite and bifenthrin against phytophagous apple mites revealed propargite 57 per cent EC (M/s Willowood Chemicals Pvt. Ltd.) @ 0.057 per cent effective in managing the mites and was at par with the already recommended propargite 0.057 per cent (Omite 57 EC) *(Ento, Nauni)*.
- During the course of study 37 species of coccinellid beetles were recorded from different agro-climatic zones of Himachal Pradesh of which *Coccinella septempunctata*, *Hippodomia variegata*, *Cheilomenes sexmaculata*, *Oenopia* spp and *Chilocorus nigrita* were the dominant species *(Ento, Nauni)*.
- Among the four pesticides, viz., NSKE (5%, 7%) darek seed extract (5%, 7%), neem powder 3000 (1 ml and 3 ml/l) and imidacloprid (0.8 ml/l) evaluated against serpentine leafminer, *Liriomyza trifolii* in tomato under polyhouse conditions., imidacloprid was found to be quite effective in reducing the population of this pest *(Ento, Nauni)*.
- Thiamethoxam (0.35 g/l), diafenthiuron (1 g/l), imidacloprid (0.3 g/l), thiacloprid (0.5 ml/l), dimethoate (2 ml/l) and spiromesifen (0.8 ml/l) were effective in managing the population of the cotton jassid in okra *(Ento, Nauni)*.
- Deltamethrin (0.5 ml/l), imidacloprid (0.5 ml/l) and acephate (1 g/l) were found to be effective against aphid in two months old capsicum under protected conditions after two sprays which were repeated at an interval of 15 days *(Ento, Nauni)*.
- Intrinsic toxicity of darek seed extract was studied under laboratory conditions against serpentine leafminer, *Liriomyza trifolii* infesting tomato. On the basis of this study, LA_{50} (LC_{50}) was calculated to be 0.40 per cent (Fiducial limit 0.2439 and 0.550%) whereas LA_{90}(LC_{90}) was 0.473 per cent (Fiducial limit 0.322 and 0.62%), respectively *(Ento, Nauni)*.
- Bare root dips of seedlings in botanicals having nematicidal principle also supported as deterrents against nematodes for some time and thereby supporting better plant growth. Dipping exposure of 60 and 120 minutes were found to be best in different parameters *(Ento, Nauni)*.
- Monitoring of various food commodities during April 2013-March 2014 approximately 812 numbers of samples have been analysed, out of which pesticide residues, 2.5 per cent samples exceeded the maximum residue limit. However, some non-registered pesticides with the CIBRC were also detected in food commodities *(Ento, Nauni)*.
- The Pesticide Residues Laboratory has undergone the final assessment by the National Accreditation Board for Testing and Calibration Laboratories (NABL) for accreditation using the criteria and procedures specifically developed to determine technical competence as per ISO/IEC 17025 *(Ento, Nauni)*.

- Most commonly encountered pesticides in the food commodities were chlorpyrifos, profenofos, ethion, dicofol, malathion, EBDC etc. Among these pesticides, only chlorpyrifos was detected above MRL *(Ento, Nauni)*.
- An efficient and reproducible method for shoot regeneration from leaf explants of apple rootstock Merton 793 was developed. Maximum shoot regeneration was reported on 0.8 and 0.6 mg/l TDZ with 1 mg/l NAA in light. Dark treated leaves showed low rates of regeneration with TDZ combinations *(BT, Nauni)*.



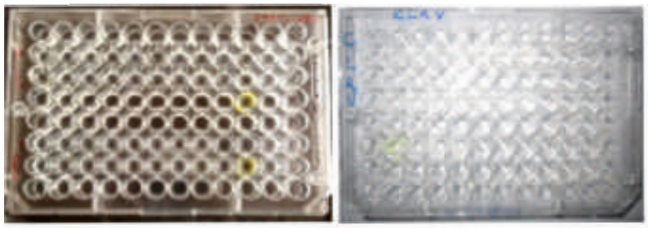
Direct shoot regeneration in M793 from leaf explants

- In case of micropropagation of clonal rootstocks of stone fruits twigs of Julior and Behmi the MS basal medium supplemented with 2.0 mg/l BAP and 1.0 mg/l GA_3 found to be the best for Julior giving 20 per cent and MS basal supplemented with 2.0 mg/l BAP and 1.0 mg/l Kn proved to be the best for Behmi giving 45 per cent sprouting of buds *(BT, Nauni)*.
- Protocol was developed for *in vitro* morphogenesis through direct and indirect somatic embryogenesis and organogenesis in *Gentiana kurroo* by providing different growth regulators and culture conditions *(BT, Nauni)*.
- A protocol for *in vitro* propagation and conservation was developed for *Swertia chirayita.* The sterilized explants (leaves) cultured on MS medium supplemented with 0.1 mg/l NAA and 3.0 mg/l BA for *in vitro* callus induction and shoot regeneration and MS medium supplemented with 2.5 mg/l BA and 0.1 mg/l Kinetin was used for *in vitro* shoot multiplication. Shoots were rooted on half strength MS medium supplemented with 400 mg/l activated charcoal and 0.1 mg/l NAA. *In vitro* conservation was carried out by using two different approaches namely slow growth by changing media composition (sucrose and abscisic acid), at low temperature and cryopreservation following vitrification.With increase in concentration of sucrose and ABA decrease in growth of *in vitro* shoots was observed. At low temperature the *in vitro* shoots incubated at 4°C, showed 100 per cent retrieval, with 1.00 cm average number of shoots, 0.86 cm shoot length and 0.34 cm leaf size *(BT, Nauni)*.



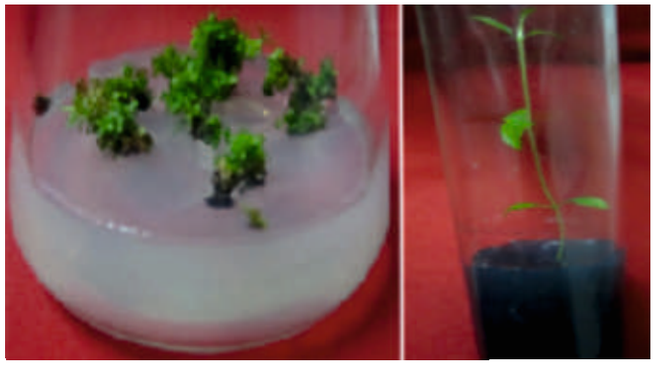
In vitro propagation of *Swertia chirayita*

- Flower petals were procured from elite selected trees of peach, plum and nectarine varieties Snow Queen, Glow Heaven, Santa Rosa, Frontier, July Elberta, May Fire and indexed for PNRSV, ACLSV, CLRV some of the potent viruses of stone fruits prevalent in India. All the selected trees gave negative results for all the tree viruses on ELISA. Leaf buds were taken as explants for establishment of *in vitro* cultures. 90 per cent establishment was achieved on MS medium supplemented with 1.0 mg/l BA. The established buds were multiplied on MS medium supplemented with 1.0 mg/l BA + 0.5 mg/l GA_3 *(BT, Nauni)*.



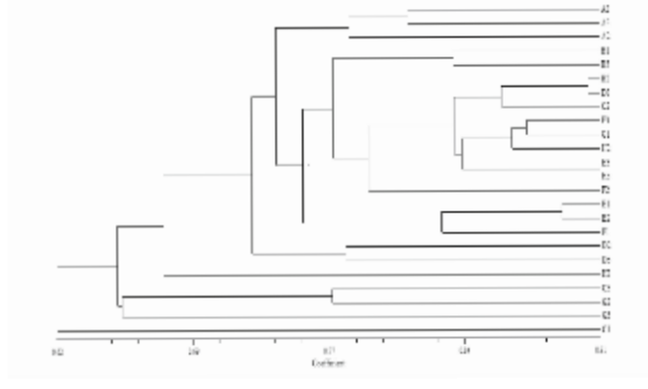
ELISA teating against ACLSV and PNRSV (a) and CLRV (b)

- *In vitro* selection of cell lines in *Punica granatum* L. (Daru) against bacterial blight was conducted on MS medium. Cell line selection was done by using bacterial culture filtrate of *Xanthomonas axonopodis* pv. *punicae* as a selective agent. Resistant lines were selected at 40 per cent level of culture filtrate after two cycles of selection. After *in vitro* testing of shoots regenerated from selected calli 4 resistant plantlets were obtained *(BT, Nauni)*.



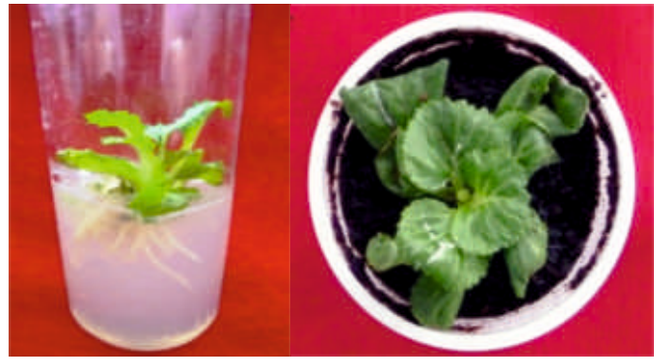
In vitro selected plants of *Punica granatum* (Daru) showing resistance against bacterial blight

- A high frequency plant regeneration protocol was developed under *in vitro* conditions for cauliflower and blue berry *(BT, Nauni)*.
- Linkage map of *Stevia rabandiana* constructed using multiple marker systems by MAPMAKER/EXP ver 3.0b F_2 population was used as a mapping population for linkage map construction. A total of four linkage groups were constructed spanning a distance of 927.3 cM. LG1 comprised 33 markers, LG2 6 markers and LG3, LG4 had 16 and 2 markers respectively. Among 53 QTL locations of rebaudioside-A, two major QTLs were found for rebaudioside-A viz., in the marker interval of L67- L71 (ISSR HB-11) - (IISRS-3-L) in LG1 and in the marker interval L38 - L40 (Sigma-5383-027) - (Sigma-5383-029) in LG3 at LOD of 2.5 and 2.7, respectively *(BT, Nauni)*.
- *Aloe vera* germplasm collected from different areas of Himachal Pradesh was characterized using morphological, biochemical, RAPD and ISSR markers. On the basis of morphological and biochemical characters very low variation was found. In RAPD analyses, a total of 91 bands were amplified, out of which 82 were polymorphic, however, for ISSR markers, 21 bands were polymorphic out of 24 bands. On the basis of dendrogram formed by RAPD and ISSR markers 57-100 per cent of genetic similarity was obtained forming two clusters *(BT, Nauni)*.



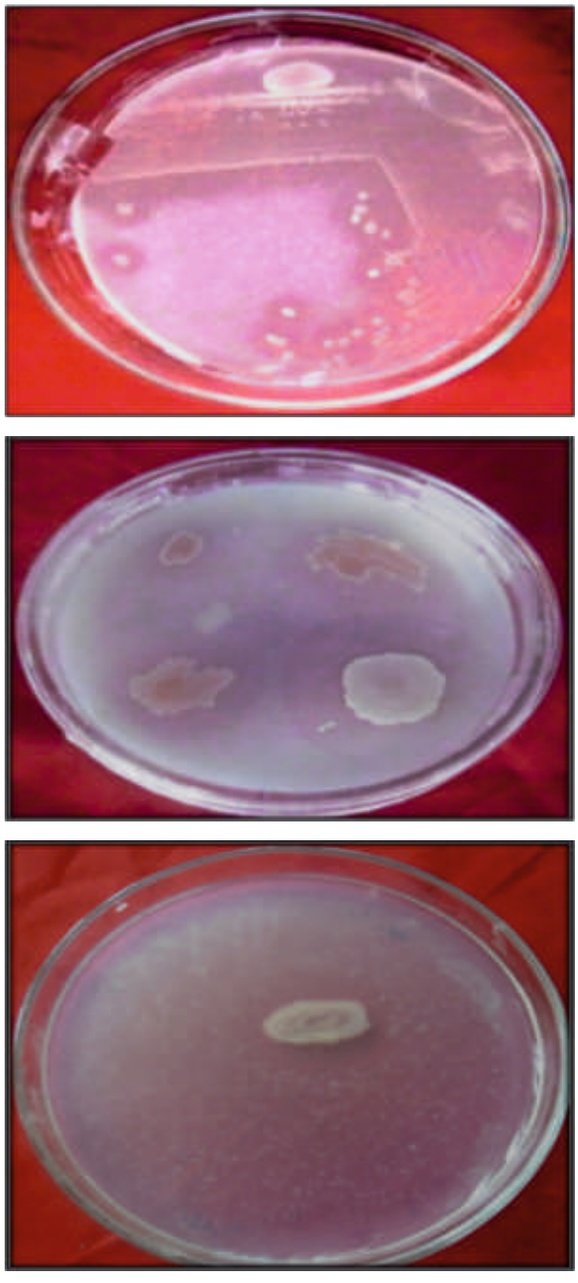
Dendrogram showing genetic relatedness among 24 genotypes of *Aloe vera* based on RAPD primers

- Molecular characterization of lettuce (*Lactuca sativa* L.) genotypes using RAPD was carried out to study the genetic relationship among various genotypes. Twenty five lettuce genotypes were selected and total of 45 primers were tried to generate RAPD profile, out of these reproducible patterns were obtained with 22 primers. A total of 87 bands were obtained out of which all were polymorphic showing 100 per cent polymorphism and seven primers have shown unique bands with specific genotypes *(BT, Nauni)*.
- Molecular characterization of root rot resistant somaclone of apple rootstock M7 was compared with its mother clone and other susceptible genotypes at molecular level using SSR and RAPD primers. One or two bands were found missing in resistant somaclone with six primers OPA-11, 13, Ch04h02, IISR33, 16, 18 and one additional band was present with primer Ch01b12 which clearly reveals that some mutation has taken place and thus resistance might have developed due to changes at DNA level *(BT, Nauni)*.
- Crude inhibitor protein prepared from developing seeds of HPK4 cultivar of *Dolichos biflorus* (21,27, 33, 39,45, 51 and 60 DAF) showed inhibitory activity against gut proteases of *S. littoralis* thereby indicating its insecticidal potential. Maximum inhibition of gut proteases of *S. littoralis* was observed in seeds harvested at 60 DAF (3021.00TUI/g fresh seed weight). The treatment of freshly laid eggs with crude inhibitor protein (5.3 mg) extract resulted in 75 per cent reduction in egg hatching of *P. brassicae* as compared to control *(BT, Nauni)*.
- Trypsin inhibitor was partially purified to 5.02 fold with 74.07 per cent recovery from seed flour of *Dolichos biflorus* extract by ammonium sulphate precipitation (20-80%), desalting on Sephadex G-10 and gel filtration chromatography on Sephadex G-100. The inhibitior pattern deviated from linearity at higher concentrations of inhibitor and up to 71 per cent of inhibition, inhibitor showed linear response. Inhibitor protein retained 98.98 per cent activity at 100^{0}C and only 18.77 per cent of the activity after autoclaving. It lost its activity on incubation with 0.1 N HCl and 0.2 N HCl at 97˚C. Attempts are being made to isolate trypsin inhibitor gene from seed flour of local *Kulath* cultivar and clone it *(BT, Nauni)*.

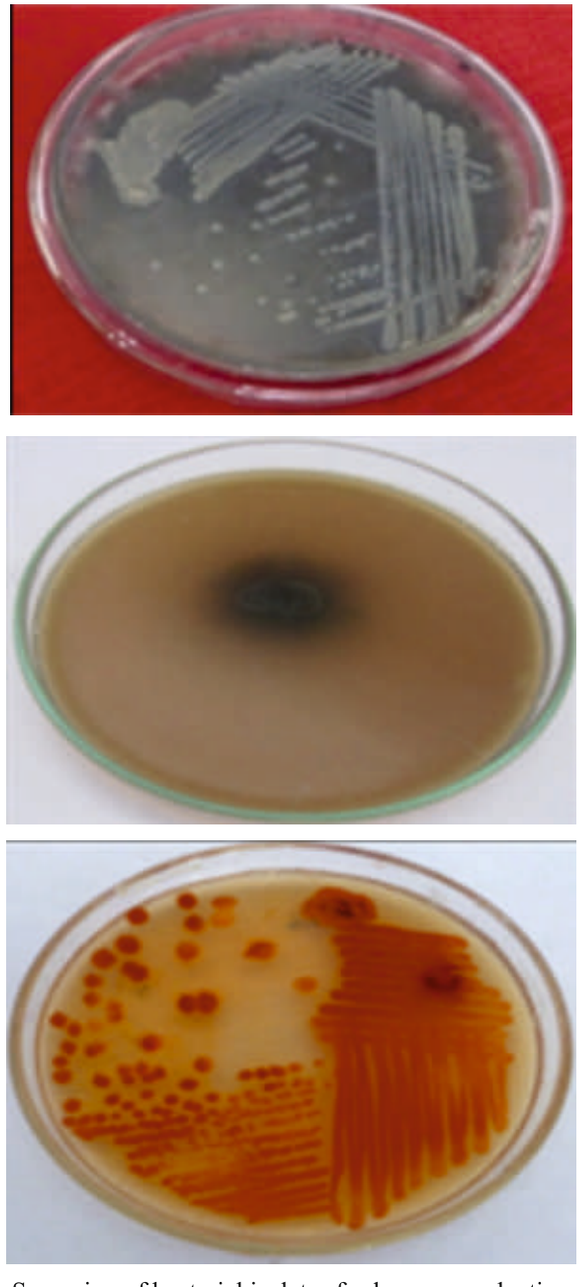


Genetic transformation in cabbage
(*Brassica oleracea* L. var. *capitata* cv. Pride of India)

- Genetic transformation studies were carried out in cabbage (*Brassica oleracea* L. var. *capitata*) for insect resistance (cry 1 Aa) gene, lettuce (*Lactuca sativa* L.) using GUS gene and pea (*Pisum sativum* L.) using npt II gene *(BT, Nauni)*.
- Bioprospecting of thermotolerant bacteria from hot water springs of Himachal Pradesh for the production of thermostable lipase enzyme and protease enzyme was done. BLASTn analysis of sequence revealed from microorganisms isolated for the production of thermostable lipase enzyme revealed that strain MBW2 showed maximum homology (99%) with *Aneurinibacillus thermoaerophilus* strain L420-91 thus bacteria identified as *Aneurinibacilus thermoaerophilus* strain MCW2, while in case of protease enzyme revealed strain MCW220 showed maximum homology (97%) with *Aneurinibacillus themophillus* strain L420-91 thus identified as *Aneurinibacillus thermophillus* strain MCW220 *(BT, Nauni)*.



