



ANNUAL REPORT

2016-17



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



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FOREWORD

Horticultural production in India has increased by 2.87 times since 1991-92, and by 1.90 times since 2001-02. This increase in production and productivity has placed India amongst the foremost countries in horticulture production, just after China. As per National Horticulture Database in 2013-14, India's contribution to world production of fruits and vegetables was 13.6 % and 14%, respectively. Himachal Pradesh has emerged as a pioneer of development model in horticulture in the Himalayas. At per capita cultivated land availability of 0.12 hectares and irrigated area of 0.02 hectares, the per capita income in Himachal Pradesh has gone up from Rs. 240 in 1948 to Rs. 1, 30, 067 today. During this period the state Gross Domestic Product has increased from 26 crores to Rs. 82, 585 crores. The food grain production has gone up from 2 lakh MT in 1948 to over 16 lakh MT, and fruit production from 1200 MT to 7.52 lakh MT, with a record production of 10.27 lakh MT, during 2010-11. The state has undergone a transformation in horticulture production over the past fifty years. At present 37.58% of the gross cropped area of Himachal Pradesh is covered with the horticultural crops. Diverse agro-climatic conditions encompassing subtropical to high altitude cold deserts of Himachal Pradesh have enabled the farmers to undertake successful cultivation of a wide range of fruits, vegetables, flowers, spices, medicinal and aromatic plants, and forest trees. At present, 36 types of fruit species are grown in Himachal Pradesh. Amongst the fruit crops, perhaps all kinds of fruits grown in the country, except those grown in the warm humid coastal regions can be produced in the State. Apple dominates the fruit industry, and out of the total area of 229202 ha under horticultural crops, apple alone occupies 111896 ha which constitutes 48.82% of the total area under fruit crops in the state. Apple production in Himachal Pradesh is 468134 MT which accounts for 76.50% of total fruit production (6, 11,877 MT). Himachal Pradesh has attained a distinction in horticulture amongst all the Himalayan States. The cultivation of horticultural crops in cold desert areas has improved farmers income through increased production and productivity, generating employment, and enhancing exports with an annual turnover of more than Rs 3117 crores, involving nearby 4,64,254 farmers in the horticulture business. Besides fruits, horticulture industry also produced 15,877 MT of mushrooms, and 11,059 MT of honey. During 2016-17, maximum productivity was recorded in papaya (5.53MT) followed by apple (4.18MT), apricot (3.15MT), kiwifruit (2.64MT), and pear (2.45MT) and minimum in almond (0.14MT).

The YSP University of Horticulture and Forestry, has been, and is continuing to contribute for the overall development of the horticulture and forestry through strategic, cohesive, interdisciplinary, and need based farmer oriented research, education, and extension activities in Himachal Pradesh. The university has made spectacular progress in human resource development, research, and dissemination of technology to the farmers in horticulture, forestry and allied sciences during the last year to achieve higher production and productivity of crops while safeguarding the environment and natural resources of the State. All the statutory meetings of the University such as Academic, Research, and Extension Councils have been conducted for planning, evaluation and execution of various education, research, and extension activities. The University has been ranked 84th amongst 3,119 institutions and 51st among 750 universities ranked by the National Institutional Ranking Framework (NIRF) of the

Ministry of Human Resource Development, Govt. of India. It has been ranked 51st amongst the Agricultural Universities by ICAR, which was largely based on the number of faculty members/students, and the budget spent on education, research and extension. The ICAR has also awarded a Certificate of Appreciation for contributions of the University to the Krishikosh for submitting 1,100 theses in the digital repository. Recently, ICAR has sanctioned a KVK for cold desert areas of Spiti Valley, which was inaugurated by the Hon'ble Union Minister for Health & Family Welfare, Sh. J.P. Nadda, and Union Minister of State for Home Affairs Sh. Kiren Rijju, Govt. of India, New Delhi, at Tabo on 24th June, 2017. An Ethiopian delegation led by Dr. Gemedo Dale - Forest Minister, Ministry of Environment, Forests and Climate Change, GOE, along with MoS (Forest), and 15 officers of Brigadier rank and equivalent (including officers from Bangladesh, Malaysia, and Japan), from the National Defence College, New Delhi, visited the university during this period.

The students of YSP-UHF have participated in extra-curricular activities in Inter-Agricultural Universities Youth Festival/ Sports and Games meet, in which Ms. Jyotsna Rana Hati was awarded the Gold Medal in solo singing. Mr. Lokesh Bhanot of COH&F Neri, bagged Bronze Medal in National level Kick-Boxing Championship-2016 at Patna w.e.f. 26-30th Dec. 2016 and Ms Sandhya participated in Asian Winter Games-2017, at Sapro, Japan from 19-26 February 2017. Other activities during the period included NSS/ NCC Camp, International Yoga Day, Tiranga March, Sanskritik Cultural Yatra, Swchhta Pakhwara, National Youth Parliament, Digital India Workshop, National Unity Day, Annual Function and Prize Distribution of College of Horticulture & Forestry, Neri, and the Independence and Republic Day celebrations. Several personality development programmes for UG & PG students were also conducted for the benefit of the students. Events such as World Health Day/Environment Day/Earth Hours Event/ Van Mahotsav/ Water Day were also organized and celebrated.

The University organised the meeting of the committee for doubling farmers income in Himachal Pradesh by 2022, and MRT for the ICAR development grant (25-26 May, 2017), AICRP workshop on Biological Control of Crop Pests and Weeds (16-17 May, 2017), and State Level Joint Meeting of ICAR Regional Committee No.1, in which the scientists, students, and research scholars from different states of India participated and interacted with each other.

In order to increase the productivity of fruit crops, especially apple, the university is advocating high density plantation on clonal rootstocks in areas suitable for high density planting in Himachal Pradesh. In this pursuit, high density demonstration orchards of apple have been established under the World Bank funded HP-HDP project at the main campus at Nauni, and at the research stations at Kandaghat, Bajaura, Mashobra, Kalpa, and Tabo. Apple plants on MM109 rootstock at Nauni have shown good fruiting in 2nd year of planting, and the demonstration plots were visited by HE, the Governor of Himachal Pradesh, Additional Chief Secretary (Agriculture), and Principal Secretary (Horticulture). Fruiting has also been observed in other high density orchards established at the regional stations of the university. His Excellency the Governor of Himachal Pradesh inaugurated the Dairy Farm of Indigenous High Yielding Cow Breeds of India on 6th March 2017 at the main campus of the university. The cow dung and urine from Desi and Exotic Cows are being utilized for experimentation on Zero Budget Natural Farming of fruits, vegetables, ornamental crops and medicinal plants.

There has been a considerable increase in flow of funds from the State Government during 2016-17, and I am highly thankful to the State Government and the Additional Chief Secretary (Finance), for special support in curtailing the budget deficit. Sincere gratitude is also expressed to ICAR, and other funding agencies for their support to the University. The support provided by Board of Management and various executive Committees of university is thankfully acknowledged for their cooperation and help in running the university. I would like to congratulate my entire team of scientists, staff and students for carrying out all the teaching, research and extension activities as planned, and contributing to the progress of the University. I appreciate the sincere and concerted efforts of Director Research and Joint Directors Research (Horticulture, Forestry & Planning), and all the members of the University for timely publication of the Annual Report for the year 2016-17.



(Hari Chand Sharma)
Vice Chancellor



PREFACE



The University has continued to focus on its mandate to achieve the goals of strategic, need based and farmer oriented development of horticulture and forestry in Himachal Pradesh through excellence in education, research and extension for food and ecological security, improved livelihood opportunities and economic prosperity of hill farming communities of Himachal Pradesh. The Directorate of Research is playing a pivotal role in planning, implementation, monitoring, evaluation and coordinating research through different departments and research stations in diverse agro-climatic zones of the State.

During last year, 367 students have completed their B.Sc. (Hort.), B.Sc. (Fort.), M.Sc., MBA, and Ph.D. degrees from COH, COF & COH&F, Neri. The convocation of the university was held on 6th March, 2017, in which 849 degrees were conferred on the students from 1st December, 2014 to 6th March, 2017, of which 409 degrees were received by undergraduate, and 440 by postgraduate students of the university. Besides these, 262 students also received the merit certificates, and 18 students were awarded Gold Medals in different disciplines.