Zone of clearance of thermostable protease producers on skimmed milk medium



Screening of bacterial isolates for laccase production

- Bioprospecting of bacteria for production and purification of laccase enzyme was done. Four hundred and forty nine bacterial isolates were isolated from three paper mills and 67 isolates were screened on the basis of black zone formation on oxidation of tannic acid and orange colour developed on oxidation of dimethoxyphenol *(BT, Nauni)*.

- Optimization of culture conditions for growth and laccase production of isolate *Pseudomonas putida* strain LUA15.1 was carried out. The crude extracellular extract was produced using optimized conditions and further purified using different purification techniques viz., ammonium sulphate precipitation, gel permeation chromatography and ion exchange chromatography *(BT, Nauni)*.

- Tannase producing bacterial and fungal isolates were isolated from Himalayan flora. The culture conditions for production of Tannase were standardized. Genomic DNA of bacterial and fungal isolates and 185 g RNA were isolated and are being amplified for 16S rRNA using universal primers. The amplified product was eluted and sequenced and the sequences were submitted to NCBI Bank *(BT, Nauni)*.
- Households of Shimla town were studied to identify saving pattern and investment schemes. It was found that households save less than 20 per cent of income. Saving is mostly in banks followed by Post Offices. Most of the households have regular plan for saving *(BM, Nauni)*.
- Quality of work life of employees of tea factories in Kangra district was studied. It was observed that the quality of work life is not in a good state at the selected factories and this could be one of the reasons for their inadequate financial performance *(BM, Nauni)*.
- A study was conducted in Solan town to examine the attitude of consumers towards soft drinks in light of health concerns associated with consumption of soft drinks. It was found that consumers are highly aware of some but not all of the health issues arising from consumption of soft drinks. The consumer however did not report any change in their liking for soft drinks after becoming aware of the health issues. They will however reduce but not seize the consumption of soft drinks as a result of their awareness *(BM, Nauni)*.



University Model Farm

Forestry

- The large sized seeds (more than 2.6 g/seed) of ban oak (*Quercus leucotrichophora*) shows brown in colour on maturity, exhibited higher germinability parameters i.e. per cent germination, germination capacity, germinative energy, germination index, germination vigour and seedling growth traits i.e. root length, shoot length, when sown in nursery conditions *(SAF, Nauni)*.
- The natural regeneration status of Ban oak under different oak associations was highest under oak + deodar association followed in decreasing order under oak + chir, oak + other broadleaved and grasslands *(SAF, Nauni)*.
- Impact of soil working on regeneration (recruits) of Ban oak was found significantly higher when soil is worked after leaf litter removal under oak + deodar association than other treatments which makes germination and establishment efficient *(SAF, Nauni)*.
- Studies on the performance of multipurpose tree species (MPT's) and grasses under different soil working techniques in degraded lands revealed that continuous contour recorded the highest plant survival percentage of *Grewia optiva* and *Morus alba*. Whereas, the pit planting recorded the lowest survival percentage. The higher value of different growth parameters such as plant height, collar diameter, above ground biomass, total plant biomass and root weight of both tree species were recorded in continuous contour as compared to pit planting and small ridge ditch technique *(SAF, Nauni)*.
- Different soil working techniques influenced the performance of grasses (*Panicum maximum* and *Setaria sphacelata)* under *Grewia optiva* and *Morus alba* based silvipasture. Continuous contour proved to be most effective in relation to performance of grasses which recorded higher (67.38%) survival percentage and number of tillers per plant of *Panicum maximum* and *Setaria sphacelata* under *Grewia optiva* and *Morus alba* based silvipasture system. However, highest (57.89 cm) tiller length per plant was recorded in *Panicum maximum* under *Grewia optiva* and in *Setaria sphacelata* (76.27 cm) under *Morus alba* based silvipasture system *(SAF, Nauni)*.
- Runoff, soil and nutrient losses under different soil working techniques were computed on the basis of each rainfall event. Continuous contour recorded the lowest (33 ha m) runoff rates as compared to small ridge ditch (41 ha m) and highest (45 ha m) was recorded with pit planting. Likewise, soil and nutrient losses were recorded less in continuous contour (46 t ha^{-1}) as compared to small ridge ditch (51 t ha^{-1}) and highest (58 t ha^{-1}) was recorded in pit planting. However, potassium loss was slightly decreased in small ridge ditch, whereas all other values regarding nutrient losses were observed in continuous contour *(SAF, Nauni)*.
- Forty indigenous and exotic grasses collected from indigenous grasslands of Himachal Pradesh and different locations of India are growing in nursery. The important species are: *Brachiaria mutica*, *Cenchrus ciliaris* (from Marwar var. Anjancaza-1-75), *Cenchrus setigerus* (from Marwar, var. Dhamancaza A-1-26), *Chloris gayana* (from Palampur), *Chloris gayana* (var. Callid), *Chrysopogon montanus*, *Cymbopogon martinii*, *Panicum coloratum*, *Panicum maximum* (var Gatton), *Panicum maximum*, *Paspalum wettsteinii*, *Pennisetum orientale*, *Eulaliopsis binate*, *Pennisetum purpureum*, *Setaria anceps* (var. Kanjungula), *Setaria anceps* (var. Nandi), *Setaria anceps* (var. Narok), *Urochloa mosambicensis*, Napier Bajra Hybrid (different varieties) and *Brachiaria mutica*. Among these grasses, *Setaria anceps* (vars. Kajungula, Nandi, Narok), *Panicum maximum* (vars. Patris green and Green panic), *Chloris gayana*, and Hybrid Napier are potentially good species for improvement of sub-tropical grasslands. They were multiplied for distribution to farmers *(SAF, Nauni)*.
- The above ground (361.30 g/m^2) and below ground (403.00 g/m^2) herbage biomass was highest under grassland in August month. Shrubs from *Q. leucotricophora* and *U. laevigata* plantations recorded 20.82 and 11.00 t ha^{-1} above ground biomass and 21.31 and 8.57 t ha^{-1} below ground biomass, respectively. Above ground biomass of trees in plantations ranged from 68.24-134.97 t ha^{-1} and their below ground biomass from 17.06-33.74 t ha^{-1}. Total

biomass of vegetation in different systems decreased in the order: *U. laevigata* > *Q. leucotricophora* > *P. roxburghii* > *E. tereticornis* > mixed forest > *A. mollissima* > grassland with their respective values as: 191.30, 130.95, 120.83, 119.80, 111.58, 96.29 and 4.50 t ha^{-1}. Total carbon density (t/ha) of the systems followed trend as *U. laevigata* (141.94) > *Q. leucotricophora* (104.24) > mixed forest (97.63) > *E. tereticornis* (96.55) > *A. mollissima* (88.37) > *P. roxburghii* (87.93) > grassland (44.20) *(SAF, Nauni)*.

- A study was conducted in Solan district of Himachal Pradesh with the aim to assess floristic composition, regeneration and soil physico-chemical properties of major forest communities (Chir forest, Oak forest, Deodar + Oak forest, Chir + Oak forest, Deodar forest, Deodar + Chir forest and Mixed forest) of Chail Wildlife Sanctuary. In general, per cent regeneration ranged from 30-67.50 in the area. It was satisfactory in Chir (65%) and Deodar forest community (67.50%) whereas, Deodar + Chir (30%), Chir + Oak (32.50%), Mixed (40%) and Oak (42.50) forest communities were poorly regenerated. Chir showed poor establishment of regeneration in association with Deodar and Kail failed completely. However, oak showed poor response to establish regeneration in Mixed forest community type. Oak regeneration was unable to establish, when it was in association with Chir. *Rhododendron arboreum* and *Pyrus pashia* seems to be under threat as regeneration of these species was absent. Mixed and Oak dominated forest communities have more humus depth than Chir and Deodar forest community. Solar influx was higher in Chir forest community followed by Chir + Deodar, Chir + Oak, Deodar + Oak, Deodar, Mixed forest, and Oak forest community in descending order *(SAF, Nauni)*.

- A study was conducted in Solan district of Himachal Pradesh with the aim to assess floristic composition of major forest communities (Chir forest, Oak forest, Deodar + Oak forest, Chir + Oak forest, Deodar forest, Deodar + Chir forest and mixed forest) of Chail wildlife sanctuary. There were 6 species of tree, 25 species of shrub and 67 species of herb belonging to 42 families. The IVI ranged from 12.24 to 300 among forest community types with lowest IVI value for *Rhododendron arboreum* in Chir forest community and highest value for Deodar and Oak in their corresponding forest community type. The IVI for shrub vegetation however, ranged from 4.41 to 102.04 with lowest value for *Berberis aristata* in Deodar + Oak forest community and highest value for *Myrsine africana* in mixed forest community. The IVI for herbaceous vegetation were in the range of 2.22 to 111.58 with lowest for *Salvia* species and highest for *Woodsia elongata* in Deodar forest community *(SAF, Nauni)*.

- The Shannon weiner's index of diversity in Chail wild life sanctuary for trees ranged from 0.31 to 1.23, for shrubs 1.53 to 2.08 and for herbaceous vegetation from 2.23 to 2.63 whereas, the Simpson's dominance index for trees ranged from 0.32 to 1.00, for shrubs from 0.73 to o.84 and for herbaceous vegetation from 0.83 to 0.91. The species richness was in the range of 0.00 to 0.64, 0.99 to 2.14 and 2.10 to 3.69 for tree, shrub and herbaceous vegetation, respectively *(SAF, Nauni)*.

- Studies were carried out to know the fodder quality of introduced bamboo species of Himachal Pradesh viz., *Dendrocalamus hamiltonii*, *Dendrocalamus asper*, *Melocanna baccifera*, *Phyllostachys aurea*, *Phyllostachys bambusoides* and *Phyllostachys pubesens* in relation to month of lopping- November, December, January, February and March. On the basis of the nutritional value indices and palatability the bamboo species were rated as: *D. hamiltonii* > *P. pubesens* > *D.asper* > *M. baccifera* > *P. bamboosoides* > *P. aurea*. The best time for lopping of bamboo species is November followed by December, February and January, respectively *(SAF, Nauni)*.

- A herbal garden with seventy five tree species of medicinal and aromatic value suitable for growing under subtropical region has been established and maintained at Neri-II farm of the Institute. Seven thousand fifty six plants of improved strains of harar, bahera, aonla and soapnut were planted in six districts of Himachal Pradesh covering an area of 47 hectare *(IBES, Neri)*.

- Polybag size of 22 cm x 15 cm and growing media i.e. Sand: Soil: Cocopeat: FYM : 1:1:0:1 was found

the best for highest germination and raising vigorous saplings of harar under low hill region of Himachal Pradesh *(IBES, Neri)*.

- Genetic stability of selected eighteen promising clones, after nursery screening of 250 clones procured from different countries of the world, were studied. Significant differences were observed for genotypes, environment and genotype x environment interaction, except non significant genotypes x environment interactions for plant height increments. The clones J-799, SI-63-007 and NZ 1002 for volume index and SI-63-007 for diameter at breast height were found most adaptive to overall environment. The clones have been identified for different agro ecological regions of Himachal Pradesh considering genetic stability of clones towards that environment *(TIGR, Nauni)*.

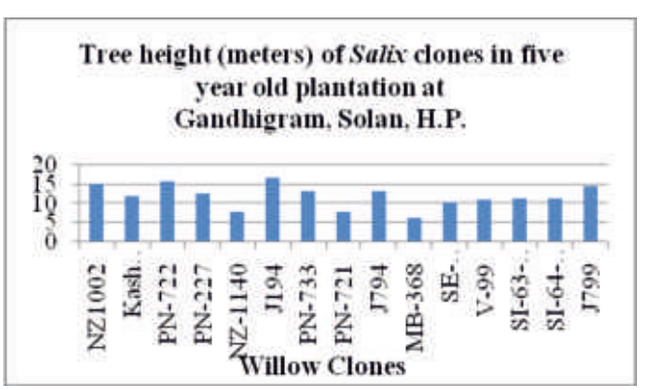


Willow germplasm bank at University Campus

- Six year old *Salix* clones planted in agroforestry model at Gandhigram, Distt Solan were evaluated for growth traits. Clones J-194, J-794, J-799, PN-722 and NZ-1002 were found superior in growth performance than others and recommended to be planted in agroforestry systems and designs in mid hill zone of Himachal Pradesh *(TIGR, Nauni)*.



Agroforestry model (6 years old willow with mustard crop) at Gandhigram, Distt. Solan



- Four year growth performance under multilocation trial of willow, at Devmandal (Sirmour), was evaluated. Highest plant height (10.42 m), diameter at breast height (8.58 cm), volume index (0.095 cm^3) number of branches (40) were recorded with clone J-799 in the moderate ecological niche *(TIGR, Nauni)*.



Growth performance of willow (4 yrs old)
at Devmandal, Sirmour

- Appropriate economic gain from willow plantation has been calculated with industrial linkage of superior willow *(Salix)* clones for pencils, artificial limb, shitake mushroom, ply board, cricket bat, goat fodder, agricultural implements, furniture and household timber, after growth of *Salix* species, 7 years old, having height 27.5 meter with 30.57 cm dbh *(TIGR, Nauni)*.
- Shitake mushroom has been successfully grown on wooden logs of superior clones of willows provided by the University which are also showing best growth performance in the field environment *(TIGR, Nauni)*.



- Genetic variability and stability for different parameters in *Dendrocalamus strictus* (male bamboo) was studied among, 23 genotypes of Himachal Pradesh identified as plus bamboo stands. Growth characters such as plant height, diameter, culm wall thickness, bole thickness were found significantly and positively correlated with biomass. Galore genotype performed best for seed and seedling parameters and growth characteristics. Galore, Bassi, Samella and Nalti genotypes were found genetically stable and best over other genotypes in progeny performance traits *(TIGR, Nauni)*.



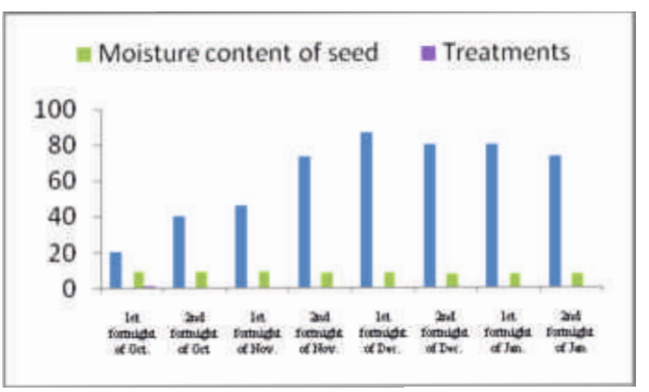


Genetic variability and stability in bamboos
of Himachal Pradesh

- Studies on the effect of collection of time of fruit/seed on the germination of *Grewia optiva,* was undertaken. The seeds of *G. optiva* were collected at 15 days interval starting from 1st October, 2013 to 31st January, 2014. The study indicated that optimum time of seed collection in *G. optiva* was between first fortnight to second fortnight of December and first fortnight of January during this period maximum germination i.e. 86.66 and 80.00 per cent, respectively were recorded under laboratory condition *(TIGR, Nauni)*.



Established open pollinated seedling seed orchard of *Grewia optiva* (beul) in the University



Moisture content and germination per cent of *Grewia optiva* seed as affected by time of seed collection period

- SO-12, CH-6, SO-9, HA -5, KA-2, SI-16 and CH-2 genotypes of *Grewia optiva* showed flowering in the Clonal Seed Orchard of *G. optiva* established in the University Campus, which is comprised of 23 families/genotypes planted in three replication at a spacing of 4x4 m. These genotypes are best for crude protein over other genotypes *(TIGR, Nauni)*.







Clonal seed orchard of *Grewia optiva* (beul)

- For selective breeding programme in poplar, genetic analysis of 31 genotypes was performed using RAPD and SSR molecular markers. Twenty six RAPD primers and 14 SSR primers amplified a total of 236 and 85 scorable bands of which 86.44 and 86.02 per cent were polymorphic. The mean coefficient of gene differentiation (Gst) was 0.388 and 0.341 indicating that 61.2 and 65.9 per cent of the genetic variation resided within the populations *(TIGR, Nauni)*.



Source of poplar genetic analysis of 31 genotypes for selective breeding programme

- Major ecosystems in the cold deserts of Himachal Pradesh were studied for cropland, forest land and alpine pasture. Total biomass was found highest for cropland ecosystem (49.80 q/ha), moderate for forest ecosystem (19.78 q/ha) and lowest for alpine pasture (0.82 q/ha) thereby, suggesting that productive and economical models are needed for harnessing the potentials of major eco-systems in cold deserts of



Major ecosystems and changing livelihood option in cold deserts of Himachal Pradesh

Himachal Pradesh for sustainable development *(TIGR, Nauni)*.

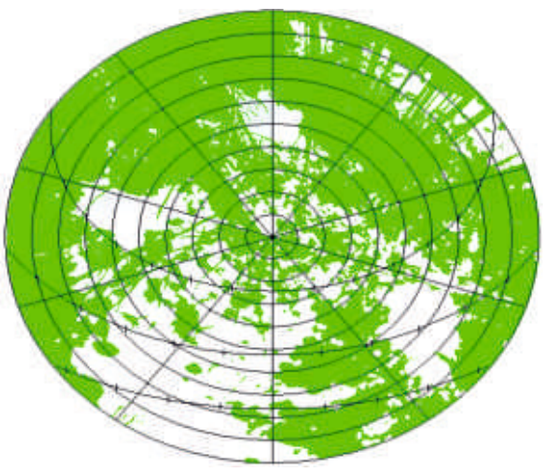
- In order to select better seed sources for improved genetic gain and quality production of *Sapindus mukorossi,* twenty four seed sources and two DBH classes from Himachal Pradesh were evaluated on the basis of fruits and seeds morphometric traits, laboratory germination, oil content and physico-chemical and progeny performance traits. The Banjar seed source was found to be superior followed by Garsa for all morphometric and chemical variability parameters and planting of best genotypes have been undertaken at Shilly farm for maintaining this valuable germplasm *(TIGR, Nauni)*.