The scientists have prepared 122 projects worth Rs. 110.30 crores, which have been submitted to funding agencies such as DST, DBT, ICAR, MOEFCC, MOA etc. of these, 18 projects for Rs. 8.11 crores have been sanctioned, and the others are in the pipeline. These are in addition to about 80 externally funded projects already in progress. Apart from these projects, Rs. 89.94 lacs have been generated through testing of 25 pesticides/Seeds/Bio products. The university has been recognised as one of the voluntary centre under AICRP on nematodes by ICAR. The characterization of apple and sweet cherry was carried out for fruit traits which will be utilized in DUS testing of the candidate varieties in future. New varieties of walnut viz. Chandler, Howard, Lara, Franquette, Fernnor, Fernette, and Maylianise have been introduced which have shown more than 95% field survival. Under the changing climate and rising temperature in sub-tropics the fruit crops viz. Avocado, Coffee, Custrad apple, Fig, Acid lime, Sapota, Ber, Dragon fruit, Macademia nut, Mangosteen, Karonda, and Longan have been introduced at Neri, Hamirpur and Jachh for evaluation. New ornamental plant species viz. *Zephyranthes*, *Haemanthes*, *Caladium*, *Amaryllis*, *Nerine*, *Zantedescia*, *Alpinia*, *Iris*, *Zephyranthes* have been added to the existing germplasm. New wild edible mushrooms have been collected from different localities of Himachal Pradesh and accession no. DMRO-899 and DMRO-900 have been allotted by the Directorate of Mushrooms. There is an acute deficiency of the fodder in the State specially during the winter season, the university has identified protein rich clones of grewia, leucaena, robinia, etc. and recently techniques have been developed for tongue and cleft grafting of thornless Robinia which will go a long way in fast multiplication of thornless Robinia plants and enhancing the availability of fodder. A clonal bank of poplar has been established and about 15 clones have been planted.

High density plantations of apple on different rootstocks have been established for varietal evaluation and demonstration of different training systems such as espalier, vertical axis, tall spindle, cordon head and spread, and spindle bush system at varied altitudes in the state. The irrigation and fertigation schedules are also being standardized for these plantations. The rejuvenation through dehorning of old peach orchards has been developed for the farmers of the Rajgarh areas of Sirmour district. The propagation of walnut is difficult, however, an epicotyl

grafting with wedge and cleft methods on 15 days old epicotyls have been standardized with 89 to 91 percent graft take success, better linear growth, and 96 per cent plants become saleable within a year. Pomegranate is new upcoming crop especially in mid hills of Himachal Pradesh, whose area has increased by 275.38 per cent with a corresponding increase in production by 1700.70 per cent over the last decade. A new variety of pomegranate 'Kandhari Seedless' selected out of the crosses between Kandhari Kabuli × Bhagwa have been developed which ripens in mid-October, fruits are saffron coloured with smooth and glossy peel, and arils are attractive cherry red coloured, soft seeded as compared to 'Kandhari Kabuli'. Two cytoplasmic male sterile chilli lines viz; CMS-A and A-7 (originally from IHR) were introduced from IIVR, Varanasi and involved in crossing with bell pepper have shown tremendous improvement in fruit size and yield over the donor parents. A hydroponic system installed in the polyhouse to study the feasibility of growing vegetable crops under nutrient film technique (NFT). Lettuce crop has been grown in Hoagland solution with and without jeevamrit (5%) which has yielded encouraging results. Shiitake is one of the prized mushrooms and production technology has been standardized for successfully cultivation on saw dust amended with wheat bran under sub-tropical conditions of the state exhibiting 35 per cent biological efficiency.

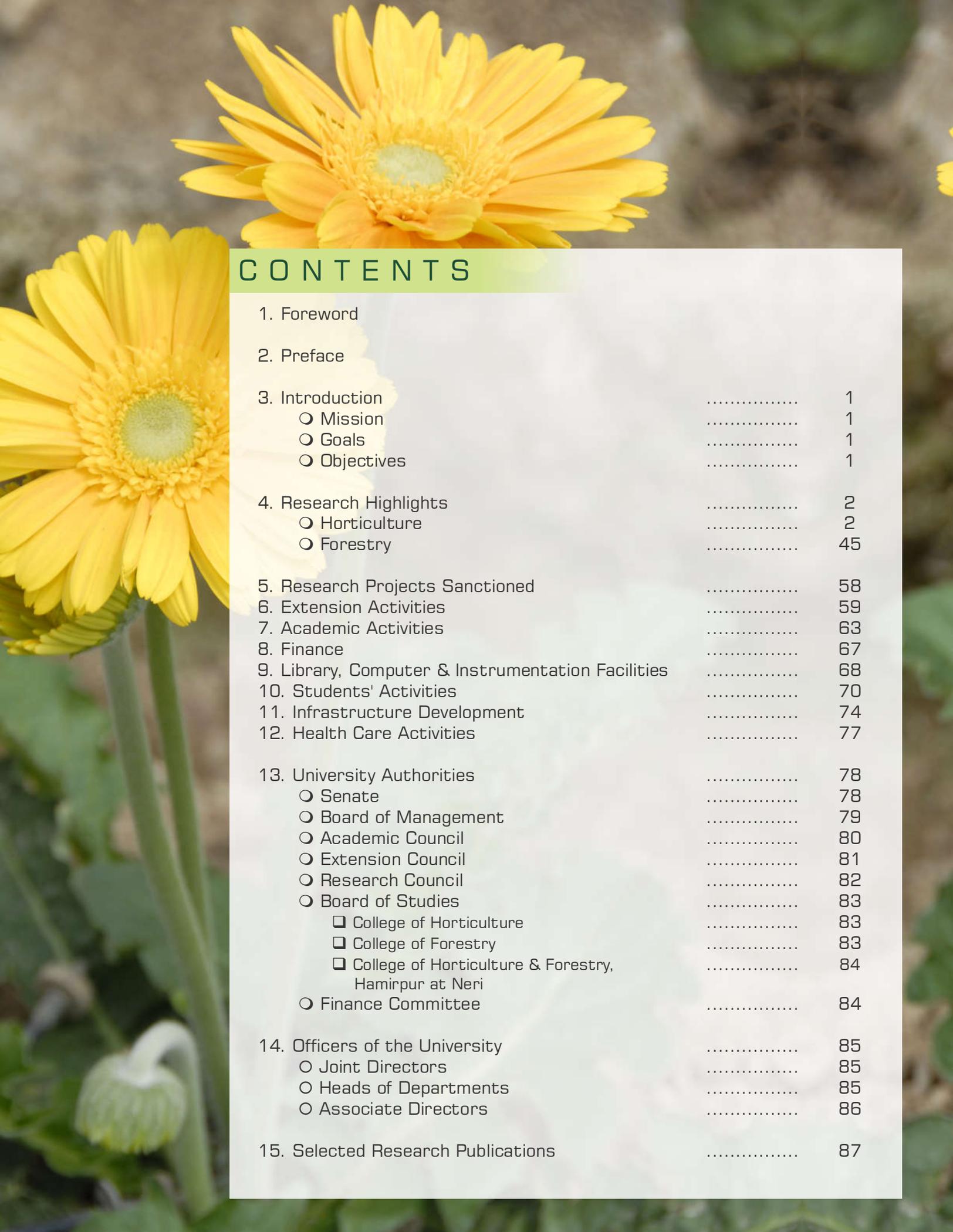
The university has disseminated technologies to the farming community through 41 institutional trainings, 52 guided/ exposure/off campus visits, in which about 2,845 farmers have benefitted. In addition, 191 farmer's calls have been attended through Kisan Call Centre, and UHF Farmers Telephone helpline. The University has also supplied 1, 48,747, quality temperate fruit plants to the farmers of the state. Recently, ICAR has sanctioned a KVK for cold desert areas of Spiti Valley, which has been inaugurated by the Hon'ble Union Minister for Health & Family Welfare Sh. J.P. Nadda, and Union Minister of State for Home Affairs Sh. Kiren Rijiju, Govt. of India, New Delhi, at Tabo on 24th June, 2017. The university is issuing regular Agro-Advisory Services to media and newspapers for the benefit of farmers.