Progeny performance of *Sapindus mukorossi* (Ritha)

- Progenies of *Melia azedarach* (Darek) from 27 sites from selected mother tree at each sites have been raised to study extent and pattern of variation with respect to growth and biomass characters. In the initial stage, S3 (Subhatu), S27 (Nauni), S14 (Ropar) and S4 (Bhota) were performing better for plant height, collar diameter, leaf area, dry fresh root weight, dry shoot weight and number of leaves *(TIGR, Nauni)*.
- High resin yielders of 19 half sib families planted/raised in forest area at Shilly nursery, during 1972 was studied for tree growth parameters viz., height, dbh, bole length, needle length, needle colour and bole form. During the last 3 years period of growth, Majhin-9A and Chabutra-3A were found best among other seed sources *(TIGR, Nauni)*.
- Among 22 progenies of *Pinus roxburghii* selected for tapping, Kopra-P5 has performed best in oleoresin yield (865.67 g/season). The canopy parameters such as leaf area index, mean leaf angle varied significantly among different progenies *(FPU, Nauni)*.





Hemispherical photographs

- The tree diameter and number of bore holes has significant effect on oleoresin yield. Highest oleoresin yield has been obtained from 40-45 cm and lowest from 30-35 cm diameter class. The highest melting point of 77.94^{0}C was observed in rosin of white colour oleoresin in the month of June and lowest melting point of 64.00^{0}C was found in yellow colour oleoresin in the month of March *(FPU, Nauni)*.
- Highest turpentine content was recorded in yellow colour oleoresin in the month of May and lowest in white colour oleoresin in the month of July, whereas, the maximum rosin content was recorded in white colour oleoresin. Regression analysis indicated that about 55.43 per cent of oleo-resin yield is influenced by turpentine content *(FPU, Nauni)*.

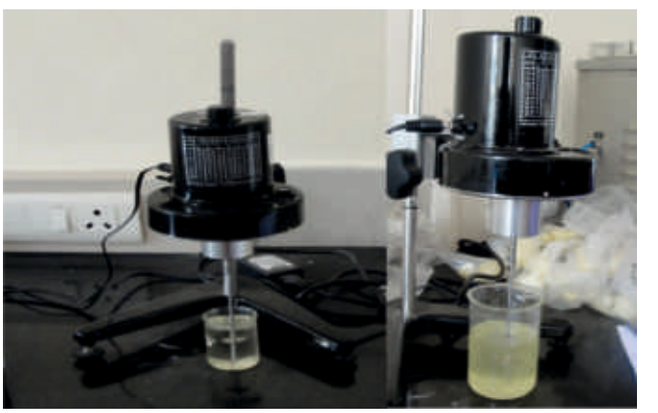


Regression between oleoresin yield and turpentine content

Oleoresin yield (g) Y	Turpentine content (ml) X	R^2
-1514.42 (486.61)	113.85* (22.86)	0.5545

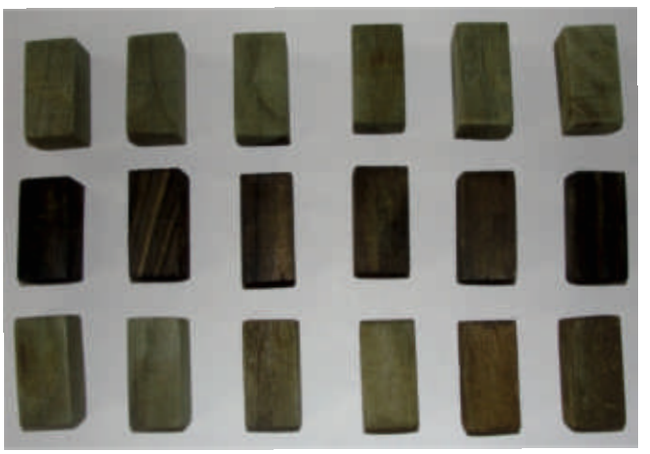
*Significant at 5% level of significant
Values in parenthesis are standard error

- The highest viscosity (25330 cps) was observed in white colour oleoresin in the month of July and lowest viscosity (6000 cps) was found in yellow colour oleoresin in the month of May. Highly significant and positive correlation was observed between oleoresin yield and temperature. The rainfall had negative and non-significant correlation with oleoresin yield *(FPU, Nauni)*.

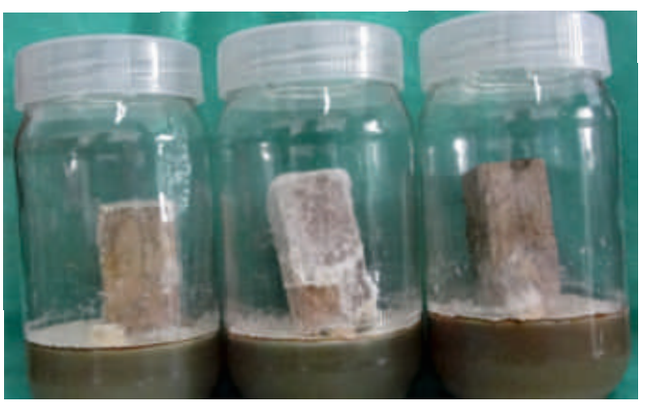


Determination of viscosity of oleo-resin

- The treatment of wood samples with *Parthenium hysterophorus* L. extract has shown an increase in specific gravity values. Among the species, *Celtis australis* L. had highest specific gravity. Highest shrinkage and swelling have been observed in tangential plane followed by radial and longitudinal planes. Similarly, *Pinus roxburghii* Sargent had maximum values among species. Volumetric swelling and shrinkage coefficients were observed to be highest in *Pinus roxburghii* Sargent. An increase in chromium absorption, leaching and retention with the increase in concentrations has been recorded. Among the species highest values for absorption, leaching and retention has been recorded in *Pinus roxburghii* Sargent and *Celtis australis* L. and the lowest in *Bombax ceiba* L. Fungal colonization has decreased with the increased *Parthenium hysterophorus* L. extract concentration i.e 2 per cent and have lowest fungus colonization as compared to 0.25 per cent concentration. In case of *Bombax ceiba* L. the extract of *Parthenium hysterophorus* L. have been found inhibitory effect against *Polyporus* sp. at all the test concentrations from 0.25 to 2 per cent *(FPU, Nauni)*.



Wood samples treated with bio-preservatives



Studies of fungus colonization on wood

- All the entries of *Lepidium sativum* gave non-significant seed yield (1309.3-1621.6 kg/ha) and 1000 seed weight. Local Solan had the maximum plant height, lateral branches per plant and inflorescence per plant. MLS 1001 gave the maximum basal leaf length whereas, Gujarat asalio-1 gave the higher basal leaf width. HLS-4 had highest flowers per inflorescence. On the basis of basal leaf, MLS 1001, HLS-4, HLS-5, *Gujarat asalio*-1 and Local Solan form one group. On the basis of middle leaf, MLS 1001 and Local Solan form one group, MLS 1007 and MLS 1016 form another group and HLS-4, HLS-5 and *Gujarat asalio*-1 also form another group. On the basis of terminal leaf, all the entries were appeared to be similar. On the basis of leaf characteristics, MLS 1007 and MLS 1016 appear to be similar with respect to basal and middle leaves. Maximum seed yield in MLS 1007 is at par with Anand Local and *Gujarat asalio* 1 *(FPU, Nauni)*.



Evaluation of *Lepidium sativum*

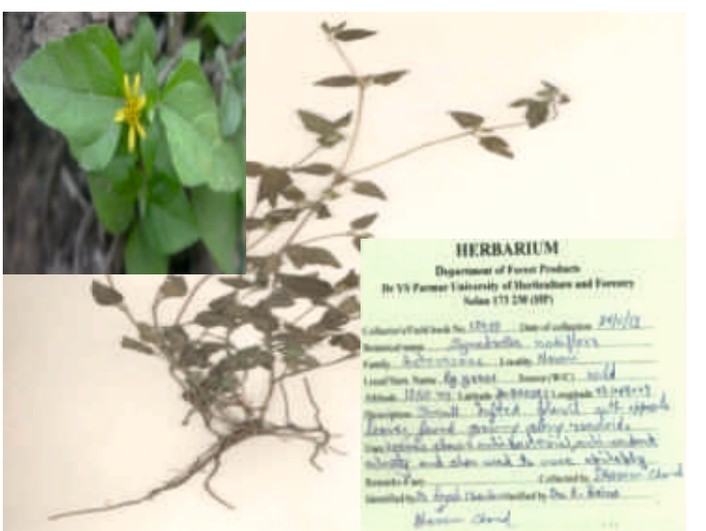
- The *Swertia chirayita* is a variant plants with suckering habit, no main shoot development, lamina bifurcation, leathery textured lamina, 3 leaves at a node, more number of veins, changed flower colour, insect pest resistant plants were observed. The variant with suckering habit, after vegetative splitting has again resprouted, produced main shoot and flowers (2nd reproductive cycle). This variant holds promise of developing a perennial type of *Swertia chirayita* with more than one reproductive cycle *(FPU, Nauni)*.
- On the basis of TLC profile and HPLC analysis it was concluded that out of the 76 samples of *Swertia chirayita*, only 19 samples were of *S. chirayita* (including 3 samples having trace amount of marker compounds), 54 were of *Andrographis paniculata* and 3 samples were of unknown species. Further, out of the 76 samples of *Picrorhiza kurroa*, 74 samples were of *P. kurroa* (including 7 samples having trace amount of marker compounds). One sample appeared morphologically of Kutki but have no marker compound, seems to be very old sample *(FPU, Nauni)*.
- Germplasm collection sites G_5 (Udaipur, HP) and G_6 (Kukumseri, HP) and Himachal Pradesh have registered highest value for morphological and quantitative parameters of *Inula racemosa* recorded for higher yield in terms of biomass and essential oil content as compared to other sites. Seeds collected from germplasm collection sites Udaipur and Kukumseri, Pattan valley of Himachal Pradesh have higher seed weight, germination per cent and seed

viability. Highest germination speed of 0.67 and 0.68 has been obtained from pre-sowing treatment (IBA 50 ppm). Maximum peak value was recorded with application of GA_3 150 ppm. Multilocation trials conducted at two different locations, it has been found that maximum sprouting per cent and fresh root and shoot weight were noticed from germplasm sites G_5 (Udaipur) and G_6 (Kukumseri, HP), under location sites S_1 (Shilly) and S_2 (Manali) highest sprouting per cent and primary root length was recorded from S_2 (Manali) *(FPU, Nauni)*.

- A total of 59 new species have been identified and their specimens being maintained in the herbarium first time. *Synedrella nodiflora* and *Lithospermum arvensis* have been first time reported from Himachal Pradesh while *Agastrache foeniculum* and *Satureja hortensis* is introduced here from USA. The specimen of families like - Thelypteridaceae, Hypodematiaceae, Polemoniaceae, Blechnaceae have been first time maintained in the herbarium. Maintenace of the germplasm of about 300 species of medicinal and aromatic plants is a continuous activity and efforts are on to add more number of plant species. Various new species are introduced viz., *Momardica dioca*, *Ficus benghalensis* L. var. *krishaae*, *Cinnamomum tamalla* and *Clossimum* spp. *(FPU, Nauni)*.



Lithospermum arvensis



Synedrella nodiflora



Momardica dioca



Ficus benghalensis var. *krishnae*



Cinnamomum tamalla



Clossimum sp.

- MLS 1007 of *Lepidium stivum* is recommendend for cultivation in mid-hill region for seed production (on the basis of preliminary observations). *Aconitum hetrophyllum* should be cultivated under domesticated conditions instead of wild harvest as its yields higher tuber biomasse. The farmers having Chir pine trees on their land should use multiple bore hole methods of Oleoresin tapping for the safety of their trees *(FPU, Nauni)*.
- An investigation was carried out to find the stable diameter class for resin yield of *Pinus roxburghii*. Various stability models viz. Finlay and Wilkinson's (1963) and Eberhart and Russell's (1966) were employed for analyzing a data set of seven years (2007-11) collected from 145 trees. The diameter class 35-45 cm was found to be most stable class for the estimation of resin yield of *P. roxburghii (BS, Nauni)*.
- The soil drenching of apple plant basin with selected bacterial isolate (*Bacillus licheniformis* strain CKA1) @ one liter of liquid formulation diluted to five liters was applied in the fields at five different locations in Shimla district. The application of liquid formulation increased the yield of apple by 13.56 to 88.47 per cent over uninoculated control *(BS, Nauni)*.

Effect of liquid formulation of PGPR (*Bacillus licheniformis* strain CKA1) on yield of apple

Formulation		Average yield (kg/tree)			
	RHRS Mashobra	Farmers field Matiana (Nanni)	Farmers field Matiana (Sabloab)	Farmers field Thanedhar (Shatla)	Farmers field Kotkhai (Kyari)
Un-inoculated control	17.77	11.63	80.00	83.33	51.10
CKA1 inoculated	20.18 (13.56)	16.66 (43.25)	103.75 (29.68)	157.05 (88.47)	66.30(29.75)

*Figures in parenthesis are per cent increase over control



Control



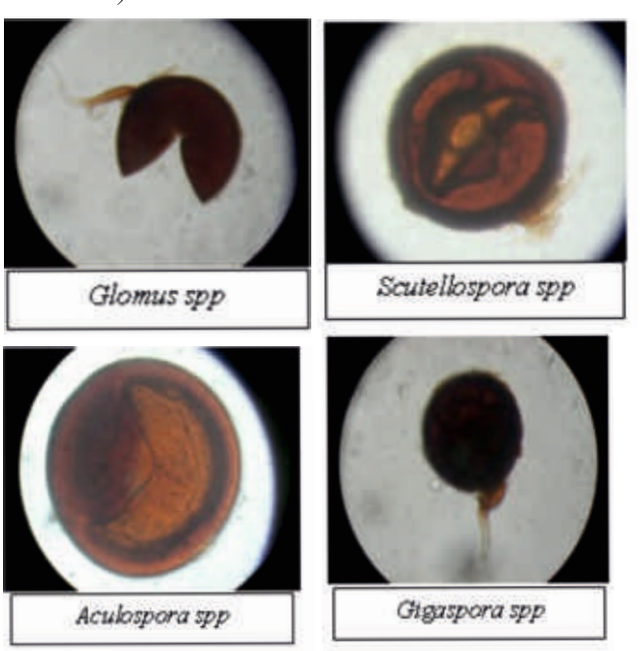
CKAI Incubated

- Studies on the biofertilizer technology for quality production of apple seedlings under nursery conditions revealed that treatment of apple seed (1000 g) with 2.5 lt liquid bacterial formulation (inoculation of *B. lichenformis*) after stratification before sowing, drench left over culture in the bed resulted into increased root shoot length and biomass by 20 per cent over uninoculated control and cent per cent control of white-root-rot caused by *Dematophora necatrix (BS, Nauni)*.



PGR (*B. licheniformis*) treated apple seedlings in nursery

- A total of ten indigenous PGPR isolates associated with sweet cherry (*Prunus avium* L.) having multipurpose plant growth promoting traits were selected from different orchards of Shimla (Kandiyali, Thanedhar, Dhar and Dhochi) and Kullu (Patlikulh, Katrain, Mashalaghat and Naggar) districts of the Himachal Pradesh. The arbuscular mycorrhizal fungal (AMF) spores count in rhizosphere of cherry had a great variation i.e. from 88.83 to 433.0 spores/50 g soil. The isolated spores belong to four genera *viz*., *Glomus, Acaulospora, Gigaspora* and *Scutellospora.* The frequency of occurrence was in the order of *Glomus* (80%) >*Acaulospora* (10%)>*Gigaspora* (5%) and *Scutellospora* (5%). The percentage of root colonization of sweet cherry under natural conditions varied from 17.52 to 30.85 per cent *(BS, Nauni)*.



Arbuscular mycorrhizal fungal (AMF) spores

- The native PGPR isolates with multipurpose PGP traits were screened under net house conditions for ginger (ten isolates), turmeric (seven) and capsicum (three) for mid hills of Himachal Pradesh. The native PGPR isolates with multiple PGP traits were also screened under net house conditions for *Podophyllum hexandrum* (ten isolates) and *Picrorhiza kurroa* (seven) for mid and high hills of Himachal Pradesh *(BS, Nauni)*.

- The conjoint application of 75 per cent NP fertilizers + *Bacillus pumilus* strain MK_5 was applied in cauliflower crop at five locations i.e., Nauni (Solan), Kandaghat (Solan), Lalsingi (Una), Ghaluwal (Una) and Haroli (Una). The conjoint application of *Bacillus pumilus* strain MK_5 + 75 per cent NP (N_{94}, P_{57} and K_{72}) fertilizers increased the yields by 25.0-30.1 per cent over recommended dose of NPK (N_{125}, P_{76} & K_{72}) besides saving of 25 per cent of NP chemical fertilizers *(BS, Nauni)*.

Effect of PGPR (*Bacillus pumilus* strain MK_5) and 75% RD dose of NP fertilizer on yield of cauliflower

Treatments	Nauni (Solan)	Lalsingi (Una)	Haroli (Una)	Kandaghat (Solan)	Ghaluwal (Una)
Recommended package of practices N_{125}, P_{76} and K_{72}	270.06	271.60	354.0	283.6	247.9
MK_5+N_{94}, P_{57} and K_{72}	337.50 (25.0)	346.2 (27.6)	451.8 (27.5)	356.2 (25.6)	322.2 (30.1)

Figures in parentheses are per cent increase over package of practices for cauliflower

- Treatment of cauliflower seed with *Bacillus pumilus* strain MK_5 liquid inoculum (1000 ml/1000 g seed) before sowing and seedling dip in 2000 ml inoculum at the time of transplanting along with application of N_{94}, P_{57} and K_{72} in place of N_{125}, P_{76} and K_{72} resulted into increased cauliflower yield by 24 per cent and also saved 31 kg N and 19 kg P_2O_5/ha chemical fertilizers *(BS, Nauni)*.



General view of field trial



75% NP+MK_5 isolate

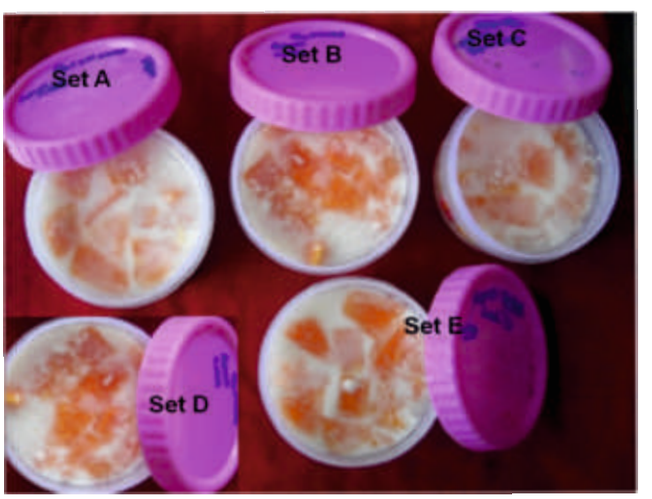


Control

- After nine months of cyclic treatments with liquid formulation of individual and consortial strains of *P. aeruginosa* I, J and K, there was an increase in plant height (15.8 to 29.7%) and number of nodes (14.7 to 34.2%) as compared to control at replant sites of apple orchard - Maggota and Siao. At both sites the, formulation of consortial strains were more effective

in increasing the plant height and number of nodes as compared to formulations of individual strains *(BS, Nauni)*.

- Functional foods enriched with Probiotics viz. Bioyogurt and multi cereal products are formulated and their nutritional composition has been analysed. The probiotics added in the food items have been isolated, screened and identified in our research laboratory. Bacteriocin mediated biopreservation of different processed food items is evaluated and their shelf stability has been found better when compared with commercial preservatives *(BS, Nauni)*.



Probiotic Bioyogurt

- Reproductive biological studies have been carried out on wild *Punica granatum* L. which is a deciduous shrub or small tree belonging to family Punicaceae and wildly distributed in mid hills of Himachal Pradesh. The experimental studies and fruit set data revealed the species to be self compatible which is autogamous (chasmogamous and homogamous) but geitomogamy leads to good fruit set *(BS, Nauni)*.
- Germination potential of aged (10 month old) non germinable seeds of *Withania somnifera* could be revived to 70.00 per cent by seed invigoration with GA_3, 200 ppm for 48 h; 65.5 per cent with 50 ppm benzyl adenine; 62.50 per cent with 200 ppm KNO_3 and 60.75 per cent with PEG 6000, -0.5 MPa for 24 hrs each. In addition, hydropriming of seeds for 48 hrs also induced 40 per cent germination. Seed invigoration treatments resulted in significant improvement in germination and vigour along with reduced mean germination time which can be used to revive the germination potential of aged left over seeds *(BS, Nauni)*.
- The studies on the optimization of drip irrigation scheduling in winter crop of tomato during October-February under naturally ventilated polyhouse conditions revealed that 60 per cent ET irrigation produced highest yield of 4.3 kg/plant and was at par with 100 per cent ET that recorded 4.4 kg/plant *(SSWM, Nauni)*.



Winter crop tomato under polyhouse

- Studies were undertaken on yield and quality of sprinkler irrigated pea as influenced by irrigation time and levels to optimize water requirement and time of sprinkler irrigation during the day time in pea. The results revealed that irrigation during morning hours (8.30 am) significantly increased the plant height, number of pods/plant and marketable yield (18%) over surface irrigation (control). The water requirement was reduced by 23 per cent over control. Yield under irrigation during afternoon (2.30 pm) was also at par with the morning hour irrigation but both were found significantly higher than evening hours (4.30 pm) owing to higher disease incidence. Among the irrigation levels, irrigation at IW/CPE ratio of 0.8 was found to be at par with irrigation levels of IW/CPE ratios of 1 and 1.2 in respect of all recorded parameters *(SSWM, Nauni)*.





Micro sprinkler irrigation in pea

- Studies on scheduling of irrigation in cauliflower *(Brassica oleracea* var. *botrytis* L.) under mid hill conditions of Himachal Pradesh keeping in view the productivity revealed that WUE and B:C ratio, irrigation at IW/CPE ratio 1.0 (T_1) was found to be efficient and economical *(SSWM, Nauni)*.
- Different organic substrates viz. animal dung, food waste, kitchen wastes, saw dust, *Parthenium*, lantana, bagasse and pine needle, etc. were studied for their role on quality of vermicompost and population dynamics of earthworms. Use of pine needle as substrate was found to be inferior compared to all other substrates, whereas, boiled pine needle proved to be better option for vermi composting. The quality of vermicompost and population dynamics of earthworms in vermi compost prepared from *Parthenium* in combination with cow dung, bagasse and kitchen waste was best compared to all other treatments. Substrates of higher C:N ratio produced poor quality of vermicompost and also took more time for decomposition, however, C:N ratio of 30 to 40 was found to be optimum for vermi composting *(SSWM, Nauni)*.
- Studies on the soil quality under different landuses in Ser Banera - Ser Chirag watershed revealed that forest land had higher soil quality index i.e. 0.74 and 0.69 and fell under group 3, followed by grass land with values 0.73 and 0.64 which qualified for groups 3 and 2, agricultural land with values 0.68 and 0.54 for groups 3 and 2, whereas, lowest soil quality index of 0.49 and 0.40 was observed under scrub land and qualified for group 2 in project and non project area of watershed, respectively *(SSWM, Nauni)*.
- Under the project "Augmentation of water resources through water harvesting in hilly areas", 46 staggered trenches having dimensions in the range of 6' x 1.5' x 1.5' to 15' x 1.5' x 2' with total volume of 90 m^3 or 90,000 liters have been dug at Pandah, Bhajo and Phangari near Kalaghat in open area as well as under chir pine forest to reduce the runoff velocity and to promote the ground water recharge. Soil moisture content at a distance of 1m, below the trenches remained 0-3.0 per cent unit higher compared to moisture content above the trenches. The corresponding value ranged from 0.0-4.5 at 2 m distance. Ten loose boulder check dams were also constructed to reduce the runoff velocity and soil erosion *(SSWM, Nauni)*.



Staggered trenches at Bhajo



Loose boulders check dam



RCC check dam for water harvesting and storage

Himachal Pradesh reveals that the medicinal plant market is oligopsonic in nature i.e., a small number of large buyers controlling the buying side results in the dominance of buyers thus making medicinal plants market a buyer's market and non-price competitive in nature. All the medicinal plants showed significantly increasing growth except in case of Bankakdi, Kuth, Kutki and Safed Musli. The variability ranged from 68.01 to 2.06 per cent. The real prices showed similar trend as nominal prices except in Banafsha. Most of the species showed normal price-demand behavior except Bankakdi, Kuth and Kutki. It has been suggested that medicinal plants like Kutki, Kuth and Bankakdi should be given priority in the light of their positive scarcity ratios *(SS, Nauni)*.

- Impact of climate change has been found resulting into about +25 per cent variation in mean maximum temperature which has brought variations in other weather parameters in a flow and the cumulative effect of these changes has brought a huge difference in apple productivity ranging between 1.75 to 98.0 per cent in the study area, RHRS, Mashobra. The lower productivity of apple as well as huge variation in it because of climate change has mainly been due to lower quantum of water available during various growth stages of apple crop *inter alia* effect of other weather parameters *(SS, Nauni)*.
- The study entitled Productivity analysis of apple orchards in Shimla District of Himachal Pradesh indicated that India has registered a compound growth rate of 1.1 MT/ha which is at par with the world average of 1.2 MT/ha in the context of apple productivity, whereas in Himachal Pradesh it was 0.30 MT/ha during the time period 1973-74 to 2011-12. Among the districts of Himachal Pradesh, Shimla and Kinnaur have shown positive trend in all aspects of apple cultivation. The productivity analysis of apple orchards in Shimla district of Himachal Pradesh reveals that an average per tree establishment cost worked out to Rs. 3318.19. Maintenance cost of bearing apple per hundred ranged between Rs. 60,169.88 to Rs. 61,769.01 at different elevations and net return varied between Rs. 162,817.14 and Rs. 269,362.63.17. However, the mean apple productivity (15.60 MT/ha) as a whole in Narkanda Block of Shimla district has shown similarity with that of the world average value *(SS, Nauni)*.
- Effect of pre-sowing seed treatments on survival and growth performance of taur *(Bauhinia vahlii)* under polyhouse conditions indicated that soaking the seeds in boiling water and allowed to cool for 48 hours gave better seed germination, plant survival as well as growth performance. Plant height was found to be highest (17.00 cm) in seeds soaked in 500 ppm GA_3 for 24 hours *(RHRTS, Bajaura)*.

- The results of the study on refinement of propagation techniques for mass multiplication of thornless Robinia revealed that grafting to be the successful methods. Observations on plant survival, height and collar diameter recorded after one year indicated that out of the two grafting methods employed, the tongue method showed higher grafted plant survival percent (88.50%) and cleft grafting resulted in highest plant height (4.95 m) and collar diameter (2.40 cm). Irrespective of grafting methods, observations on different dates of grafting revealed highest plant survival (92.2%) in second week of March *(RHRTS, Bajaura)*.



Thorned plant used as a rootstock



Nursery raised through seed

- The work on the standardization of grafting/budding in soap nut (*Sapindus mukorossi*) indicated that best time for chip budding was second week of February whereas, for tongue grafting third to fourth week of February. After one year of grafting only eight percent plant came in to bearing phase in July, 2013 whereas, chip budded plants did not bear fruits so far. The number of fruits varied between six to thirty fruits per plant *(RHRTS, Bajaura)*.



Soapnut plants in bearing phase after one year of tongue grafting

- *Taxus baccata* stem cuttings were treated with ten different concentrations of rooting hormones viz. 5000, 7500 and 10,000 ppm of IAA, IBA and NAA including a control under two different conditions (a) under glass house in sand bed and (ii) under trees shade in polybags having equal proportion of Sand: Soil: FYM on two different dates viz. 11th June and 20th December, 2013. Observations on survival percent recorded in March, 2014, revealed that cutting planted on 11th June under glass house did not survive at all, whereas the cuttings planted on 11th June under open shady condition resulted in highest (90%) survival after treating the cuttings with 10000 ppm IAA. However, the cuttings planted on 20th December under open shady conditions showed highest survival (100%) after treatment with 5000 ppm IAA *(RHRTS, Bajaura)*.



Taxus cuttings raised in sand under glass house

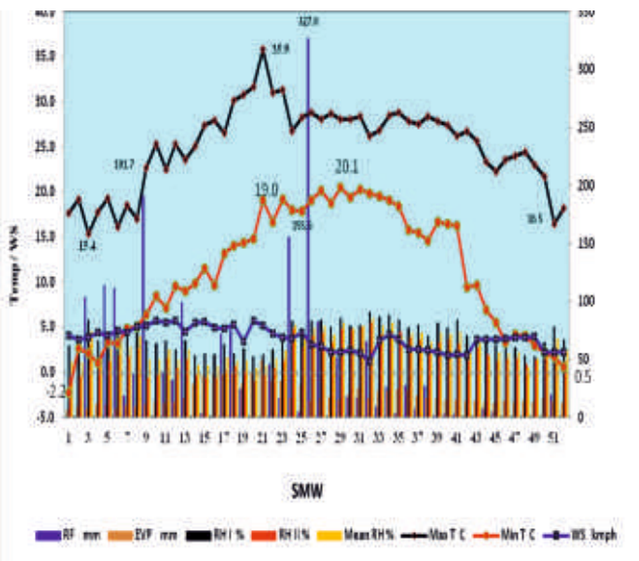


Taxus cuttings raised in poly bags under tree shade

- Some new strains of Lasura, Dheu, Bael and Jamun were collected from various parts of Himachal Pradesh and India and their successful grafting techniques for further propagation were developed in the individual tree species *(RHRTS, Jachh)*.
- The survival of the sandal wood plants was enhanced upto 90 per cent in summer months by the use of cost effective indigenous method of irrigation utilizing drips and tin cans *(RHRTS, Jachh)*.
- Napier NB-37, setaria and guinea grass can be cultivated on along with the harar and the production upto 240-590 q/ha green fodder can be achieved when cultivated with Harar at early stage of planting *(RHRTS, Jachh)*.
- In a study on the carbon sequestered by the farm plantations, pure plantation of *Eucalyptus tereticornis* showed the significantly higher total above and belowground carbon (1458.88 t ha^{-1}) followed by mix plantation of *Quercus leucotrichophora* plus *Ulmus villosa,* pure plantation of *Populus deltoides* and mix plantation of *Eucalyptus tereticornis* plus *Pinus roxburghii.* Pure plantation of *Quercus leucotrichophora* showed the significantly lowest value of total above and below ground carbon (280.27 t ha^{-1}).Total biomass plus soil carbon sequestered in the farm plantations also followed the same trend *(ES, Nauni)*.
- During the year about 104 Gramin Krishi Mausam Seva bulletins based on numerical weather prediction models issued by IMD, Pune have been prepared bi-weekly for Solan, Sirmour and Shimla and disseminated to various Government/Non-government agencies through e-mail, fax, local news papers besides broadcasted through AIR/DDK, Shimla for wider distribution and publicity *(ES, Nauni)*.
- The qualitative and quantitative analysis of rainfall forecast in Solan district indicated highest accuracy (RS 78.9%, HK-0.51 and CSI- 0.79) for Kandaghat station followed by Kasauli and Nauni. The accuracy of seasonal rainfall was found to be highest during the post monsoon season. In general, the accuracy of rainfall forecast was found to be 76.15 per cent in district Solan *(ES, Nauni)*.
- The total rainfall recorded at meteorological observatory, Nauni during 2013-2014 was 1467.0 mm in 123 rainy days. During the year, summer months (April-May) recorded 110.6 mm rainfall in 6 days. A strong western disturbance influenced the area and caused heavy showers (70 mm) on 24th April, 2013. In the month of June, the total rainfall of 252.3 mm was received in 15 days, whereas, it was 152.5 mm (11 rainy days), 119.4 mm (18 rainy days) and 66.4 mm (10 rainy days) during July, August and September, respectively. During post monsoon season (October-December) and winter season (January- March, 2014) the area received total rainfall of 119.1 (10 rainy days) and 352.2 mm (32 rainy days), respectively. The winter season experienced ground frost during December-January (42 days). The highest day temperature of 36.2°C was recorded on 25th May, 2013.The lowest night

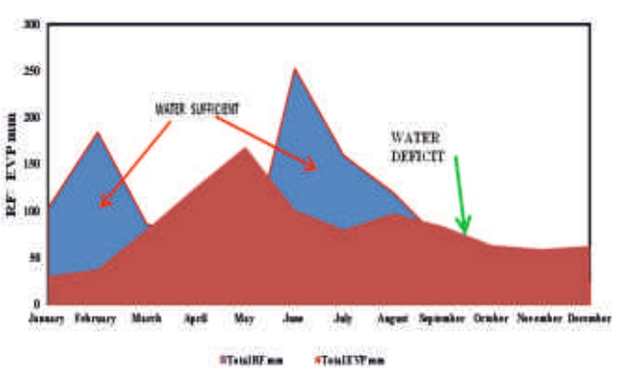
temperature/minimum temperature of (-) 0.5°C was recorded on 10th January, 2014 *(ES, Nauni)*.

- The weekly meteorological data recorded at university revealed that highest maximum temperature of 35.9°C was observed in 21st Standard Meteorological Week (SMW). The lowest minimum temperature of minus (-) 2.2°C was attained on 1st SMW. The last SMW (52) also attained lowest night temperature of 0.5°C *(ES, Nauni)*.



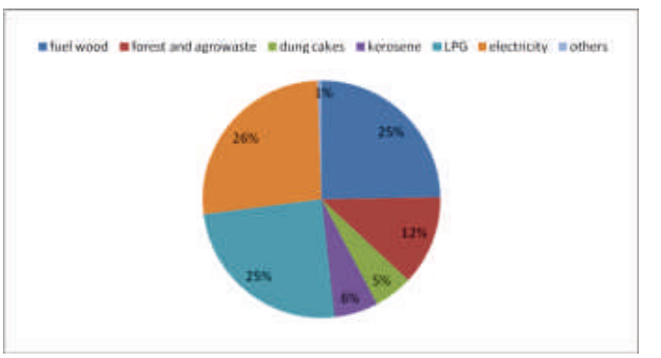
Weekly meteorological data of Solan district during the year 2013

- The Climatic Water Balance during the year 2013 revealed that Solan district experienced water deficit during autumn period. However, region experienced sufficient rains during winter and rainy seasons *(ES, Nauni)*.



Climatic water balance during 2013 (Solan)

- House hold fuel consumption study conducted in rural areas of Solan block indicated that electricity is the most popular energy source in the region and 26 per cent population is using electricity as energy resource, followed by LPG and fuel wood (25% each), forest and agro waste (12%), kerosene (6%) and dung cakes (5%) *(ES, Nauni)*.



Household wise fuel consumption in Solan

- The studies on the variation in weather parameters of Solan district over period of 28 years (1984-2011) were carried out by using secondary data on weather parameters viz., maximum temperature, minimum temperature, rainfall, sunshine hours, wind speed and relative humidity. The study revealed that there is an increase in maximum and minimum temperatures of 2.95°C and 0.5°C, respectively, whereas, rainfall shows decrease of 75.45 mm during the study period *(ES, Nauni)*.