I take this opportunity to thank all the Statutory Officers, Heads of Departments, Associate Directors (R&E) of Regional Research Stations and Incharges of different Research Stations for providing input for Annual Report. I appreciate the sincere and concerted efforts of Joint Directors Research (Horticulture, Forestry & Planning) and all the staff of the Directorate of Research in bringing out the Annual Report for the year 2016-17.



Dr. K.S. Verma
(Director Research)



A background image of several bright yellow daisy flowers in various stages of bloom, set against a blurred natural background. The flowers are the primary visual element of the page.

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INTRODUCTION

Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan has its origin from Himachal Agriculture, Solan, established in 1962 with its affiliation to Panjab University, Chandigarh. The College was raised to the status of Post Graduate College, Himachal Pradesh Agriculture College and Research Institute 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 College of Horticulture and Forestry at Neri, Hamirpur. In addition, there are five Regional Horticultural Research and Training Stations, one Regional Horticulture & Forestry Research Station, nine Research Sub-Stations and five 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 and Training 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

Fruits Crops

- Characterization of apple (61 varieties) and sweet cherry (23 varieties) was carried out for fruit traits which will be utilized in DUS testing of the varieties in future (*RHR&TS, Mashobra*).



Sharp's Early (Pink)



Super Chief (White)



Early Red Bird (Pinkish)



Tydeman's Early (Creamish)

Flower and flesh colour of some apple varieties

- Different apple varieties on rootstocks and scion combinations of apple for standardization of training systems and canopy management are being evaluated. The plants were trained to tall spindle training system in which the one year shoot were bended below the horizontal to restrict vegetative growth and promote fruit bud formation in next year. Whereas, trees being trained as vertical axis and slender spindle system, the shoots were spread to horizontal by putting weights (*RHR&TS, Mashobra*).



Bending of branches in Tall spindle System



Spreading of branches in Vertical Axis

- Two spur type varieties viz. Super Chief and Scarlet spur II on M7 root stock, 2 standard varieties viz; Jeromine and Red Velox on M9 root stock and pollinisers viz; Gale Gala and Redlum Gala on M9 and Merton 793 are being evaluated under 6 different training systems and planting densities viz Espalier: 1.5x3.0m; Vertical Axis: 0.75x1.5m; Cordon System: 1.0x1.5m; Head and Spread: 1.5x2.5m; Spindle Bush: 1.5x2.0m; Modified Central Leader: 3.0 x3.0m (Control) (*RHR&TS, Bajaura*).



Espalier System



Head and Spread



Spindle Bush



Super chief (Polyhouse)



Super chief (Open field)



Scarlet Spur-II (Polyhouse)



Scarlet Spur-II (Open Field)

- A field trial was laid out to ascertain the influence of controlled and open field environmental conditions on fruiting and quality parameters of Super Chief, Oregon Spur-II and Scarlet Spur-II cultivars of apple on EMLA-111 rootstock. Results revealed that the varieties raised in polyhouses produced smaller spherical fruits having lower weight in comparison to the open field raised varieties, where larger and heavy fruits of less spherical in shape were produced. Besides this, lower shelf life of 2 and half months were also recorded in polyhouse produced fruits. There were non significant differences in TSS and fruit pressure in polyhouses and open field conditions. Russet appearance on the skin of Scarlet Spur-II cultivar of apple under polyhouse was also observed, whereas no russet appearance was recorded in open field grown cultivar of Scarlet Spur-II. This russet appearance on the fruit might be due to higher temperature in polyhouses in comparison to open field, which suggests that the prevailing higher temperature during fruit growth period could be the reason behind russet appearance on the apple (*RHRSS and KVK, Tabo*).

- The horticultural performance of different exotic cultivars of apple namely Gibson Golden on EMLA 7, Oregon Spur on EMLA 111 and EMLA 7, Gale Gala on EMLA 7 and EMLA 111, Oregon Spur II on EMLA 111 and Bud 9, Super Chief on EMLA 111 and Bud 9, Akane on EMLA 7 and Coe-Red Fuji on EMLA 7 rootstocks revealed that the Gale Gala on EMLA 111 rootstock performed better in term of vegetative growth and yield. Gale Gala on EMLA 111 recorded highest fruit tree height (499.66 cm), plant diameter (32.20 mm) and shoot extension growth (60 cm). The highest fruit yield (117.11 kg) was also recorded in Gale Gala on EMLA 111 followed by Gibson golden (112.66 kg) and Super Chief (109.33 kg), respectively (*RHR&TS and KVK, Sharbo*).
- Demonstration cum experimental orchard of imported apple plants from Italy has been established under various densities to develop package and practices and to upsurge the

productivity of quality fruits in limited resource of land under World Bank aided Himachal Horticulture Development Project. The initial data on plant growth parameters showed that the cultivar Red Velox has attained maximum shoot growth followed by Super Chief and minimum growth was seen in cultivar Redlum Gala and Jeromine. Plant height and plant spread were observed maximum in Red Velox closely followed by Jeromine in height, and spread in Redlum Gala, whereas least plant height and plant spread were observed in cultivar Gale Gala and Jeromine, respectively (*RHRSS and KVK, Tabo*).

- High density apple plantation (2.5×1 m) of varieties viz Super Chief and Red Velox on clonal rootstock established at Nauni, for developing optimum fertigation schedules. The survival of these varieties after one year was 83.7% and 83.8% The experimental site has flat land (0-1% slope) and very deep soils (>90 cm). There is bearing in some plants during 1st year of plantation. Various growth parameters viz. plant height, plant girth and annual shoot extension were recorded before the application of fertilizers. The respective parameter varied from 142.0-244.6 cm, 16.6-24.4 mm and 56.8-118 cm, in variety Super Chief and in Red Velox 131.6-231.6 cm, 16.0-21.1 mm and 41.3- 94.7 cm, (*SS&WM, Nauni*).



One year old high density apple plantation on MM 106 and fruit bearing in some varieties

- Preliminary observations were recorded on growth and yield of five low chilling apple cultivars viz. Anna, Michael, Mollies Delicious, Red Fuji and Scarlet Gala in three year old plants raised on M9 rootstock. The cultivar Anna and Scarlet Gala surpassed all other cultivars for trunk girth, tree height, tree spread in EW and NS directions (*RHR&TS, Jachh*).



Fruiting in low chill apple cultivars on M9 rootstock

- An experiment was conducted to find out the most suitable alternative source of nitrogen for apple trees as a substitute of CAN. The results revealed that calcium nitrate + urea (50% recommended dose of nitrogen through each source) significantly increased the vegetative growth, fruit set, yield, and improved fruit physico-chemical properties of apple in comparison to other nitrogen sources. This treatment also significantly increased the leaf N and K contents (*FS, Nauni*).
- Comparative efficiency of different nitrogen sources on soil properties and productivity in apple revealed optimum leaf nutrient contents when N was applied at recommended level through calcium nitrate + urea + liming. Annual shoot extension was maximum (71.8 cm) with the application of urea alone, but the fruit yield was recorded to be highest (39.6 q ha^{-1}) when N applied through 15:15:15 + urea. The average fruit size (81.3 mm length and 78.7 mm breadth) and weight (202 g) were maximum with calcium nitrate + urea + liming, in Vance Delicious apple (*SS&WM, Nauni*).
- The foliar application of 1-2% a.i. of hydrogen cyanamide has been found effective in dealing with issue of delayed and non-uniform bud burst and prolonged flowering period in apple under growing conditions interrupted with warm climate during winters. The application of ethaphon 39 SL @ 100 ml/100 lt/100 lt has been found effective (*RHR&TS, Bajaura*).
- A trial was conducted for standardization of the agro-techniques for replantation of declining orchards of apple in Himachal Pradesh. Thirty composite soil samples along with roots were collected from different replant sites. Overall, 30

new isolates of fluorescent *Pseudomonas* species were isolated from rhizospheric soil of apple orchards for further evaluation (FS, Nauni).

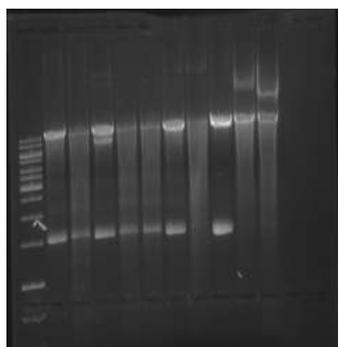
- ❑ Bio-efficacy testing of Gibberellic acid 0.45% in apple cultivar Red Delicious at different doses viz. 1.5 ml/L, 2 ml/L, 2.5 ml/L, 3.5 ml/ml, 4 ml/L and 8 ml/L along with control was applied at silver tip, fruit setting and walnut stages. The application of Gibberellic acid 0.45% at 2.5 ml/L recorded highest fruit length, fruit breadth, fruit weight and yield (RHR&TS and KVK, Sharbo).
- ❑ The application of APPLIN at the rate of 2 ml/liter at walnut stage was effective in enhancement of fruit size, fruit shape, length/diameter ratio and fruit colour (RHR&TS and KVK, Sharbo).
- ❑ Soil application of YaraMila Complex and YaraLiva Nitrabor had a significant effect on fruit set, fruit yield and fruit quality of apple. Maximum fruit set (30.01%), fruit yield (341.61 kg/tree and 94.64 t/ha), fruit weight (162.00 g) and fruit size (64.83 and 70.89 mm) was recorded when YaraMila Complex (2000 g) and YaraLiva Nitrabor (1500 g) was applied at bud burst, fruit setting and post harvest stage. Fruit firmness was highest (8.97 kg/cm²) when YaraMila Complex (1500 g) and YaraLiva Nitrabor (1000g) was applied at bud burst, fruit setting and post harvest stage. Maximum TSS (13.10%) was recorded when YaraMila Complex (2000 g) and YaraLiva Nitrabor (1500 g) was applied at bud burst, petal fall, fruit setting and fruit development stage (RHR&TS, Mashobra).
- ❑ Standardization of drip irrigation and fertigation schedules in apple plantation (Var. Early Red One) on tissue cultured root stocks revealed maximum plant girth (18.81 mm) under sub-surface drip irrigation @ 60% ET+ fertigation of 100% recommended dose (RD). Minimum plant girth (4.02 mm) was observed under surface irrigation + conventional fertilizers. However, maximum plant height (126.24 cm) was observed under drip irrigation @ 100% ET + 100 % RD (SS&WM, Nauni).
- ❑ Preharvest spray of calcium chloride at 0.25, 0.50, 0.75 and 1.00% concentrations were applied after 60 days from full bloom to enhance post harvest quality and storability of Golden Delicious fruits.

The fruits were harvested at maturity. It was observed that highest fruit size (diameter) was found in 0.25% treatment fruit which were at par with 0.50%, whereas, lowest size was observed in 1.00% CaCl₂ sprayed fruits (RHR&TS, Mashobra).

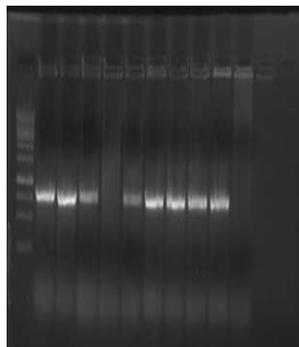
- ❑ There was a significant effect of BOLT™ SP on flowering, fruit set and fruit quality in apple. All the parameters under observation except L- D ratio were significantly affected by the treatments of the product. It was observed that single application of BOLT™ @ 1 gm/l could not enhance fruit set, fruit retention, yield and fruit quality significantly over control. As the dose and frequency of the yield enhanced upto 1.5 g there was a significant increase in the characters under study. Highest fruit set (34.89%), fruit retention and yield (137.33 kg/tree) was recorded in plants receiving three applications of BOLT™ SP @ 1.5 g/l . The fruit quality (fruit weight 138.33 g, firmness, 14.00 and TSS 13.00) was also recorded in the same treatment. When the dose of the BOLT™ SP was further increased flowering, fruit set, yield and fruit quality parameters showed decreasing trend indicating that 1.5 g/l was the optimum dose for application of BOLT™ granules (COH&F, Neri).
- ❑ Cloning of full length *rol b* gene (from *Agrobacterium rhizogenes*) in pCAMBIA 2300, a plant expression vector, after colony PCR, presence of 1.5kb *rol b* with its promoter and terminator was confirmed. Presence of transforming vector containing the *rol B* gene was confirmed in *A. tumefaciens* strain LBA4404. Regeneration from *rol b* gene cocultivated leaves of apple Merton793 (transformed) was achieved and putative regenerants developed (BT, Nauni).



A. tumefaciens containing *rol B* gene after mobilization



pCAMBLA 2300+ rol B gene showing vector borne and fall out after long run



Colony PCR of pCAMBIA2300 + to *A. tumefaciens*



Putative transgenic shoots of apple Merton 793



- Rooting response of crab apple was tested at IBA concentrations of 0.3, 0.5, 0.7 and 1 mg/l without and with dark treatment which resulted in highest root induction (71%) in dark treated shoots, though little callus was found. On supplementing activated charcoal, all the treatments resulted in more than 54% rooting, and highest rooting efficiency (95%) was found at 1 mg/l IBA and 1 g/l activated charcoal. While testing different levels of NAA (0.2-0.5 mg/l), 63-89% rooting response was obtained. However, basal stem portions revealed profuse callogenesis and roots seemed to emerge from callus. To counter this problem, these levels of NAA were supplemented with 1.5 g/l AC which resulted in 70-90% rooting efficiency and inhibited callus formation. During hardening of in vitro plants, it was found that rooted plantlets without callus survived more i.e. 77% in peat pots. On their transfer to soil containing pots after six weeks, 100% plants survived. *Ex vitro* rooting results showed that soaking of shoots in low IBA in dark before their transfer to potting mixture is better (62-85%

rooting) as compared to high auxin dip (*BT, Nauni*).



Micropropagation of *Malus baccata* var. *himaliaca*

- On the basis of pre-selection survey in Shimla district, 250 wild seedlings of apricot were studied, out of which 42 genotypes were selected on the basis of different fruit quality parameters. Ten genotypes namely, SRB1, SRB2, SRB5, SRB6, SR2, SCJ1, SCJ2, SM2, SCK2 and SKuM2 exhibited horticulturally desirable characteristics (*FS, Nauni*).
- The data depicted wide variation in growth, flowering and quality parameters amongst three CITH apricot cultivars. Highest plant height, shoot growth, and fruit weight were recorded in cultivar CITH-1 and minimum in the cultivar CITH-2. The plant girth, tree spread, and TSS were observed in cultivar CITH-3, whereas, minimum was recorded in cultivar CITH-2. These differences might be due to inherent characteristics of CITH-1, 2 and 3 (*RHRSS and KVK, Tabo*).

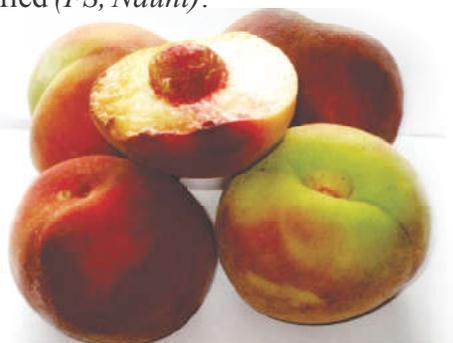


CITH-1



CITH-3

- ❑ An experiment was conducted to study the effect of integrated nutrient management on growth, yield and fruit quality of apricot (*Prunus armeniaca* L.). The results revealed that the application of different integrated nutrient sources in apricot trees significantly influenced the plant vegetative characters, fruiting characters, physico-chemical characters, leaf nutrient status, soil nutrient status, and benefit to cost ratio. Maximum fruit set (61.00%), and total yield (61.9 kg/tree) was recorded in treatment consisting of 50% N (CN) + 50% N (Urea) + *Azotobacter* + PSB + Vermicompost. However, fruit TSS, total sugars, reducing and non-reducing sugars were significantly higher in 50% N (CN) + 50% N (Urea) + *Azotobacter* + PSB + FYM which were statistically at par with T₁₂. Regarding nutrient status, the highest leaf N (2.95%), leaf K (2.60%), soil N (386.33 kg/ha), soil P (51.00 kg/ha), and soil organic carbon content (1.81%) were recorded in T₁₂ [50 % N (CN) + 50 % N (Urea) + *Azotobacter* + PSB + Vermicompost (RHR&TS, Kandaghat).
- ❑ In nectarine, urea application 1186 g/mature tree applied in two split applications i.e. half before flowering and remaining half 15 days after first application was observed better in terms of growth, production and leaf nutrient status as compared to the earlier recommendations of CAN at the rate of 2000 g per tree (RHR&TS, Bajaura).
- ❑ A promising low chill peach, 'Tropic Snow' whose fruits matured by 2nd week of June; TSS(15.33⁰B); fruit weight:45g; sugar/acid (24.69); fruit skin colour- Yellow group 50 A and fruit flesh : white; Freestone and 'Cacanska' plum which is firm fleshed with long shelf life (10-14 days); harvesting by 2nd week of June; TSS 13.5% and fruit weight 42 g with better shelf life were identified (FS, Nauni).