Agroforestry Model

Research Projects sanctioned
(01.04.2013 to 31.03.2014)

Horticulture

1. Demonstration of *in situ* plantation and moisture conservation techniques for replantation of old orchards of stone fruits under rainfed conditions of Himachal Pradesh [Dr DP Sharma] Ministry of Agriculture, Department of Agriculture and Cooperation, GOI, India
2. Integrated project on quality/seed/planting material production, irrigation management and soil health concerns in vegetable and spice crops [Dr HS Kanwar] Ministry of Agriculture, Department of Agriculture and Cooperation, GOI, India
3. Biotechnological interventions for establishment of own rooted progeny orchad of some stone fruits [Dr Manisha Thakur] Ministry of Science and Technology, Department of Biotechnology
4. Breaking yield barriers in cucumber (*Cucumis sativus* L.) through introgression fo useful genes from unadapted landraces and wild relatives [Dr Ramesh Kumar] CSIR
5. Breeding day neutral strawberries and tagging everbearing gene using PCR based markets [Dr Girish Sharma] CSIR
6. Network project on Production of Quality Material of Vegetable Crops [Dr HS Kanwar] Ministry of Agriculture, GOI (through CPRI, Shimla/ICAR)
7. Network project on Production of Quality Seed Planting Material of Spice Crops [Dr DK Mehta] Ministry of Agriculture, GOI (through CPRI, Shimla/ICAR)
8. Network project on strengthening of nursery production of fruit crops [Dr JS Chandel] Ministry of Agriculture, GOI (through CPRI, Shimla/ICAR)
9. Establishment of DUS Coordinating Centre for *Phalanopsis* [Dr Sita Ram] PPV&FRA
10. Demonstration of temperate fruits and vegetable nursery under protected condition [Dr Chuni Lal Sharma] DRDA

Forestry

1. Network Projects on Market Intelligence National Centre for Agricultural Economics and Policy Research (NCAP)
2. Fund for the improvement of S&T infrastructure in the universities and higher educational institution FIST programme-2012 [Dr RK Aggarwal]
3. Development of Demonstration Plot and Transfer of Production Technology of Commercially Important Medicinal and Aromatic Plants in Himachal Pradesh (Facilitation Centre) [Dr Meenu Sood] Ministry of Health and Family Welfare, Department AYUISH, National Medicinal Plant Board, New Delhi
4. Studies on the Bioefficacy of Javico Organic Nutritional Formulations in apple and tomato [Dr Diwaker Tripathi] Javico Bio Organic Ltd. 2001, Amardeep Colony, Kaimari Road, Hissar



DIRECTORATE OF EXTENSION EDUCATION

The Directorate has responsibility for planning, organizing, coordinating and evaluating the extension education programmes of the University through the main campus, regional research stations, sub stations and Krishi Vigyan Kendras of the university. It aims at transfer of improved technology to the farmers, orchardists, NGOs, stake holders and personnel of the development line departments on fruits, vegetables, flowers, mushrooms, medicinal plants, beekeeping, forestry, agroforestry and allied fields. The Directorate with limited staff and infrastructure at its disposal has many programmes of transfer of technology which are being carried out through its different wings namely Transfer of Technology wing, Farm Advisory Services wing, Communication wing and Agricultural Technology Information Centre (ATIC). Various programmes being undertaken by various units of the directorate and their achievements during the said year are as under:

Training and Transfer of Technology

- Institutional trainings for farmers and extension functionaries.
- Location specific trainings (off-campus) under wasteland and other watershed programmes for the officers of developmental departments and the farmers.
- Farmer-Scientists interactions
- Farm women trainings
- Transfer of technology through Days / Melas / Workshops/Seminars



One day training camp at Bhuira, Sirmaur



One day training at Renuka, under RKVY project



Chief Guest Sh Vinay Kumar, CPS (PWD), Govt of HP addressing at Renuka, Sirmour



Awareness camp on Beekeeping at farmers Nalagarh



Five days training on beekeeping (Kullu farmers)



Five days training on beekeeping (Kullu farmers)



Practical demonstration on beekeeping to the farmers of Solan district at Nalagarh

Entrepreneurship Development Programmes

The Ministry of Agriculture, Government of India under Central Sector Scheme on Human Resource Development in Horticulture sponsors Horticulture Supervisors course of one year duration. The main objective of these trainings is to improve knowledge and develop skills and attitude amongst youths for generation of self employment.

Under these programmes, a total of 75 institutional (on-campus) as well as 6 location specific (off- campus) training programmes were organized from time to time to the farmers as well as end users. A total of 2846 and 858 farmers, respectively participated in these on-campus and off-campus training programmes. In addition, 6 institutional trainings were also organized for extension functionaries of the state line departments of Govt. of Himachal Pradesh in which 199 persons participated. The directorate also conducted 51 guided/exposure visits for the farmers, extension functionaries and students of Himachal Pradesh as well as from other states in which 1300 persons were benefitted. Besides this, two specific days - Van Mahotsava and Foundation Day of the University were also organized in which about 250 and 2500 farmers participated, respectively. Farmers-Scientists interaction was also held on the Foundation Day which helped in exchanging the knowledge and experiences on different aspects of scientific cultivation of fruit and vegetable crops.

Communication and Publication

- Publication of farm literature on burning issues pertaining to horticulture, forestry and allied disciplines.
- AIR and Doordarshan programmes.
- Preparation of video films, audio cassettes, CDs, Photographs, slides etc.
- Farm Radio Schools on various themes.
- Telephonic Helpline for attending to queries of farmers/orchardists.

Under these programmes, a total of 4 TV talks were delivered by the scientists of this directorate at Doordarshan Kendra (DDK), Shimla and one chat show was also organized. A total of 25 publications were also published from this directorate under this period for sale to the farmers and other visitors, which are as under:

Publications

Title	No. of copies
फल उत्पादन	1000
शीतोष्ण फल वृक्षों की सिंचाई एवं काट-छांट	1500
फलों से पेय पदार्थ	1000

- फलों एवं सब्जियों से जैम, मुरब्बा तथा कैंडी 500
- सब्जी उत्पादन 2000
- स्पीति घाटी में मटर की उन्नत खेती 850
- फल उत्पादन 2000
- फलों एवं सब्जियों की चटनी 1000
- फूलों की व्यवसायिक खेती 2000
- फलों से पेय पदार्थ 2000
- फलों एवं सब्जियों के अचार 2000
- सब्जी उत्पादन 2000
- कृषि वाणी (कृषि विज्ञान केन्द्र रोहडू) 500
- खुम्ब उत्पादन 1000
- औद्यानिकी एवं वानिकी खण्ड 21 (2013) 1000
- कारनेशन व गुलदाऊदी की व्यवसायिक नर्सरी एवं पुष्प उत्पादन 500
- आम के मुख्य हानिकारक कीट एवं रोग प्रबन्धन 1000
- विभिन्न जलवायु क्षेत्रों के लिये पॉलीहाउस का रूपांकन 500
- चुनिंदा फूलों की व्यवसायिक खेती एवं नर्सरी उत्पादन 500
- मधुमक्खी महत्वपूर्ण परागकर्ता कीट 150
- देसी मधुमक्खी पालन के लिये आधुनिक चौखटों वाला मौनगृह 150
- Forest Seed Technology – A Practical Manual 500
- Laboratory Manual – Tissue Culture and Molecular Biology 500
- Cytology and Cytogenetics – A Practical Manual 500
- Package of Practices for Floriculture and Landscaping 1000

Agriculture Technology Information Centre (ATIC)

- To provide the clientele through single window system up-to date information about various activities/achievements of the University.
- Make available all the proven technologies along with quality material/products of the University like seeds, planting material, processed products, literature etc.
- Strengthen linkages between the University researchers and farmers, orchardists, foresters, NGO and State Development Department and Supporting organizations.
- Provide diagnostic and farm advisory services to the farmers, orchardists, foresters and other stake holders through plant clinic lab, literature, Farmers' Telephone Helpline, guided visits, AIR collaborated courier service etc.
- Feedback from the users/clientele about the services provided to them are received and passed on to the researchers/planners/development departments for further assessment, refinement and effective execution.
- Overcoming of technology dissemination loss.

These above services are made available to the farmers/orchardists through

- Farm Advisory Services through courier service in collaboration with All India Radio, Shimla for solving farmers'/orchardists burning problems.
- Guided visits.
- Diagnostic Services at Plant Clinic Lab.
- Museum visits.
- Farmers' Service and Sale Centre.
- Organization of Exhibitions during various occasions at different locations in the State.

During the period under report, three exhibitions and 51 guided visits were organized in which about 26500 and 1300 farmers, farm women, rural youth, students and extension functionaries, respectively were benefited. The queries (47) of farmers received from AIR, Shimla through courier service of this university were replied for solving farmers' problems. Besides this, 334 farmers calls through Kisan Call Centre were received and farmers were given the remedial measures about their problems. One collaborative programme (Kisan mela) was also organized by the DEE in collaboration with Yogoda Satsang Society and Shoolini University in which about 150 farmers were benefited.

Transfer of Technology
Sponsored Institutional Trainings

TOT Centre	Training programmes		Number of participants			
	Name	No. of training programme	Farmers		Extension workers	Total
			Male	Female		
Directorate of Extension Education	On campus -Farmers -Extension Functionaries	75 6	2325 111	515 74	6 14	2846 199
Under projects	Off campus -Farmers	6	-	-	-	858

Other extension activities undertaken by Directorate of Extension Education

Activity		DEE	
		No. of activities	No. of beneficiaries
Guided visits	Himachal Pradesh	16	469
	Other States (J&K, Uttarakhand, UP, Punjab, UT Chandigarh, Rajasthan, Delhi, Haryana, Meghalaya etc.)	25	716
	Extension functionaries	8	78
	Students (Himachal Pradesh, Rajasthan, Kerala etc.)	2	37
	Total	**51**	**1300**
Van Mahotasav (4th August, 2013)		1	250
Foundation Day of the University (1st December, 2013)		1	2500
Location Specific Training Camps		1	24
Replied to the Farmers letters received from AIR, Shimla through Courier Service of the University		-	47
Exhibitions			
During State Level Shoolini Fair at Solan (21-23 June, 2013)		1	12000 (Approx)
During Progressive Punjab Agriculture Summit AgriTech -2014 organized by PHD Chamber of Commerce and Industry (CII) and Govt. of Punjab at Chappar Chiri, Sector 91, Mohali (Punjab) from 15-19 February, 2014.		1	25,000
During District Level Red Cross Mela – 2013 held at Solan on 21st September, 2013)		1	300 (Approx)
Collaborated Programme: Kisan Mela at Panthi in Shimla district organized in collaboration with Yogoda Satsang Society and Shoolini University.		1	150

Regional Centre (NAEB)

- The Regional Centre, NAEB is playing a pivotal role in integrated watershed development programme. The activities undertaken under these programmes include community organization and institutional trainings
- Practices for harvesting, processing and marketing of selected non-timber forest plants and medicinal plants in Himachal Pradesh was carried out. It was observed that harvesting of roots of medicinal plants should be done after plant shed their seeds and about 30-40 per cent herb should be left for plantation of regeneration. Domestication of medicinal plant should be encouraged.
- Identification of indicators to access the success of afforestation programme in the state of Himachal Pradesh was done and observed that in order to maintain afforestation, it is important to take preventive measures to protect it from animals, human and pest damage. Afforestation programmes should not be based on achieving physical and financial targets each year, but it should be based on small areas to be planted and maintained for longer period. Local farmers should be encouraged to plant forest trees on their lands.



ACADEMIC ACTIVITIES

To pursue human resource development in horticulture, forestry and allied sciences, the University offers following undergraduate and postgraduate programmes through its constituent colleges/institute, viz., College of Horticulture, College of Forestry, Nauni, Solan and Institute of Biotechnology and Environmental Science, Neri, Hamirpur.

College of Horticulture

- Undergraduate Programme
  - BSc (Honours) Horticulture: Four Year Programme
- Postgraduate Programmes
  - MSc in Entomology, Floriculture and Landscape Architecture, Food Technology, Fruit Science, Molecular Biology and Biotechnology, Nematology, Plant Pathology, Seed Science and Technology and Vegetable Science
  - Master of Business Administration (Agribusiness) and Master of Business Administration
  - PhD in Entomology, Floriculture and Landscape Architecture, Food Technology, Fruit Science, Molecular Biology and Biotechnology, Nematology, Plant Pathology, Seed Science & Technology and Vegetable Science

College of Forestry

- Undergraduate Programme
  - BSc (Honours) Forestry: Four Year Programme
- Postgraduate Programmes
  - MSc in Agricultural Economics, Agroforestry, Environment Management, Environmental Science, Forest Genetic Resources, Medicinal and Aromatic Plants, Watershed Management, Natural Resosurce Management, Microbiology, Plant Physiology, Plantation Technology, Silviculture, Soil Science & Water Management, Wood Science and Technology and Statistics
  - PhD in Agricultural Economics, Agroforestry, Environmental Science, Forest Genetic Resources, Medicinal and Aromatic Plants, Microbiology, Natural Resource Economics, Silviculture, Soil Science, Wood Science & Technology and Statistics

Institute of Biotechnology and Environmental Science, Neri, Hamirpur

- Undergraduate Programmes
  - BSc (Honours) Horticulture: Four Year Programme
  - BSc (Honours) Biotechnology: Four Year Programme

Students Admitted

The detail of the students admitted and passed out in various degree programmes of the University during the academic session 2013-14 is given below:

Undergraduate Programme(s)

College	Degree Programme	Admissions
College of Horticulture	BSc (Honours) Horticulture (4 year programme)	72
College of Forestry	BSc (Honours) Forestry (4 year programme)	57
IBES, Neri	BSc (Honours) Horticulture (4 year programme)	58
	BSc (Honours) Biotechnology (4 year programme)	32
	Total	**219**

Postgraduate Programme(s)

College/Discipline	Admissions		
	MSc/MBA	PhD	Total
College of Horticulture			
Entomology	8	4	12
Floriculture and Landscape Architecture	8	3	11
Food Technology	11	4	15
Fruit Science	8	5	13
Molecular Biology and Biotechnology	5	7	12
Nematology	3	1	4
Plant Pathology	7	5	12
Seed Science and Technology	7	4	11
Vegetable Science	8	4	12
MBA/MBA (Agribusiness)	40	-	40
Total	**105**	**37**	**142**
College of Forestry			
Agricultural Economics	3	2	5
Agroforestry	3	5	8
Environment Management	4	-	4
Environmental Science	5	7	12
Forest Genetic Resources	3	4	7
Medicinal and Aromatic Plants	-	2	-
Microbiology	7	6	13
Natural Resource Economics	-	2	2
Plantation Physiology	3	-	3
Silviculture	3	2	5
Soil Science	5	2	7
Statistics	4	3	7
Watershed Management	1	-	1
Wood Science and Technology	2	2	4
Total	**44**	**37**	**81**
Grand Total	**149**	**74**	**223**

Passed Out Students

College	BSc	MSc	MBA	PhD	Total
College of Horticulture	65	74	54	20	213
College of Forestry	51	46	-	9	106
Total	**116**	**120**	**54**	**29**	**319**

COLLEGE OF HORTICULTURE

Students on roll after 1.4.2013

Undergraduate	Boys	Girls	Total
BSc (Honours) 1st year	22	40	62
BSc (Honours) 2nd year	17	48	65
BSc (Honours) 3rd year	16	48	64
BSc (Honours) 4th year	36	49	75
BSc (Honours) extra	7	-	7
Total	98	175	273

Postgraduate	Boys	Girls	Total
MSc (Horticulture) 1st year	33	32	65
MSc (Horticulture) 2nd year	22	39	61
MSc (Horticulture) extra	7	3	10
Total	61	75	136

PhD	Boys	Girls	Total
PhD 1st year	20	17	37
PhD 2nd year	11	14	25
PhD 3rd year	10	11	21
PhD extra	6	7	13
Total	47	49	96

MBA/ABM	Boys	Girls	Total
MBA 1st year	17	15	32
ABM (Agri-business) 1st year	2	1	3
MBA 2nd year	26	26	52
ABM (Agri-business) 2nd year	2	-	2
Total	47	42	89
Grand total	341	253	594

Passed out during the period

Name of the programme	Boys	Girls	Total
BSc (Horticulture)	30	32	62
MSc (Horticulture)	39	24	63
MBA	27	22	49
PhD (Horticulture)	12	6	18
Total	108	84	198

ICAR Central Development Assistance Scheme

- This college has been allocated the funds amounting to Rs. 121.00 crores under different sub heads during the financial year 2013-14. These funds were further allocated and provided to the departments of College of Horticulture for the purchase of Chemicals, Glassware's, Plastic wares, repair and AMC of instruments and equipments, publication of Practical Manuals for UG/PG students. The funds were also provided to the faculty and students of this college for the participation in the National Seminars, Symposiums & Trainings etc.

NAIP Project

- Organized the on-line as well as off-line training to the students of Horticulture at College of Horticulture, Dr YSPUH&F, Solan in the month of September & October, 2013.

COLLEGE OF FORESTRY

Students on roll after 1.4.2013

Undergraduate	Boys	Girls	Total
BSc (Honours), 1st year	29	31	60
BSc (Honours), 2nd year	36	29	65
BSc (Honours), 3rd year	24	25	49
BSc (Honours), Final year	33	30	63
Total	**122**	**115**	**237**

Postgraduate	Boys	Girls	Total
MSc 1st year	18	26	44
MSc Final year	26	39	65
Total	**44**	**65**	**109**

PhD	Boys	Girls	Total
PhD 1st year	12	25	37
PhD 2nd year	12	23	35
PhD Final year	18	16	34
Total	**42**	**64**	**106**

Passed out during the period

Name of the programme	Boys	Girl s	Total
BSc (Honours) Forestry	27	19	46
MSc	15	24	39
PhD	6	3	9
Total	**48**	**46**	**94**

- BSc 3rd year students were undertaken on educational tour to Central and South India w.e.f. 26.12.2013 to 26.1.2014. During this period, they visited various forestry based institutes and industries at Jodhpur, Mumbai, Goa, Trichur, Trivandrum, Coimbatore, Bangalore, Hyderabad and Jhansi.
- A MoU was signed between this college and Hawassa University, Ethiopia on 7.3.2014 to facilitate and enhance academic co-operation in the fields of research, education, quality assurance, institutional development and information dissemination. Exchange of faculty and students for skill up gradation and capacity building in the broad spectrum of forestry and related disciplines.



Signing MoU Hawassa University, Ethiopia

UNIVERSITY AUTHORITIES

(01.04.2013-31.3.2014)

Senate, Board of Management, Finance Committee, Academic Council, Research Council, Extension Council and Board of Studies

The University Authorities are consisting of University Senate, Board of Management, Academic Council, Research Council, Extension Council, Finance Committee and Board of Studies for College of Horticulture and College of Forestry.