Tropic Snow



Cacanska Plum

- ❑ In plum, 02 varieties viz; Frontier and Black Amber on seedling rootstock have been planted under different training systems and spacing viz. Vertical Axis: 2.0 x 4.0.5m; Tatura Trellis System (Y shape): 1.5 x 4.0m; Free Spindle: 2.0 x 4.0m and Central Leader system: 3 x 3m (Check) (RHR&TS, Bajaura).
- ❑ Tissue culture raised plants of 'Santa rosa' and 'Frontier' were transferred to the field alongwith conventionally propagated control plants of same age for comparison of pomological characters (BT, Nauni).
- ❑ A study was conducted on floral biology, pollination, and fruit set in four pistillate cultivars of kiwifruit viz., Hayward, Bruno, Monty and Allison and two staminate cultivars viz. Allison and Tomuri. Different modes of pollination namely; bagging, open pollination and controlled hand pollination were tested. Hand pollination recorded higher per cent fruit set in comparison to open pollination. The fruit characters like fruit length, fruit breadth, fruit weight, and seed number improved with the hand pollination over open pollination (FS, Nauni).



Fruit set with Tomuri as male parent in hand pollination



Fruit set with Allison as male parent in hand pollination

- ❑ Evaluation-cum on farm testing to study the performance of blueberry varieties namely; Biloxi, Blue Crop, Sharp Blue, Legacy, Misty, Arlene and Revellie revealed that Revellie was the first to break leaf bud while Misty, Sharp Blue and Arlene were last to do so during 3rd week of February. Highest plant height, stem diameter, leaf length, leaf width and leaf area was recorded in Misty (*FS, Nauni*).
- ❑ Thirty pear cultivars were evaluated for testing their suitability under mid-hill conditions. Gola trees were the tallest and Godara Sand Pear was the least. Duration of flowering revealed significant variation amongst different pear cultivars, which ranged between 10 to 15 days. The shortest duration was in 'Gola' (10 days) followed by 'Godara Sand Pear' while longest in 'Durandeu' and Monarch (15 days) (*FS, Nauni*).
- ❑ An experiment was conducted on 22 years old rejuvenated orchard of peach cv. "Early White Giant" at farmer's field in the village, Neri Kotli (Rajgarh) of Sirmour district. Treatment combinations comprising of three different levels of dehorning viz., dehorning at 1.5 m, 1.25 m and 0.75 m coupled with variable level of nitrogen applications. Best results in terms of quality characteristics were obtained in fruits harvested from plants where dehorning level was 1.25 m and recommended dose of nitrogen, phosphorus and potassium was applied. This treatment also yielded best grade fruits (3- layer grade) (*FS, Nauni*).
- ❑ A field experiment was conducted to determine the effect of different levels of drip and basin irrigation on growth, yield, fruit quality and leaf nutrient contents of peach cv. Red Haven. It is concluded that drip irrigation at 100% ETC registered 21.22, 17.72, and 24.02 per cent increase in tree height, trunk girth, annual shoot growth, and yield, respectively over basin irrigation method, and it also produced better size and quality fruits (*FS, Nauni*).
- ❑ Effect of mulching, NPK and irrigation levels on the growth and water requirement of nectarine (*Prunus persica* Batsch var. *nucipersica*) revealed maximum annual shoot extension (76.3 cm), plant height (2.07 m) and girth (5.45 cm) under plastic mulch. Under N levels, 100 per cent recommended dose of NPK recorded highest annual shoot extension (67.8 cm), maximum increase in plant height (1.16 m), and girth (5.13 cm). Total water requirement was 41.9, and 20.6% less in grass (18.3 cm), and black plastic mulches (25.0 cm), respectively, over unmulched control (31.5 cm) with insignificant difference in growth among mulches. Grass mulch was found to be superior in terms of water conservation and saving over unmulched control and black plastic mulch (*SS&WM, Nauni*).
- ❑ In difficult to propagate walnut, epicotyl grafting with wedge, and cleft methods on 15 days old epicotyls gave as high as 89 to 91 per cent graft take success, better linear growth and 96 per cent plants became saleable within a year. 80 imported plants of walnut cultivars namely; Chandler, Howard, Lara, Franquette, Fernnor, Fernette, and Maylianise were procured which have shown more than 95% field survival (*FS, Nauni*).
- ❑ Varietal evaluation studies of walnut (*Juglans regia* L.) in Kotkhai Selection-1, Pratap, and Govind varieties growing in temperate conditions yielded shells ranging between 146.66g - 200g. Sample fruits bearing initiated after a gap of 8-9 years of its plantation. Increasing trend in yield was observed during past three years (2014-2016) and significant variation was observed in yield on the basis of variety. Study concluded that Kotkhai Selection-1 variety of walnut is suitable, and can be recommended for farmers to grow in temperate conditions for better yield (*TH&FRS, Kotkhai*).



Rejuvenation of senile peach orchard

- Multi-locational testing trials under medium density were conducted on elite walnut and apricot, where genotypes of CITH-1 and CITH-3 showed promising results in both crops in terms of plant growth, fruit production and quality (*RHR&TS, Bajaura*).



CITH Walnut-1

CITH Apricot-2

- Under medium density orcharding experiments on almond maximum plant height in cv. IXL followed by Non Pariel was observed and minimum in cv. Mukhdoom. Maximum trunk girth was observed in cv. Mukhdoom followed by cvs. Pramijay and Pramoskaij and minimum in cv. IXL. Maximum plant spread was observed in cv. Mukhdoom and minimum in cv. Waris (*RHR&TS, Bajaura*).
- Almond cultivars viz. Non-Pariel, Merceed, Pranyz, Primorskaij, Waris, IXL and Makhdoom are under evaluation in dry temperate conditions. During the year 2016, Non- Pariel, and Waris cultivars attained the maximum plant height (370 cm), plant diameter (8.9 mm) and annual shoot extension growth (148 cm) (*RHR&TS and KVK, Sharbo*).
- Horticultural performance of pistachio nut revealed that there is a problem of blank nut due to non synchronization of flowering in male and female cultivars due to which total fruit yield of the crop was recorded almost negligible (*RHR&TS and KVK, Sharbo*).
- An experiment was conducted to study the effect of different growing media on growth, yield and fruit quality of strawberry (*Fragaria × ananassa* Duch.) cv. Chandler grown under protected conditions. Among the different growing media, perlite in combination with FYM was found to be the most effective combination for improving the plant growth parameters and berry yield. It also

resulted in better berry size, TSS, reducing, non-reducing and total sugars. However, perlite alone was also highly effective in improving the berry size, TSS and sugars. Growing media also significantly influenced leaf N and K though it failed to significantly influence leaf P. Maximum leaf N and K was recorded under perlite +FYM treatment. On the basis of the results obtained in the present course of investigation, it can be concluded that amongst the different growing media, perlite in combination with FYM is the most suitable medium for obtaining higher runner production and better yield of good quality berries (*KVK, Kandaghat*).

- In vitro* propagation of virus free commercially important strawberry cultivars initiated. Leaf Samples of commercially important strawberry cultivar Chandler collected from fields of Behrewala, Sudalwan and Purewala villages of Dhaulakuan, District Sirmaur was assessed for Tobacco Streak Virus, Tobacco Ring Spot Virus and Strawberry Latent Ring Spot Virus. None of the samples were found to be infected. Leaf samples of Sweet Charlie, Selva, and Brighton cultivars of strawberry were collected from IARI, Shimla (*BT, Nauni*).
- A pomegranate variety 'Kandhari Seedless' selected out of the crosses, between Kandhari Kabuli × Bhagwa ripened in mid October at Bajaura and 6 years old plant gave 40 kg fruits, The fruit are saffron colored with smooth and glossy peel, and arils are attractive cherry red colored, soft seeded as compared to 'Kandhari Kabuli' and total soluble solids are 15.0° B. Acidity is 0.52%. Fruit weight 350-400 g. (*RHR&TS, Bajaura*).



Newly developed variety Kandhari Seedless

- The germplasm of different fruits have been introduced from different sources within and outside the state for establishment of repository of varied genotypes for further evaluation and development of bud wood banks.
- Commercial fruit crops: New germplasm of various fruit species have been introduced from different sources. In mango the major cultivars include are Pusa Arunima, Pusa Ambika, Pusa Lalima, Pusa Shreshta, Pusa Pitambar etc. introduced from GBPUA&T, Pant Nagar, and PCDO-Kashipur, Uttrakhand. In citrus - 1. Mandarin: Kinnow, Daisy mandarin, W-Murket, 2. Sweet orange: Malta, Valencia, Musambi, Red blood 3. Grape fruit; Red flush, Star Ruby, 4. Acid Lime: Pant Lemon, Punjab local, Kagzi lime, Baramasi 5. Sweet lime: Punjab Sweet lime has been introduced from PAU-Ludhiana, HRS-Abohar, RHRS Dhaulakuan. Like-wise elite germplasm of guava (Shweta, Lalit, Allahbad Safeda, L-49, Pant Prabhat, Arka Kiran, G-6-Red guava), pomegranate (Kandhari Kabuli, Bhagwa, Phule Super Bhagwa), Ber (Umran), Sapota (Cricket ball) Jackfruit (Pant Mahima and Pant Lalima, have been introduced from various reputed institutions (*COH&F, Neri*).
- Low chill cultivars of temperate fruits for frost prone areas as an option such as peach (Glow Haven, Royal Paradelux, Florida Prince, Partap, Shan-i-Panjab, Early granade), plum (Sutlej Purple, Kala Amritsari), Apple (Anna, Dorsett Golden, Michel, Schlomit, Harman-99, Tropical Beauty, Pettingill Apple, Rome Beauty, Gala Mast, Auvil Early, Fuji, Baldwin, Beacon, Belle-de-Boskoop, Benoni, Ben Davis, Winter Banana, Worcester Pearmain, Yellow Transparent, York-a-Red, Mollies Delicious, Wealthy, Turley Winesap, Buckye gala, Granny Smith, Pink lady, Braeburn, Gala, Ginger Gold, Mutsu, Wagener, Jeromine, Red Velox), Persimmon (Fuyu) Pear (Hosui, Khosui, Chajjaru, BA-29 rootstock) have been introduced (*COH&F, Neri*).
- New fruit crops: Introduction of new fruit crops under changing climate and rising temperature in sub-tropics viz. Avocado (TKD-1), Coffee (Sel 5B, Sel-9 and Chandragi), Custard apple (Balanagar and Arka Sahan), Fig (Poona Fig, Dinkar) and Acid lime (Phule Sharbati, Phule Sai), Sapota (Kalipatti), Ber (Seb, Sanour, Chuhara, umran), Dragon fruit (Red flesh and White Flesh), Macademia nut, and Mangosteen are being introduced (*COH&F, Neri*).
- New mango cultivars namely, 'Dashehari-51', 'Ambika', 'Pusa Arunima', 'Pusa Surya', 'Gulab Jamun' and 'Sindhuri' introduced and were evaluated for pomological traits under Shiwalik foothills of Himachal Pradesh. It is extrapolated that 'Gulab Jamun' attained maximum plant height (275.6 cm), tree spread (372.6 cm), tree girth (44.8 cm), whereas, 'Dashehari-51' obtained maximum fruit yield (36.9 kg tree⁻¹). Two new introductions viz., 'Pusa Arunima' and 'Pusa Surya' recorded maximum annual shoot extension growth (36.8, 34.2 cm), fruit weight (198.5, 197.9 g) and TSS (18.9, 18.6° Brix), respectively and possessed attractive colour (*RHR&TS, Dhaulakuan*).
- Performance studies on six cultivars of mango on seedling root stock revealed that cultivar Langra attained maximum tree girth (91.99 cm) and tree height (7.90 m) followed by Dashehari (78.01 cm). Maximum fruit yield (38.3 kg) was recorded in Dashehari, while Amrapali gave the lowest yield (23.1 kg/plant). With respect to fruit size and fruit weight, Dashehari, Mallika and Langra were observed to be the best. TSS content was significantly highest in the cultivar Dashehari. Overall cultivar Dashehari was observed to be the best cultivar under Nagrota conditions (*L&MRS, Nagrota Bagwan*).
- In citrus, four sweet orange cultivars viz. Pineapple, Jaffa, Mosambi and Blood Red were evaluated for maturity and yield potential. In term of maturity, cultivar Pineapple was found to be early maturing (November) followed by Jaffa (December) and Blood Red (January). Pineapple cultivar of sweet orange gave maximum yield (23.3 kg/tree) in 5 years old plants in comparison to other three cultivars (*RHR&TS, Jachh*).
- Performance studies conducted in guava germplasm established at the station revealed that cv. Allahabadi Safeda excelled all other cultivars

(L-49, Lalit and Arka Amulaya) for fruit size, quality and fruit yield (90.5 kg/tree) (*RHR&TS, Jachh*).

- Different levels of deblossoming in guava cv. Lalit for crop regulation had significant effect on percent fruit set in rainy season crop when deblossoming was done during the month of April. Maximum mean values of rainy season yield was exhibited by control trees followed by 25% deblossoming levels, whereas in winter season, yields were found to be maximum (21.5 kg/tree) in 100% deblossomed trees followed by 75% and 50% deblossomed trees. In term of fruit size, weight, volume and quality, rainy season fruits were found to be inferior as compared to winter season fruits in different levels of deblossoming treatments. Five year old trees of guava cv. Lalit planted under ultra high density (2x2 m) plantation gave fruit yield of 24.5 kg/tree during rainy and winter season (*RHR&TS, Jachh*).



Guava Meadow Orchard



Allahabadi Safeda

- Guava cultivars (budded) viz., 'Lalit', 'Allahabadi Safeda', 'DK-Red Flesh', 'Punjab Hybrid-I', 'Punjab Hybrid-II', 'L-49', 'Shweta (G-4)', 'Hisar Surkha' and 'Hisar Safeda', planted at 6 x 6 m apart and were evaluated for pomological traits. 'Lalit' was observed to be the predominant cultivar in yield (35.9 kg tree⁻¹), TSS (16.7° Brix) and fruit size (58.8 x 55.7 mm) and was at par with 'Allahabadi Safeda' with respective values of 31.4 kg tree⁻¹, 16.1° Brix and 57.5 x 50.4 mm. The results have shown that in 'Allahabadi Safeda' (budded), fertigation frequency had significantly affected cropping behavior of the trees which recorded maximum average plant height (158.7 cm), tree circumference (16.7 cm), tree diameter (124.6 cm), annual shoot extension growth (46.3 cm), no. of primary branches (4) and number. of secondary branches (7), number of flower buds per shoot (27.2), fruit set (70.1%), fruit yield (5.2

kg tree⁻¹) and fruit weight (145.5 g) were recorded. Similar growth attributes were recorded with corresponding values of 187.2, 19.2, 132.6, 53.8 cm, 4 and 7, number of flower buds per shoot (28.4), fruit set (73.1%), fruit yield (5.5 kg tree⁻¹) and fruit weight (161.3 g) in 'Lalit' (inarched) when supplemented with fertigation scheduling (*RHR&TS, Dhaulakuan*).