Senate

Members	Designation/Status
Ex-Officio members:	
Smt. Urmila Singh	Chancellor (Chairperson)
Dr. KR Dhiman	Vice Chancellor, UHF, Nauni upto 07.05.2013
Sh. Tarun Shridhar	Vice Chancellor, UHF, Nauni w.e.f. 08.05.2013 to 26.07.2013
Dr. Vijay Singh Thakur	Vice Chancellor, UHF, Nauni w.e.f. 26.07.2013
Sh. PC Kapoor	Additional Chief Secretary (Horticultu re) to the Government of Himachal Pradesh upto 20.04.2013
Sh. Tarun Shridhar	Principal Secretary (Horticulture) to the Government of Himachal Pradesh w.e.f. 21.04.2013 to 01.07.2013
Sh. Vineet Chawdhry	Additional Chief Secretary (Horticulture) to the Gov ernment of Himachal Pradesh w.e.f. 02.07.2013
Dr. Bharati S. Sihag	Principal Secretary (Forests) to the Government of Himachal Pradesh
Shri Tarun Shridhar	Principal Secretary (Forests) to the Government of Himachal Pradesh w.e.f. 04.09.2013
Dr. JC Rana	Director of Agriculture, Government of Himachal Pradesh
Dr. Gurdev Singh	Director of Horticulture, Government of Himachal Pradesh
Sh. RK Gupta, IFS	Principal Chief Conservator of Forests, Government of Himachal Pradesh
Dr. RC Sharma	Dean, College of Horticulture, UHF, Nauni upto 30.05.2013
Dr. JP Sharma	Dean, College of Horticulture, UHF, Nauni w.e.f. 01.06.2013
Dr. SD Kashyap	Dean, College of Forestry, UHF, Nauni upto 30.04.2013
Dr. RC Sharma	Dean, College of Forestry, UHF, Nauni w.e.f. 03.05.2013 to 30.05.2013
Dr. GS Shamet	Dean, College of Forestry, UHF, Nauni w.e.f. 01.06.2013
Dr. RC Sharma	Director of Research, UHF, Nauni
Dr. NB Singh	Director of Extension Education, UHF, Nauni
Sh. MR Verma	Comptroller, UHF, Nauni upto 31.08.2013
Sh. PC Sharma	Comptroller, UHF, Nauni w.e.f. 03.09.2013
Ar. Pavan Sharma	Estate Officer, UHF, Nauni
Dr. MS Pathania	Librarian, UHF, Nauni upto 30.04.2013
Dr. MS Pathania	Librarian, UHF, Nauni w.e.f. 17.05.2013
Dr. RC Sharma	Students' Welfare Officer, UHF, Nauni 03.04.2013 to 05.04.2013
Dr. AS Chandel	Students' Welfare Officer, UHF, Nauni w.e.f. 06.04.2013

Member Secretary	
Mrs. Rupali Thakur, HAS	Registrar, UHF, Nauni
Other Members	
Sh. Ajay Mahajan	Member, HP Legislative Assembly
Sh. Mohan Lal Brakta	Member, HP Legislative Assembly
Dr. Diwakar Tripathi	Sr. Scientist, Department of Soil Science and Water Management, UHF, Nauni
Mrs. Ashu Chandel	Assistant Professor, Department of Basic Sciences, UHF, Nauni
Sh. OP Thakur	Senior Assistant, Department of Fruit Sciences, UHF, Nauni

Board of Management

Members	Designation/Status
Ex-Officio members:	
Dr. KR Dhiman	Vice Chancellor, UHF, Nauni upto 07 .05.2013
Sh. Tarun Shridhar	Vice Chancellor, UHF, Nauni w.e.f. 08 .05.2013 to 26.07.2013
Dr. Vijay Singh Thaku r	Vice Chancellor, UHF, Nauni w.e.f. 26 .07.2013
Dr. SK Sharma	Vice Chancellor, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur upto 31.07.2013
Dr. KK Katoch	Vice Chancellor, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur w.e.f. 01.08.2013
Sh. PC Kapoor	Additional Chief Secretary (Horticulture) to the Government of Himachal Pradesh upto 20.04.2013
Sh. Tarun Shridhar	Principal Secretary (Horticulture) to the Government of Himachal Pradesh w.e.f. 21.04.2013 to 01.07.2013
Sh. Vineet Chawdhry	Additional Chief Secretary (Horticulture) to the Government of Himachal Pradesh w.e.f. 02.07.2013
Dr. Shrikant Baldi	Principal Secretary (Finance) to the Government of Himachal Pradesh
Dr. Bharati S. Sihag	Principal Secretary (Forests) to the Government of Himachal Pradesh
Sh. Tarun Shridhar	Principal Secretary (Forests) to the Government of Himachal Pradesh w.e.f. 04.09.2013
Dr. Gurdev Singh	Director of Horticulture, Government of Himachal Pradesh
Sh. RK Gupta, IFS	Principal Chief Conservator of Forests, Government of Himachal Pradesh
Dr. JC Rana	Director of Agriculture, Government of Himachal Pradesh
Member Secretary	
Mrs. Rupali Thakur, HAS	Registrar, UHF, Nauni
Other Members	
Dr. RC Sharma	Dean, College of Horticulture, UHF, Nauni upto 30.05.2014
Dr. PL Gautam	Chairman, Protection of Plant Varieties and Farmers Rights Authority, NASC Complex, New Delhi – 110012
Dr. OP Sharma	Additional PCCF (Retd.), Pinewood House No. 141, Ward No. 1, Heera Nagar, Hamirpur – 177001

Sh. Pratap Chauhan	Village Chaithla-Nagpuri, Kotkhai, Shimla
Sh. Hariman Sharma	Village Panyala, PO Kothi, Tehsil Ghumarwin, District Bilaspur 174021
Sh. Chet Ram Negi	VPO Tapri, Tehsil Nichar, District Kinnaur – 172104
Mrs. Veena Thakur	W/o S hri Ashok Thakur, Durga Villa, Flat No. 3, Upper Kaithu, Shimla
Er. JS Katoch	Engineer-in-Chief (Retd.), VPO Bandla, Tehsil Palampur, District Kangra
Dr. BP Singh	Director, CPRI, Shimla
Dr. VRR Singh	Director, HFRI, Dehradun

Finance Committee

Members	**Designation/Status**
Dr. KR Dhiman	Vice Chancellor, UHF, Nauni upto 07 .05.2013
Sh. Tarun Shridhar, IAS	Vice Chancellor, UHF, Nauni w.e.f. 08 .05.2013 to 26.07.2013
Dr. Vijay Singh Thakur	Vice Chancellor, UHF, Nauni w.e.f. 26 .07.2013
Dr. Shirkant Baldi, IAS	Principal Secretary (Finance) to the Government of Himachal Pradesh
Dr. AR Sihag	Principal Secretary (Agriculture) to the Government of Himachal Pradesh upto 21.05.2013
Sh. RD Dhiman	Principal Secretary (Agriculture) to the Government of Himachal Pradesh w.e.f. 22.05.2013 to 01.07.2013
Sh. Deepak Sanan	Additional Chief Secretary (Agriculture) to the Government of Himachal Pradesh w.e.f. 02.07.2013
Sh. PC Kapoor	Additional Chief Secretary (Horticulture) to the Government of Himachal Pradesh upto 20.04.2013
Sh. Tarun Shridhar	Principal Secretary (Horticulture) to the Government of Himachal Pradesh w.e.f. 21.04.2013 to 01.07.2013
Sh. Vineet Chawdhry	Additional Chief Secretary (Horticulture) to the Government of Himachal Pradesh w.e.f. 02.07.2013
Mrs. Rupali Thakur, HAS	Registrar, UHF, Nauni
Sh. Rajesh Sharma, HAS	Special Secretary (Finance)-cum-Examiner, Local Audit Department to the Government of Himachal Pradesh
Dr. Gurdev Singh	Director of Horticulture, Government of Himachal Pradesh
Sh. RK Gupta, IFS	Principal Chief Conservator of Forests, Government of Himachal Pradesh
Sh. OP Sharma, IFS	Additional PCCF (Retd.), Pinewood House No. 141, Ward No. 1, Heera Nagar, Hamirpur – 177001
Member Secretary	
Sh. MR Verma	Comptroller upto 31.08.2013
Sh. PC Sharma	Comptroller w.e.f. 03.09.2013

Academic Council

Members	Designation/Status
Dr. KR Dhiman	Vice Chancellor, UHF, Nauni upto 07 .05.2013
Sh. Tarun Shridhar	Vice Chancellor, UHF, Nauni w.e.f. 08 .05.2013 to 26.07.2013
Dr. Vijay Singh Thakur	Vice Chancellor, UHF, Nauni w.e.f. 26 .07.2013
Dr. RC Sharma	Dean, College of Horticulture, UHF, Nauni upto 30.05.2013
Dr. JP Sharma	Dean, College of Horticulture, UHF, Nauni w.e.f. 01 .06.2013
Dr. SD Kashyap	Dean, College of Forestry, UHF, Nauni upto 30 .04.2013
Dr. RC Sharma	Dean, College of Forestry, UHF, Nauni w.e.f. 03.05.2013 to 30.05.2013
Dr. GS Shamet	Dean, College of Forestry, UHF, Nauni w.e.f. 01 .06.2013
Dr. RC Sharma	Director of Research, UHF, Nauni
Dr. NB Singh	Director of Extension Education, UHF, Nauni
Sh. DP Pandey	Director, Forestry Education, Forest Research Institute, Dehradun
Dr. MS Pathania	Librarian, UHF, Nauni upto 30.04.2013
Dr. MS Pathania	Librarian, UHF, Nauni w.e.f. 17.05.2013
Dr. RC Sharma	Students' Welfare Officer UHF, Nauni w.e.f. 03.04.2013 to 05.04.2013
Dr. AS Chandel	Students' Welfare Officer, UHF, Nauni w.e.f. 06.04.2013
Dr. PS Chauhan	Professor & Head, Department of Fruit Science, UHF, Nauni
Dr. JP Sharma	Sr. Scientist, RHRS, Bajaura, District Kullu (HP)
Dr. CK Shirkot	Sr. Microbiologist & Head, Department of Basic Science, UHF, Nauni
Dr. Romesh Chand	Sr. Scientist, Department of Forest Products, UHF, Nauni
Dr. RC Mishra	Village Roda PO Rahon, via Barhmalkera, Palampur, District Kangra (HP)
Dr. GS Randhawa	Professor, Department of Biotechnology, IIT Roorkee (Uttarakhand)
Member Secretary	
Mrs. Rupali Thakur, HAS	Registrar, UHF, Nauni

Research Council

Members	Designation/Status
Dr. KR Dhiman	Vice Chancellor, UHF, Nauni upto 07 .05.2013
Sh. Tarun Shridhar	Vice Chancellor, UHF, Nauni w.e.f. 08 .05.2013 to 26.07.2013
Dr. Vijay Singh Thakur	Vice Chancellor, UHF, Nauni w.e.f. 26 .07.2013
Dr. Gurdev Singh	Director of Horticulture, Government of Himachal Pradesh
Dr. JC Rana	Director of Agriculture, Government of Himachal Pradesh
Sh. RK Gupta, IFS	Principal Chief Conservator of Forests, Government of Himachal Pradesh
Dr. RC Sharma	Dean, College of Horticulture, UHF, Nauni upto 30.05.2013
Dr. JP Sharma	Dean, College of Horticulture, UHF, Nauni w.e.f. 01 .06.2013
Dr. SD Kashyap	Dean, College of Forestry, UHF, Nauni upto 30.04.2013

Dr. RC Sharma	Dean, College of Forestry, UHF, Nauni w.e.f. 03.05.2013 to 30.05.2013
Dr. GS Shamet	Dean, College of Forestry, UHF, Nauni w.e.f. 01 .06.2013
Dr. NB Singh	Director of Extension Education, UHF, Nauni
All the Heads of Departments	UHF, Nauni
All the Associate Directors (R&E)	UHF
Member Secretary	
Dr. RC Sharma	Director of Research, UHF, Nauni
Other Members	
Sh. Arvind Bindal	Bindal Colony, Solan
Sh. Baldev Thakur	VPO Mandal, Tehsil Jubbal, District Shimla
Sh. Vidya Sagar Negi	VPO Telangi, PO Reckong Peo, District Kinnaur (HP)
Sh. Kailash Chand Saini	Ward No. 4, Santoshgarh, Tehsil and District Una, HP
Sh. Girdhari Lal	Village Banjal, PO Lathiani, Tehsil Bangana, District Una HP

Extension Council

Members	**Designation/Status**
Dr. KR Dhiman	Vice Chancellor, UHF, Nauni upto 07 .05.2013
Sh. Tarun Shridhar	Vice Chancellor, UHF, Nauni w.e.f. 08 .05.2013 to 26.07.2013
Dr. Vijay Singh Thakur	Vice Chancellor, UHF, Nauni w.e.f. 26 .07.2013
Dr. Gurdev Singh	Director of Horticulture, Government of Himachal Pradesh
Dr. JC Rana	Director of Agriculture, Government of Himachal Pradesh
Sh. RK Gupta, IFS	Principal Chief Conservator of Forests, Government of Himachal Pradesh
Dr. RC Sharma	Dean, College of Horticulture, UHF, Nauni upto 30.05.2013
Dr. JP Sharma	Dean, College of Horticulture, UHF, Nauni w.e.f. 01 .06.2013
Dr. SD Kashyap	Dean, College of Forestry, UHF, Nauni upto 30 .04.2013
Dr. RC Sharma	Dean, College of Forestry, UHF, Nauni w.e.f. 03.05.2013 to 30.05.2013
Dr. GS Shamet	Dean, College of Forestry, UHF, Nauni w.e.f. 01 .06.2013
Dr. RC Sharma	Director of Research, UHF, Nauni
All the Heads of Departments	UHF, Nauni
All the Associate Directors (R&E)	UHF
Joint Director (Training)	Directorate of Extension Education, UHF, Nauni
Joint Director (Communication)	Directorate of Extension Education, UHF, Nauni
Extension Co-ordinator	Directorate of Extension Education, UHF, Nauni
Deputy Commissioner	Solan, District Solan
Member Secretary	
Dr. NB Singh	Director of Extension Education, UHF, Nauni
Other Members	
Sh. Nihal Chand	Barog View, Hospital Road, Solan

Sh. Gian Thakur	VPO Kotkhai, District Shimla, HP
Sh. Maharaj Krishan Badyal	M/S HP Farmers, 1st Floor, Dogra Bazar, Chamba, District Chamba, HP
Sh. Ravi Kant Sharma	Village Kharoth, PO Ballah, Via Paraur, Tehsil Palampur, District Kangra, HP
Sh. Arjun Mehta	Village Ser -Manon, PO Shaya Chabhron, Tehsil Rajgarh, District Sirmour, HP

Board of Studies for College of Horticulture

Members	**Designation/Status**
Dr. RC Sharma	Dean, College of Horticulture, UHF, Nauni upto 30.05.2013
Dr. JP Sharma	Dean, College of Horticulture, UHF, Nauni w.e.f. 01.06.2013
All the Heads of Departments	College of Horticulture, UHF, Nauni
Secretary	
Dr. K Kumar	Professor, Department of Fruit Science, UHF, Nauni
Other Members	
Dr. CK Shirkot	Professor and Head, Department of Basic Science, UHF, Nauni
Dr. LR Sharma	Professor and Head, Department of Social Sciences, UHF, Nauni
Dr. JN Raina	Professor and Head, Department of Soil Science and Water Management, UHF, Nauni upto 31.08.2013
Dr. GP Upadhyay	Professor and Head, Department of Soil Science and Water Management w.e.f. 15.10.2013
Dr. BP Sharma	Department of Floriculture and Landscaping, UHF, Nauni
Dr. Vishal Singh Rana	Department of Fruit Science, UHF, Nauni
Dr. NK Bharat	Department of Plant Pathology, UHF, Nauni
Dr. Kuldeep Thakur	Department of Vegetable Science, UHF, Nauni
Ms. Surekha Kumari	Department of Food Science and Technology
Dr. Rajnish Sharma	Department of Biotechnology, UHF, Nauni
Dr. Kapil Kathuria	Department of Business Management, UHF, Nauni
Dr. (Mrs.) Sapna Katna	Department of Entomology, UHF, Nauni

Board of Studies for College of Forestry

Members	**Designation/Status**
Dr. SD Kashyap	Dean, College of Forestry, UHF, Nauni upto 30.04.2013
Dr. RC Sharma	Dean, College of Forestry, UHF, Nauni w.e.f. 03.05.2013 to 30.05.2013
Dr. GS Shamet	Dean, College of Forestry, UHF, Nauni w.e.f. 01.06.2013
All the Heads of Departments	College of Forestry, UHF, Nauni
Secretary	
Other Members	
Dr. JP Sharma	Professor and Head, Department of Entomology, UHF, Nauni upto 17.12.2013

Dr. ML Khan	Professor and Head, Department of Entomology, UHF, Nauni w.e.f. 18.12.2013
Dr. BC Suman	Professor and Head, Department of Plant Pathology, UHF, Nauni
Dr. SV Bhardwaj	Professor and Head, Department of Biotechnology, UHF, Nauni upto 31.04.2013
Dr. DK Srivastava	Professor and Head, Department of Biotechnology, UHF, Nauni w.e.f. 18.12.2013
Dr. Chaman Lal	Department of Silviculture and Agroforestry, UHF, Nauni
Dr. Bhupinder Dutt	Department of Forest Products, UHF, Nauni
Dr. Rajesh Kaushal	Department of Basic Science, UHF, Nauni
Dr. Sudhir Verma	Department of Soil Science and Water Management, UHF, Nauni upto 17.12.2013
Dr. Pradeep Kumar	Department of Soil Science and Water Management, UHF, Nauni w.e.f. 18.12.2013
Sh. Jai Pal Sharma	Department of Tree Improvement and Genetic Resources, UHF, Nauni
Dr. Mohinder Kumar Brahmi	Department of Environmental Science, UHF, Nauni upto 17.12.2013
Dr. Parminder Kaur Baweja	Department of Environmental Science, UHF, Nauni w.e.f. 18.12.2013
Dr. Subhash Sharma	Department of Social Sciences, UHF, Nauni.