- Kanchan cultivar of aonla was observed to be the highest fruit yielder (111.5 kg) under Jachh conditions of Himachal Pradesh. However, in term of fruit size and fruit weight, cultivar Banarasi was found superior to other cultivars under study (*RHR&TS, Jachh*).
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- Karonda Red and Karonda Gola selections were evaluated for their horticultural performance. Out of the two selections, Karonda Red was found to be high yielding (5.5 kg/plant) than Karonda Gola (4.9 kg/ha). However, both the cultivars were acidic in nature and can be used for pickle making (*RHR&TS, Jachh*).
 - Studies conducted on five newly introduced Litchi cvs. viz. China, Shahi, Bedana, Purbi and Dehrrarose from NRC, Muzzafarpur (Bihar) during 2011-12 revealed that cv. Shahi surpassed all other four cultivars for trunk girth (19.3 cm), tree height (155.6 cm) and tree spread in EW (148.5 cm) and NS (170.7 cm) directions. Sample fruits were harvested and full yield potential is yet to be assessed as these cultivars have to attain full bearing potential (*RHR&TS, Jachh*).
 - Horticultural performance studies on litchi cultivars namely, 'Dehradun', 'Calcuttia', 'Rose Scented', 'Early Large Red' and 'Seedless Late' inferred that 'Early Large Red' recorded maximum average plant height (439.2 cm), tree spread (447.6 cm), tree girth (71.5 cm), yield (67.5 kg tree⁻¹), fruit weight (20.2 g), whereas, 'Seedless Late' obtained maximum aril (79.9%) and 18.8° Brix of TSS. 'Early Large Red' was earliest variety to mature (65 days) (*RHR&TS, Dhaulakuan*).

- The results on the performance studies in seven cultivars of litchi under Nagrota Bagwan conditions revealed that cultivars Dehradun attained maximum tree girth and tree spread, whereas, Rose Scented produced tallest trees. In term of fruit quality Dehradun was observed to be the best for fruit yield and most of the quality parameters like fruit size, fruit weight, and TSS content. Maximum fruit cracking (21.1%) was recorded in cultivar Dehradun while the least (7.2%) in Calcuttia. However, Dehradun was observed to be early maturing than other cultivars (*L&MRS, Nagrota Bagwan*).

- Twenty eight Longan plants planted at station during 2012 were evaluated for growth parameters like trunk, girth, tree height and spread. Plants gave average trunk girth of 16.8 cm, tree height (2.13 m) and tree spread of 1.40 m in EW and 1.63 m in NS directions (*RHR&TS, Jachh*).



Vegetable Crops

- On the basis of mean performance of seven tomato entries including a standard check (Arka Vikas), Entry2015/TOINDVAR-1 recorded significantly highest yield of 388.00 q/ha over other varieties tested (*VS, Nauni*).
- Among eleven bell pepper genotypes viz., HC201, Early Prolific, Master, Solan Bharpur, Novosibirski, Early Giant, Arka Mohini, Bull Nose, EC93056, EC392688, and California wonder. Solan Bharpur gave highest fruit yield per hectare i.e. 285.30q (*VS, Nauni*).
- Initial evaluation trials on 5 entries of capsicum including a standard check (Kt-1 (Pusa Deepti), genotype 2015/CAPVAR-2 was adjudged top yielder (219.50 q/ha) followed by at par performance by 2015/CAPVAR-1 (*VS, Nauni*).
- Initial evaluation testing of 6 hybrid entries of capsicum including a standard check (Arka Nishant-1), hybrid 2015/CAPHYB-3 gave

highest yield i.e. 267.83 q/ha which was at par with check Nishant-1 (253.67 q/ha) under IET-HYB (*VS, Nauni*).

- Four hybrid entries of capsicum including a standard check (Arka Nishant-1) were evaluated under advanced varietal-II testing programme. However, none of the new entry could surpass the check (Arka Nishant-1) which recorded highest yield (247.50 q/ha) among all entries (*VS, Nauni*).
- The five red colour pepper inbreds purified in the year 2016 have been involved in crossing using diallel fashion excluding reciprocals to generate the information on General Combining Ability (gca) and Specific Combining & ability (sca) to identify the most suitable general combiners and the best specific crosses which can further be advanced for testing as hybrids in the farmer's greenhouses. A total of 10 cross Combinations have been raised for evaluation. The whole planting material is being grown this year for evaluation and recording of observations on different agronomic traits. The seeds of newly stabilized inbreds are further multiplied for its use in future crop improvement programmes (*SS&T, Nauni*).
- Two cytoplasmic male sterile chilli lines viz; CMS-A and A-7 (originally from IIHR) were introduced from IIVR, Varanasi. These lines were crossed with 10 bell pepper cultivars separately in 2006. All the crosses were found 100% male sterile. There was tremendous improvement in fruit size. The fruit size (LxB) was surpassed to the respective donor parent in A-7xNo.12, CMS-AxNo.28 and CMS-AxCWP-2. Maximum fruit yield was recorded in A-7xNo.12 (452.7 g plant⁻¹), which was lower to its donor parent No.28 (642.8 g). This shows desirable achievement from chilli to bell pepper, except the persistence of calyx with the fruit (*RHR&TS, Dhaulakuan*).



A-7x No.12

A-7x No.28



CMS-Ax No.28



CMS-Ax CWP-2

- Amongst six mid season cauliflower varieties 2016/CAUMVAR-7 recorded highest net curd weight of 465.00 g and per hectare yield of 146.38 q/ha followed by 2016/CAUMVAR-3 with net curd weight of 402.00 g and 126.55 q/ha yield. Nine mid season cauliflower hybrids were evaluated at spacing of 60 x 45 cm and hybrid 2016/CAUMHYB-3 recorded highest net curd weight of 578.00 g and per hectare yield of 181.96 q followed by 2016/CAUMHYB-9 with net curd weight of 525.00 g and 165.27 q/ha yield (*VS, Nauni*).
- The five cabbage hybrid entries evaluated along with two standard checks viz; Quisto and KGMR-1, Quisto registered highest head yield (398.08 q/ha). However, two new hybrid entries viz; 2015/CABHYB-4 and 2015/CABHYB-3 with an yield out lay of 362.84 and 351.07 q/ha, respectively were at par to the former i. e. Quisto but significantly higher over another check i.e. KGMR-1 which recorded an yield of 290.74 q/ha only. Newly developed six genotypes of cabbage were evaluated and out of them i.e. UHFCAB-4 recorded highest net curd weight (820g), net curd yield per hectare of 312.66 q followed by at par performance by two others viz, UHFCAB-6 and 296.16 (*VS, Nauni*).
- Amongst the various hybrids of broccoli, hybrid 2015/BROHYB-5 performed well for majority of curd characters and gave maximum yield per hectare (297.17 q) over other hybrids. Amongst 6 hybrid of broccoli evaluated during winter season, hybrid 2015/BROHYB-5 performed well for majority of curd characters and gave maximum yield per hectare (297.17 q) over other hybrids (*VS, Nauni*).
- Advanced varietal testing of 4 newly bred varieties and two standard checks viz., Pant Khira-1 and Pusa Sanyog variety 2014/

CUCUVAR-1 gave significantly highest number of fruits per vine (13.98), and maximum fruit length. Amongst the 4 newly developed hybrids and a standard check (PCUCH-3), hybrid 15/CUCUHYB-5 recorded more number of fruits per vine (16.19), maximum fruit length 19.07 cm), and diameter (4.59 cm), fruit weight (471.67 g) and yield per hectare (299.28 q) closely followed by hybrid 15/CUCUHYB-4 and 15/CUCUHYB-1 (*VS, Nauni*).

Varietal Evaluation of different vegetable crops



Tomato



Ginger



French Bean



Pea

- ❑ None of the four genotype of carrot, out yielded the check cultivar Solan Rachna in yield and other root characters. While, genotype “All Season” was found best amongst the genotypes and produced an average marketable root yield of 201.56 q/ha (*VS, Nauni*).
- ❑ Of the initial varietal evaluation of 10 entries of early pea including 2 standard checks, entry 2016/PEVAR-4 gave highest yield of 105.00 q/ha closely followed by 2016/PEVAR-6 which exhibited 99.17 q/ha. Similarly, initial varietal evaluation of 11 entries of mid season pea including 2 standard checks revealed entry no. 2016/PEVAR-6 recording the highest marketable yield of 111.25 q/ha followed by 2016/PEVAR-5 (108.33 q/ha). The observations recorded showed that the entry 2015/PEVAR-7 gave highest yield of 108.75 q/ha closely followed by 2015/PEVAR-4 which exhibited 104.17 q/ha (*VS, Nauni*).
- ❑ Similarly, in late pea group, the entry no. 2014/PEVAR-4 recorded the highest marketable yield of 125.00 q/ha followed by 2014/PEVAR-3 (117.50 q/ha) in an AVT-II trial (*VS, Nauni*).
- ❑ Amongst, six varieties of cowpeas evaluated during rainy season of 2016, entry coded 2016/COWPBVAR-1 found best for majority of pod characteristics and recorded highest marketable yield of 112.94 q/ha (*VS, Nauni*).
- ❑ Evaluation of five varieties of dolichos bean (Bush) identified 2016/COWPBVAR-5 as best entity for majority of pod characteristics and recorded highest marketable green pod yield of 137.14q/ha. Similarly, evaluation of nine varieties of pole type dolichos bean found 2016/DOLPVAR-4 best for majority of pod characteristics and recorded highest marketable green pod yield of 221.97 q/ha (*VS, Nauni*).