Officers of the University

Officers	**Designation/Status**
Smt Urmila Singh	Chancellor (Chairperson)
Dr. KR Dhiman	Vice Chancellor upto 07.05.2013
Sh. Tarun Shridhar	Vice Chancellor 08.05.2013 to 26.07.2013
Dr. Vijay Singh Thakur	Vice Chancellor w.e.f. 26.07.2013
Dr. RC Sharma	Dean, College of Horticulture upto 30.05.2013
Dr. JP Sharma	Dean, College of Horticulture w.e.f. 01.06.2013
Dr. SD Kashyap	Dean, College of Forestry upto 30.04.2013
Dr. RC Sharma	Dean, College of Forestry w.e.f. 03.05.2013 to 30.05.2013
Dr. GS Shamet	Dean, College of Forestry w.e.f. 01.06.2013
Dr. RC Sharma	Director of Research
Dr. NB Singh	Director of Extension Education
Sh. MR Verma	Comptroller upto 31.08.2013
Sh. PC Sharma	Comptroller w.e.f. 03.09.2013
Ar. Pawan Sharma	Estate Officer
Dr. MS Pathania	Librarian upto 30.04.2013
Dr. MS Pathania	Librarian w.e.f. 17.05.2013
Dr. RC Sharma	Students' Welfare Officer 03 .04.2013 to 05.04.2013
Dr. AS Chandel	Students' Welfare Officer w.e.f. 06 .04.2013
Mrs. Rupali Thakur, HAS	Registrar

Joint Directors	
Dr. NP Dohroo	Joint Director Research (Horticulture) upto 26.07.2013
Dr. Kamlesh Kanwar	Joint Director Research (Horticulture) w.e.f. 29.07.2013
Dr. D. Tripathi	Joint Director Research (Forestry) w.e.f. 05.08.2013
Dr. Manoj Kumar Vaidya	Joint Director Research (Planning) w.e.f. 28.07.2013

Heads of the Departments	
Dr. PS Chauhan	Professor and Head, Department of Fruit Science
Dr. VK Joshi	Professor and Head, Department of Food Science and Technology
Dr. BC Suman	Professor and Head, Department of Plant Pathology upto 31.01.2014
Dr. JN Sharma	Professor and Head, Department of Plant Pathology w.e.f. 01.02.2014
Dr. JP Sharma	Professor and Head, Department of Entomology upto 26.07.2013
Dr. ML Khan	Professor and Head, Department of Entomology w.e.f. 27.07.2013
Dr. ML Bhardwaj	Professor and Head, Department of Vegetable Science
Dr. YC Gupta	Professor and Head, Department of Floriculture and Landscaping
Dr. SV Bhadwaj	Professor and Head, Department of Biotechnology upto 31.04.2013
Dr. DK Srivastava	Professor and Head, Department of Biotechnology w.e.f. 01.05.2013
Dr. YS Negi	Professor and Head, Department of Business Management
Dr. SD Kashyap	Professor and Head, Department of Silviculture and Agroforestry upto 30.04.2013
Dr. GS Shamet	Professor and Head, Department of Silviculture w.e.f. 01.05.2013 to 26.07.2013
Dr. NK Gupta	Professor and Head, Department of Silviculture and Agroforestry w.e.f. 27.07.2013
Dr. NB Singh	Professor and Head, Department of Tree Improvement and Genetic Resources upto 26.07.2013
Dr. Sanjeev Thakur	Professor and Head, Department of Tree Improvement and Genetic Resources w.e.f. 27.07.2013
Dr. Kulwant Rai	Professor and Head, Department of Forest Products
Dr. LR Sharma	Professor and Head, Department of Social Sciences
Dr. JN Raina	Professor and Head, Department of Soil Science and Water Management upto 31.08.2013
Dr. GP Upadhyay	Professor and Head, Department of Soil Science and Water Management w.e.f. 02.09.2013
Dr. CK Shirkot	Professor and Head, Department of Basic Sciences
Dr. HS Kanwar	Professor and Head, Department of Seed Science and Technology
Dr. Satish Kumar	Professor and Head, Department of Environmental Sciences
Associate Directors	
Dr. Vijay Singh Thakur	Associate Director (R&E), Regional Horticultural Research Station, Mashobra upto 25.07.2013
Dr. BS Thakur	Associate Director (R&E), Regional Horticultural Research Station, Mashobra w.e.f. 29.07.2013 (Renamed as Regional Horticultural Research and Training Station w.e.f. 23.12.2013)
Dr. Jayant Kumar	Associate Director (R&E), Regional Horticultural Research Station, Bajaura (Renamed as Regional Horticultural Research and Training Station w.e.f. 23.12.2013)

Dr. SS Rana	Associate Director (R&E), Regional Horticultural Research Station, Jachh (Renamed as Regional Horticultural Research and Training Station w.e.f. 23.12.2013)
Dr. AK Joshi	Associate Director (R&E), Regional Horticultural Research Station, Dhaulakuan (Renamed as Regional Horticultural Research and Training Station w.e.f. 23.12.2013)
Dr. Satish Kumar Sharma	Associate Director (R&E), Regional Horticultural Research Stati on, Sharbo upto 10.12.2013
Dr. Rajeshwar S Chandel	Associate Director (R&E), Regional Horticultural Research Station, Sharbo w.e.f. 10.12.2013
Dr. ML Verma	Programme Coordinator, Krishi Vigyan Kendra, Reckong Peo upto 21.08.2013.
Dr. Satish Kumar Sharma	Programme Coordinator, Krishi Vigyan Kendra, Rckong Peo w.e.f. 23.08.2013 to 10.12.2013
Dr. Rajeshwar S Chandel	Associate Director (R&E) and Programme Coordinator, RHRS, Sharbo and Krishi Vigyan Kendra, Reckong Peo now renamed as Regional Horticultural Research and Training Station and Krishi Vigyan Kendra, Sharbo (Kinnaur) w.e.f. 23.12.2013
Dr. DD Sharma	Senior Scientist -cum-Incharge, Horticultural Research Station, Kandaghat
Dr. DD Sharma	Programme Coordinator, Krishi Vigyan Kendra, Kandaghat
Dr. DD Sharma	Associate Director (R&E) and Programme Coordinaotr, HRS, Kandaghat and Krishi Vigyan Kendra, Kandaghat now renamed as Horticultural Research and Training Station and Krishi Vigyan Kendra, Kandaghat (Solan) w.e.f. 23.12.2013
Dr. Uday Sharma	Programme Coordinator, Krishi Vigyan Kendra, Chamba upto 10.04.2013
Dr. Rajeev Raina	Programme Coordinator, Krishi Vigyan Kendra, Chamba w.e.f. 11.04.2013
Dr. NS Kaith	Programme Coordinator, Krishi Vigyan Kendra, Rohru upto 13.03.2014
Dr. Manish Kumar	Programme Coordinator, Krishi Vigyan Kendra, Rohru w.e.f. 14.03.2014
Dr. KS Verma	Director, Institute of Biotechnology and Environmental Science, Neri.
Dr. Naveen Chand Sharma	Assistant Scientist-cum-Incharge, Temperate Horticultural Research Station, Kotkhai up to 17.02.2014 (Renamed as Temperate Horticultural and Forestry Research Station w.e.f. 23.12.2013)
Dr. Chuni Lal	Assistant Scientist - cum-Incharge, Regional Horticultural Research Sub-Station, Tabo
Dr. RS Prashar	Senior Scientist - cum-Incharge, LMRS, Nagrota Bagwan upto 29.08.2013
Dr. Rajesh Kumar Kaler	Senior Scientist- cum-Incharge, LMRS, Nagrota Bagwan w.e.f. 09.10.2013

COMPTROLLER OFFICE

The university has received Grant-in-Aid from different agencies during the financial year 2013-2014 (01.4.2013 to 31.3.2014) for carrying out the teaching, research and extension education programmes. The detail of receipts and expenditure is given as under:

(Rs. in lac.)

Sr. No.	Main source of funding	Grant-in-aid received (tentative)	Domestic income (tentative)	Total receipt (tentative)	Total expenditure (tentative)
1.	Department of Horticulture, Govt of HP	6300.01	1060.50	7360.51	7815.40
2.	Department of Forest , Govt of HP	32.00	0.00	32.00	38.35
	Total	**6332.01**	**1060.50**	**7392.51**	**7853.75**
1.	ICAR Co-ordinated Projects	453.42	--	453.42	450.20
2.	ICAR adhoc short terms projects	73.48	--	73.48	70.00
3.	ICAR Development Assistance	467.83	--	467.83	410.50
4.	Govt. of India	326.26	--	326.26	290.75
5.	Krishi Vigyan Kendras	323.90	--	323.90	320.90
6.	Mini Mission Projects.	63.30	--	63.30	58.30
7.	Miscellaneous Projects	613.00	--	613.00	575.76
8.	ICIMOD	1.86	--	1.86	1.10
	Total	**2323.05**	**1060.50**	**2323.05**	**2177.51**
	Grand Total	**8655.06**	**1060.50**	**9715.56**	**10031.26**



LIBRARY

Satyanand Stokes Library of the University specializes in Horticulture and Forestry information. It serves its users through computerized in-house databases and international databases available on CD-ROM. The library is well connected to Internet and e-mail facilities since January 1998.

CD-ROM Services

CD-ROM services continued to be popular and in extensive use particularly among the researchers. Subscriptions to the HORT-CD, FOREST SCIENCE databases were renewed and updated. One library professional has been exclusively assigned this job to conduct searches and produce output in the form of printout. The detail of searches conducted during the year is as under:

Total number of records generated from CD-ROM services	50129
Total number of CD-ROM users	420

Internet and e-mail

The internet and e-mail services are very popular amongst the students and faculty. To encourage the use of this facility, orientation of internet browsing particularly and search formulation techniques was given to the new entrants. By availing this facility, the participation of scientists in national/international conferences was reported to have increased substantially by availing E-mail facility and publication of papers were similarly expedited. Many students were able to seek admissions/jobs abroad.

Total number of Internet Users	3364

Digitilization and Softcopy Format of Theses

The library has digitized about 500 PhD theses w.e.f. 2000 onwards under the Krishi Prabha Project of ICAR and are available through website at http:www.hau.ernet.in. Format for the submission of softcopy of PhD/MSc theses has been approved by the university. Accordingly updating of theses database is now being done electronically. This has resulted in saving the paper. Further the soft copies submitted in the library are being transmitted to the lead centre of Krishi Prabha Project & HPKV, Palampur via e-mail. This has resulted in saving the postage charges.

Cera Access

With the advancement of web technology and free connectivity in the library, the scientists/ teachers and students have been given access to the electronic journals w.e.f. July 23, 2008 through CERA: Consortium for e-Resources in Agriculture. CERA offers access to 2000+ electronic journals through htt://www.cera.jccc.in. As such tracking of literature has become easier and the scientists have more time for research. This has helped in creating an e-access culture among scientists/teachers and students.

Current Periodical Section

The current periodicals section has subscribed 85 (64 Indian, 21 Foreign) research periodicals in hard copy form. All the periodicals are arranged in this section alphabetically by Title.

Technical Jobs

About 1270 documents were classified and catalogued and 1789 documents were fed in the computer and databases updated.

Other Statistics at Glance

Circulation

Readers visited	51222
Books issued	24676
Books returned	19100
Books consulted	74200
No. of reference inquires	4105
Journals consulted	204087

Acquisition Section

Following number of documents acquired during the year

I) Books purchased	791
ii) Books received as a Gratis	99
iii) Periodicals	163
ii) Theses added	34
Total	**1087**

Total holdings as on 31.03.2014

Books	46249
Periodicals	17056
Theses	4404
Others	515
Total	68907

Bindery

336 documents were completely bound and 2411 documents were repaired/stitched in addition to other miscellaneous jobs of other departments/offices of the university.

Book Bank

The library has some text collection in the book bank. During the year under report these books have been issued to the needy and most deserving students. The library intends to further strengthen this collection so that more students could be benefited.

Course on Library and Information Services

The library as usual has offered the two courses PGS-501 & PGS 502 on Library and Information Services & Technical Writing & Communication Skills (0+1) to MSc, MBA and PhD students of College of Forestry and College of Horticulture.



COMPUTER AND INSTRUMENTATION CENTRE

Computer and Instrumentation Centre provides central facility in computer and information technology to all the students, scientists and other staff of the university with more than two hundred regular users on roll. The Instrumentation centre provides facility for the repair and maintenance of the analytical equipments /instruments etc. of all the departments/offices/ research stations of the university. Various activities carried out in the CIC during 2013-14 are as under:

- Computer courses were offered to post graduate, MBA and MBA Agribusiness students and as minor courses for MSc/PhD Agricultural Statistics.









Transfer of Technology (TOT)

- Being a service unit CIC is helping scientists/ researchers in transfer of technology by providing related services such as Internet/e-mail facilities and repair and maintenance facilities.

Software updation and maintenance

Following software were updated and maintained

- Pay Roll System
- University Accounts Reconciliation System
- DA Arrear System
- GPF/CPF accounting System
- Students Semester Report System
- Entrance Exam Evaluation system
- Pay arrears for teachers and non-teacher.
- Income Reconciliation System

e-mail/Internet and Local Area Network (LAN)

At present all the departments and offices of the University have been provided e-mail/internet facility through campus wide Local Area Network (LAN) and 1 Gbps Internet Leased Line (under NKN project). The e-mail/internet facilities have also been provided to the University Library, Cyber Cafe, Sub-DIC Centre (Biotechnology), Communication Centre and ARIS Cells of College of Horticulture and Forestry. Presently about 250 internet/e-mail nodes at users location have been provided.

University Website

The University Website is being regularly updated by incorporating the latest information pertaining to departments/offices of the university.

University Entrance Examination

- Result of entrance examination for admission to BSc Horticulture and BSc Forestry four year program for the year 2013-2014 was evaluated and compiled in the Computer Centre. The result was also put on website of the university being maintained at the Centre.
- Result of written test for admission to MSc programmes of the university was also evaluated and compiled in the Computer Centre.
- Result of written exam for the recruitment of forest guards in HP Forest department for all the twelve circles of the State was compiled in the Computer Centre and merit list prepared.

Support

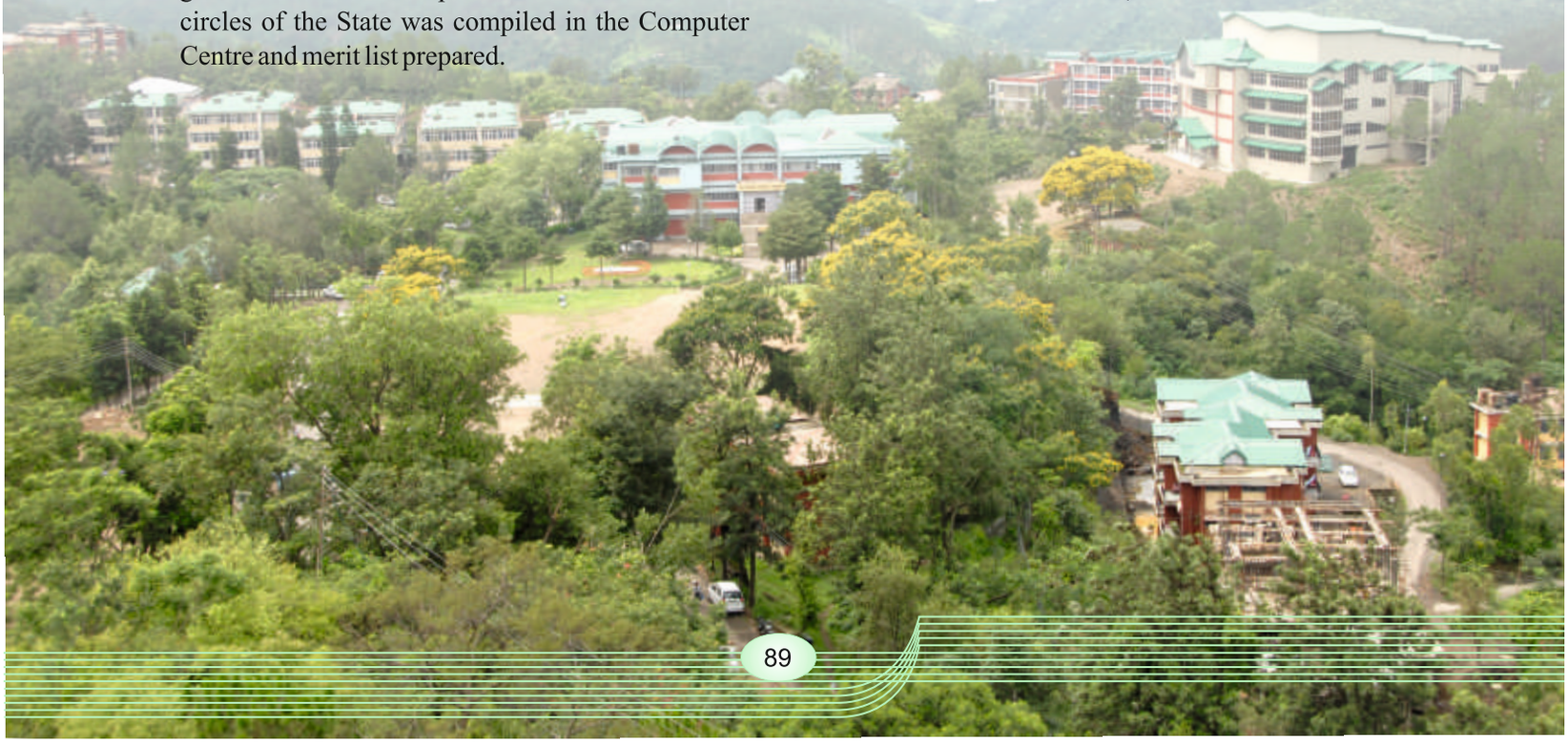
- Provided software and hardware support/assistance to all the departments/offices of the university.
- Provided Campus Wide Local Area Network support and consultancy in the various departments/offices of the university.

Instrumentation Centre

- Instrumentation workshop provided preventive and corrective maintenance support to various departments/offices of the university in main campus as well as to its research stations. During the period 226 requisitions were received out of which 125 jobs have been completed. No objection certificates have been issued to 26 equipments in which either the facility was not existing in the centre or the spares were not available in the open market. Remaining jobs are pending for want of spare or otherwise.
- Technical guidance/inspection facility was provided to university departments/research stations for purchase of equipment/machines as well as for disposal of unserviceable stock (dead stock).

Trainings

- Three days Sensitization Training Program on "Statistical Analysis of Horticulture & Forestry Datasets using SAS" jointly organized by CIC and NDRI Karnal March 5-7, 2014 at CIC.



STUDENTS WELFARE OFFICE

The Students' Welfare Officer is the overall Incharge-cum-Custodian of all the students welfare activities viz. sports and games, hostel management including lodging and boarding, health and hygiene, cultural, literary, NCC, NSS and other extra co-curricular activities. Full care is given for inculcating the feelings of friendship, amity, brotherhood, goodwill, comradeship and respect among the students beside promoting discipline. During the year under report, Students' Welfare Organization accomplished various student activities as under:

CSA Annual Function

The Central Students' Association of this university organized its Annual Function (Avyam) on 7.4.2013 at the University campus. Mrs Vidya Stokes, Hon'ble Minister for IPH, Horticulture and IT Govt. of Himachal Pradesh was the Chief Guest of the function. On this occasion, a colourful cultural programme was presented by the students of this university which was greatly appreciated by dignitaries and audience.

NSS Special Camp

Seven day NSS Special Camp for the B Sc Third Year Students was organized at the University campus w.e.f. June 25 to July 1, 2013. Seventy NSS volunteers from College of Horticulture and College of Forestry, Solan attended the camp. The main focus of the camp was overall personality development of the students and cleanliness activities.

Dheeraj Memorial Cricket Tournament

Dheeraj Memorial Cricket Tournament was organized by the Central Students' Association & TEAS jointly w.e.f. August 16, 2013 to September 17, 2013. In all 22 Cricket Teams participated in the tournament from campus and adjoining area. Dr JP Sharma, Dean College of Horticulture was the Chief Guest of concluding function on 17.9.2013 and gave the prizes to the winners.

Mimmy Memorial Football Tournament

Mimmy Football tournament was held w.e.f. August 18 to September 14, 2013 in which 10 football teams from the University campus participated. BSc Final year students team of the university won the tournament. Dr AS Chandel, Students' Welfare Officer presided over the concluding function and distributed the prizes to the winning teams.

Central Students' Association Elections

The election to the Central Students' Association, Dr YS Parmar University of Horticulture and Forestry, Solan for the Academic Session, 2013-14 were held on September 4, 2013 peacefully at the campus of the university. The elected Executive Committee of Central Students' Association is as follows:

Ms Raveena Negi, F-2012-26-M	President
Mr Pushap Raj, H-2012-34-M	Vice President
Mr Ankush Bhaik, H-2010-08-BIV	General Secretary
Mr Harash Vardhan Singh, F-2011-17-BIV	Joint Secretary-cum-Treasurer

Celebration of Ganesh Festival

The students of Maharashtra studying at this university celebrated the Ganesh Festival w.e.f. 9 to September 13, 2013. The idol of Ganesha was emersed in the Giri stream near Yashwant Nagar on September 13, 2013.

Jagran

The Central Students Association of this university organized a Jagran in the temple in university campus on October 5, 2013. The students, staff and inhabitants of residential colony Dr YSPUH&F, Solan participated in the Jagran.

Educational-cum-Heritage Trip

The Central Students' Association of this university organized an Educational-cum-Heritage Trip to Jaipur w.e.f. 15 to October 19, 2013. The students of university visited various historical places of Jaipur (Rajasthan) during the trip.

Freshers' Welcome Function

The Central Students' Association and TEAS organized Freshers' Welcome Function at the university campus on 29.10.2013. Dr Vijay Singh Thakur, Hon'ble Vice Chancellor was the Chief Guest of the function. A colourful cultural programme was presented by the students on this occasion. The senior students were advised to treat the freshers as younger brothers & sisters and live in complete harmony. Senior students were also

advised to help the juniors in studies as well as other matters.

On this occasion, Oath was also administered by the Hon'ble Vice Chancellor to the newly elected Office Bearers of the Central Students Association, 2013-14.

North Zone Intervarsity Kabaddi Championship (Women), 2013-14

North Zone Intervarsity Kabaddi Championship (Women), 2013-14 was organized in the university campus w.e.f. 16 to November 19, 2013. The teams from 19 universities across the country participated in the championship.

All India Intervarsity Kabaddi Championship (Women), 2013-14

All India Intervarsity Kabaddi Championship (Women), 2013-14 was organized by the university w.e.f. 26.11.2013 to 1.12.2013 in which 16 universities from different parts of India participated. Hon'ble Minister for IPH, Horticulture and IT Govt of Himachal Pradesh, Mrs Vidya Stokes was the Chief Guest of concluding functions and honoured the top teams with prizes.

North Zone Intervarsity Volleyball Championship (Men), 2013-14

The Students Welfare Organization conducted North Zone Intervarsity Volley Ball Championship (Men), 2013-14 w.e.f. 18 to December 22, 2013 at campus. In all 34 teams from different universities of the country participated in the championship. Dr Vijay Singh Thakur, Hon'ble Vice Chancellor was the Chief Guest of prize distribution function. The Winners and top ranking teams qualifying for All India Inter University Volley Ball Championship 2013-14 were honoured with prizes.

Dheeraj Memorial Cricket Tournament

Dheeraj Memorial Cricket Tournament was organized by the Central Students' Association & TEAS jointly w.e.f. February 1, 2014 to March 4, 2014. Twenty teams participated in the tournament. M Sc Cricket team of the university was the winner of tournament.

NCC Activities

- During the Academic Session 2013-14, 87 students were enrolled for NCC, which includes 59 boys and 28 girls cadets.
- NCC week was celebrated in the university campus w.e.f. 17 to November 24, 2013.

NSS Special Activities

- Organized a debate in the NSS class on "How to control the menace of increasing eve molestation cases in India" on May 3, 2013 in which 78 NSS volunteers participated.
- Celebrated Van Mahotsav on August 4, 2013. NSS volunteers planted 250 plants near Kalaghat, Solan.
- A campaign for eradication of parthenium was launched in the university campus on 23.8.2013.
- Communal Harmony Fortnight was celebrated w.e.f. August, 20 to September 3, 2013. Slogan writing and painting contest on National Unity and Integrity and Communal Harmony were organized during the period.
- A candle light procession was undertaken on October 1, 2013 to celebrate Gandhi Jyanti as non-violence day in which about 150 students participated. Essay writing & slogan writing contest on the theme "Gandhi Ji an apostle of peace, truth and Non-violence were organized on this occasion.

Hostel Management

- Wardens and Hostel Committees are responsible for running the day to day hostel affairs and maintaining the discipline in the hostels.
- Different magazines and newspapers are subscribed regularly for all the hostels.
- All the hostels are equipped with coloured TVs, Aqua Guards, Water Coolers and indoor game facilities like table tennis, badminton, carram board, chess etc. Hostel kitchens are provided with LPG connections. Cooperative messes are run by Hostel management committees under the overall supervision of Hostel Wardens.



ESTATE OFFICE

- During the financial year 2013-14 (1.4.2013 to 31.3.2014) a sum of Rs. 1645.00 Lakhs only was spent on various works transferred by the Comptroller/deposited by other departments with the Estate Organization as development assistance from various funding agencies viz. ICAR, ICFRE, Govt. of India, State Horticulture/Forestry grants etc. for buildings, roads, water supply, irrigation and electrification etc. at the main campus Nauni-Solan and various research stations and KVK's.
- Detail of some of the major/minor works undertaken/completed during the financial year 2013-14 are as under:

Sr. No.	Name of work	Status	Location
1.	Construction of Auditorium	Completed	Nauni
2.	Construction of Farmer Hostel	Completed	Nauni
3.	Construction of Class room for COF	Completed	Nauni
4.	Construction of Road from B agour to Pandah nursery	Completed	Nauni
5.	Renovation of Residue pesticide Lab., Department of EAP	Completed	Nauni
6.	Construction of Modern teaching block, Department of STPC	Completed	Nauni
7.	Construction of Tank, Department of SSWM	Completed	Nauni
8.	Modernization of Main entry gate	Completed	Nauni
9.	Construction of Five Nos. LDPE water storage tank, Department of SSWM	Completed	Nauni
10.	Construction of field store, Department of Fruit Science	Completed	Nauni
11.	Construction of Hall above ATIC building - BP	Completed	Nauni
12.	Providing Brick flooring in Cow shed	Completed	Nauni
13.	Providing pipe line in Cow shed	Completed	Nauni
14.	Construction of check dam at main campus	Completed	Nauni
15.	Construction of poly houses in Hi -tech floriculture project	Completed	Nauni
16.	Construction of Administrative Building at KVK	Completed	Kandaghat
17.	Construction of Angle iron racks at KVK	Completed	Kandaghat
18.	Replacement of roof of existing nursery store at RHRS	Completed	Mashobra
19.	Construction of field Lab. and chowkidar hut at RHRS	Completed	Mashobra
20.	Construction of residential quarter at KVK	Completed	Rohru
21.	Development of Road at RHRS	Completed	Sharbo
22.	Completion of Glass house	Completed	Sharbo
23.	Construction of Trainees hostel at KVK	Completed	Kalpa
24.	Construction of Poly tunnels at RHRSS	Completed	Tabo
25.	Construction of RCC water storage tank at RHRSS	Completed	Tabo
26.	Construction of RCC water storage tank at RHRS	Completed	Jachh
27.	Construction of Check dam and RCC water storage tank at IBES	Completed	Neri
28.	Construction of Poly houses at IBES	Completed	Neri
29.	Construction of Farm Road at IBES	Completed	Neri
30.	Construction of Play ground at IBES	Completed	Neri

In addition to above the following works are in progress and near completion.

- Construction of Check dam, Department of of SSWM Nauni
- Construction of Girls Hostel-V Nauni
- Construction of Girls Hostel-VI Nauni
- Construction of Boys Hostel Nauni
- Addition of toilet block in New PG hostel Nauni
- Renovation of Vegetable Pathology Lab, Department of MPP Nauni
- Construction of four Nos. LDPE water storage tank , Department of STPC Nauni
- Providing PVC Pipes in the LDPE ponds, Department of SSWM
- Renovation of Roof treatment in COF and pedestrian link in Lab. Block Nauni
- Construction of Central facility building in Hi-tech floriculture project Nauni
- Construction of room over bore well at Dhaulakuan
- Construction of RCC water storage tank at Mashobra
- Renovation of Lab. cum-office building Rohru
- Repair of Mist propagation Unit at Sharbo
- Renovation of Training hall storage and related Labs. at RHRS Sharbo
- Providing sewerage system in Scientist hostel at Manali
- Construction of first floor of Plant health clinic lab. and lecture hall Neri
- Construction of Boundary wall at Neri
- Construction of Two Nos. Mist Chamber at Neri
- Construction of Field Lab. and store at Neri
- Construction of poly house 15x10 m at Neri
- Construction of Security room and main gate at IBES Neri
- Construction of approach road to Scientist Block at IBES Neri
- Construction of Class room in basement and ground floor at IBES Neri
- Construction of Shed and platform for cold storage at Bhota
- Construction of LDPE water storage tanks at IBES Neri
- Providing white washing and painting of Administration Building at Chamba

Besides above various other major/small works at Nauni as well as various research stations/KVK's etc. were carried out alongwith annual maintenance of buildings, water supply sanitary installations, electrical installations, maintenance of roads, transportation services, R/M of Guest House etc. during the year.



HEALTH CENTRE

Health Centre is providing health facilities to the students, teachers, employees and surrounding village inhabitants. The progress made during the period under report is as follows.

Number of patients treated as OPD

- New 10973
- Old 7412
- Total 18385

Activities Undertaken

- Two pulse polio camps organized in collaboration with CMO, Solan
- Twelve immunization and vaccination camps organized
- RNTCP Programme collaborated with CMO, Solan for the treatment of tuberculosis
- Round the clock medical cover provided to the residents of the camps including on gazetted holidays along with refer all ambulation of serious cases to District Hospital, Solan; IGMC, Shimla and PGI, Chandigarh
- Miscellaneous administrative work for the running of the institute including purchase of essential medicines and laboratory regents

Sr No	Name of test	Total patients
	Heamatology	
1	Haemoglobin	658
2	Total leucocyte count	133
3	Differential leucocyte count	134
4	Erythrocyte sedimentation rate	275
5	Bleeding time/clotting time	12
6	Blood grouping plus Rh grouping	594
7	Blood film for malarial parasite	5
8	Blood haematological profile	397
	Microbiology (Serology)	
1	Typhoid (widal test)	123
2	Syphilis VDRI	76
3	RA test	42
4	Hb Ai	15
	Urine	
1	Urine for pregnancy test	64
2	Urine profile	232
3	Urine RE/ME	493
	Fecess	
1	Ova/Cyst	23
	Sputum	
1	Sputum for AFB (RNICP)	136
	Biochemistry	
	Lipid Profile	
1	Total cholesterol	200
2	HDL cholesterol	199
3	LDL cholesterol	199
4	VLDL cholesterol	199
5	Tryglycrides	199
6	Total lipid	199
	Renal profile	
1	Total protein	114
2	Albumin	114
3	Creatinine	114
4	Urea	120
5	Uric acid	282
	Lever profile	
1	Alkaline phosphatase	175
2	Bilirubin	215
3	ALT (GPT)	179
4	AST (GOT)	169
	Metabolic profile	
1	Glucose	947
	Electrolite profile	
1	Calcium	25
2	Sodium potassium	10
	Others	
1	Thyroid Test	21
	Total	7095



RESEARCH PUBLICATIONS

Aggarwal RK 2013. Effect of rainfall on cropping pattern in mid Himalayan region. African Journal of Environmental Science and Technology 7(7): 634-640.

Ahmad SM and Sharma DD 2014. Knowledge of farmers of Baramula (J&K) about weedicides and their use in rice crop. International Journal of Farm Sciences 4(1): 114-117.

Ahmad Suheel, Pant KS and Ali Asif 2013. Variation in oil content and quality as the basis for determing harvestable maturity of *Jatropha curcas* L. seeds. Annals of Biology 29(3): 402-404.

Babita and Rana VS 2013. Effect of Dormex on bud break, flowering and yield in kiwifruit cv. Hayward in mid hill zone of Himachal Pradesh. Journal of Horticultural Sciences 8(1): 47-50.

Banyal Ajay Kumar, Sharma Uday and Thakur Jitender 2013. Impact of pruning intensities on growth and yield of apple cv. Royal Delicious in Chamba District of Himachal Pradesh. Progressive Research 8(2): 321-322.

Banyal Ajay Kumar, Sharma Uday and Thakur Jitender 2013. Effect of different chemicals and mulch materials on fruit quality and productivity of Litchi cv. Dehradun. Progressive Research 8(2): 254-256.

Banyal Sanjeev Kumar 2013. Effect of NPK fertigation and rootstocks on soil nutrient status and fertilizer use efficiency in high density apple orchard. The Horticulture Journal 26(1&2): 21-30.

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Bharat NK 2013. Effect of indigenous AM fungi and BCAs on health of apple seedlings grown in replant disease soil. Indian Phytopathology 66(4): 381-386.

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Bhardwaj A and Verma SC 2012. Evaluation of vegetable oils against pulse beetle, *Callosobruchus chinensis* L (Coleoptera:Bruchidae) infesting pea seeds (*Pisum sativum* L.). Pest Management in Horticulture Ecosystem 18(1):241-246.

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Bhardwaj SK, Sharma Y, Kaushal R and Sharma SD 2013. Effect of integrated nutrient management on soil fertility and productivity of pea-tomato cropping system in mid Himalayas. Himachal Journal of Agricultural Research 39 (1): 20-27.

Bhat MM, Thakur NS and Jindal N 2014. Dying and storage of wild pomegranate arils. Asian Journal of Dairy and Food Research 33(1): 18–25.

Brakta A, Thakur PD and Handa A 2013. First report of apple top working disease caused by viruses (ASGV, ACLSV, and ASPV) in apple in India. Plant Disease 97(7): 1001

Chandel S 2013. Chemical and non-chemical methods in managing scale rot, *Fusarium oxysporum* f. sp. *lilii* of lilum. Indian Journal of Plant Protection 41(3): 263-266.

Chandel, JS and Kalzang Chhukit 2013. Influence of propagation media on rooting of cutting and vegetative growth of rooted plants of kiwifruit cultivar Hayward. The Horticulture Journal 26(1&2): 1-4

Chauhan VK, Joshi AK, Brahmi MK and Gupta Atul 2014. Variability in herbage genotypes of Cymbopagon. International Journal of Farm Sciences 4(1): 50-54.

Chauhan Anjali, Balgir P Praveen and Shirkot CK 2014. Characterization of *Aneurinibacillus aneurinilyticus* strain CKMV1 as a plant growth promoting rhizobacteria. International Journal of Agriculture, Environment and Biotechnology 7(1): 37-45.

Chauhan Avinash, Katna Sapna and Rana BS 2013. Life cycle of bumble bee *Bombus haemorrhoidalis* Smith in Himachal Pradesh. Insect Environment 19(3): 183-186.

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Chauhan VK, Joshi AK and Chauhan Neena 2013. Rejuvenation of frost affected mango orchards through pruning treatments. International Journal of Farm Sciences 3(2): 32-40.

Choudhary Punit, Singh NB, Verma Archna and Sharma JP 2013. Crossability relationship among tree willows (*Salix* spp.) and molecular genetic variation among their progenies. Indian Journal of Genetics 73(3): 302-309

Devi B, Bhardwaj DR, Panwar P, Pal S, Gupta NK and Thakur CL 2013. Carbon allocation, sequestration and carbon dioxide mitigation under plantation forests of north western Himalaya, India. Annals of Forestry Research 56(1): 123-135.

Devi B, Bhardwaj DR, Panwar P, Pal S, Gupta NK and Thakur CL 2013. Long term effects of natural and plantation forests on carbon sequestration and soil properties in mid-hill sub-humid condition of Himachal Pradesh, India. Range Management Agroforestry 34(1): 19-25.

Devi Neetu and Khanna Anju Sudhakar 2013. Relative susceptibility of various *Pleurotus* spp. against *Cyllodes indicus* Grouvelle (Coleoptera: Nitidulidae). Indian Journal of Mushrooms 31(1): 12-23.

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