- ❑ Bowman-Birk trypsin inhibitor protein purified from seed flour of a local bean (*Phaseolus vulgaris* L.) cultivar Baspa had insecticidal activity and antimicrobial activity. Gene encoding for this protein was isolated, characterized, cloned and expressed (*BT, Nauni*).



Mustard Green

- ❑ Of five mustard genotypes evaluated during 2016, the check variety Pusa Sag with an yield outlay of 271.95 q/ha out yielded all the newly bred entries under evaluation. However, entry coded as 2014/MGVAR-4 with an yield of 265.85 q/ha was at par to the check variety i.e. Pusa Sag (*VS, Nauni*).
- ❑ The advanced varietal evaluation of 4 entries pole French bean including a standard check; Kentucky wonder shows that entry 2015/FBPVAR-1 recorded significantly highest yield of 186.36 q (*VS, Nauni*).
- ❑ Thirty six garlic genotypes were evaluated for two years 2014-15 and 2015-16 in rabi season. Genotypes viz., Kandaghat Selection, LC-1, SG-30, LC-2 and LC-3 were found promising in terms of yield and yield contributing characters, and performed better than check variety Agrifound Parvati. Maximum yield was recorded in genotype Kandaghat Selection (168.30 q/ha) followed by LC-1 (154.35 q) (*VS, Nauni*).
- ❑ One hundred and eighty five ginger collections were maintained/evaluated for rhizome yield and other horticultural traits. The yield range varied from 102.48 q/ha (SG-1118) to 137.28 q/ha (SG-1024). Yield of three lines viz., SG-1024 (137.28), SG-1095 (135.78) and SG-1287 (130.47) excelled the check Himgiri which yielded 129.24 q/ha. The rhizome rot disease incidence varied from 10.17-21.82% with 10.17% and 12.62% in SG-24-4 and Himgiri, respectively (*VS, Nauni*).



SG-26-04



Himgiri

- Sprouted buds of ginger from rhizomes of varieties 'Himgiri', 'Solan Ginger-4-4(SG 4-4)', 'SG-1156' and 'Suprabha' were excised and surface sterilized and cultured on MS medium supplemented with various concentration and combination of growth regulators for *in vitro* establishment of buds. Maximum percent establishment of 80.19 in Himgiri, 78.29 in SG-4-4 and 74.79 in SG-1156 was obtained in MS medium fortified with 1.0 mg/l BA and 0.1 mg/l NAA. Proliferated shoots were separated into single shoots and cultured on for shoot multiplication. Highest multiplication rate of 1:6 in Himgiri, 1:7 in SG 4-4 and 1:4 in SG 1156 was observed on medium SM₈ i.e MS medium fortified with BA (0.5 mg/l) and NAA (0.1 mg/l). In all the control experiments no multiplication could be obtained even after 6 weeks of culture (BT, Nauni).



Establishment of sprouted buds of ginger

- Proliferating shoots of ginger cultivar Himgiri and Solan Ginger-4-4 were used as target tissue for gamma irradiation after 4th passage of subculturing. Cobalt-60 was used as source of gamma rays and radiation. After irradiation, cultures were kept in culture room at 25±2°C temperature and 16/8 (day/night) photoperiod and radiation effect was recorded in terms of survival rate every week. After four weeks of irradiation of 80 Gy 49.78% shoots survived in Himgiri and no shoot survived irradiation of more than 80 Gy, therefore 0% survival was observed. Whereas, in SG-4-4, 30.34 % shoots survived at irradiation of 70 Gy and no survival was observed on dosage of 80 Gy and above. Control cultures showed 100% survival percentage at 4, 8 and 12 weeks interval (BT, Nauni).
- The surviving shoots from 10, 20 and 30 Gy in Himgiri and 10 to 70 Gy in SG-4-4 are being

multiplied on previously standardized multiplication medium. Sub culturing is done after every 4 weeks to get large number of mutated shoots for *in vitro* selection experiments. *F. oxysporum* f. sp. *zingiberi* was isolated from diseased rhizomes, for pathogenicity test (*BT, Nauni*).



Proliferation of Gamma irradiated ginger

- One hundred and thirty five turmeric collections were maintained/ evaluated for rhizome yield and other horticultural traits. The yield range varied from 184.38q/ha (PCT-13) to 394.20 q/ha (ST-908). Yield of three lines viz., ST-908 (394.20 q/ha), CO-1 (353.15 q/ha) and ST-20 (346.75 q/ha) excelled the checks Palam Lalima and Palam Pitamber which yielded 337.720q/ha and 346.097q/ha, respectively. The curcumin content varied from 3.447-6.067% with maximum in BDJR-1144 whereas, 3.827% and 3.577% in Palam Lalima and Palam Pitamber, respectively. Of the five genotypes of turmeric including local check, the tolerant turmeric line CL-54 gave the maximum yield (32.87 t/ha) along with minimum

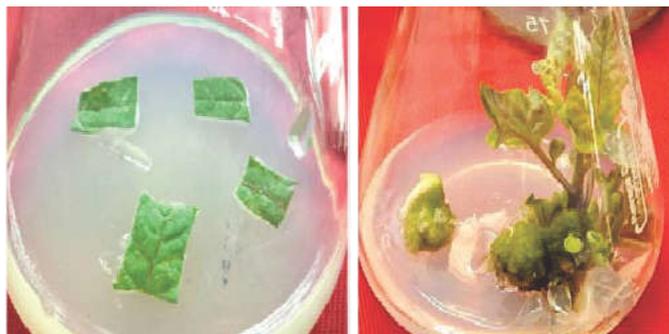
leafspot(6.56%) and leaf blotch (7.09%) severity as compared to local checks recorded values of 25.37 q/ha., 19.87% and 27.67 %, in that order (*VS, Nauni*).

- Tomato genetic stock comprising of 23 lines, 9 varieties and 4 local collections were evaluated and it was found that genotypes EC- 191535, LE-79-5 and Yalabingo were high yielders and found suitable for growing during autumn-winter season, where as genotype EC 191540, BWR-5 performed better in summer season. For developing the hybrids, FT-5 was good general combiner for most of the traits. The hybrid combinations viz., EC- 191535 × FT-5, BT-1-1 × FT-5 and EC-174913 × FT-5 were found promising and gave higher fruit yields (653.8 q/ha, 598.6 q/ha and 593,3 q/ha, respectively) (*RHR&TS, Jachh*).
- Standardization of 3 growing media in UV stabilized grow bags (sand, coco peat and coco peat + vermicompost) and 3 levels of drip irrigation @ 100% evapo-transpiration (ET), 80% ET and 60% ET for tomato (var. Solan Lalima). Use of Coco peat + vermicompost media revealed maximum plant height (142.24 cm), number of fruits/plant (83.91), and fruit yield (6.20 kg/plant). These parameters were recorded to be lowest in coco peat alone i.e.138.39 cm, 82.11 fruits/plant and 5.86 kg/plant, respectively. Further, under irrigation levels, maximum value of respective parameter being 141.14 cm, 83.74 fruits/plant and 6.16 kg/plant was under 60% ET (*SS&WM, Nauni*).



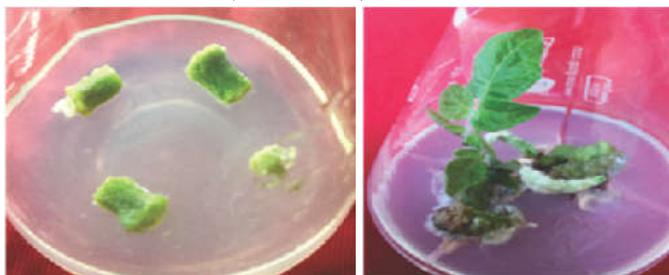
Tomato plants in grow bags

- ❑ In a study to evaluate the performance of different tomato hybrids for yield and component traits in cold desert region, significant differences among varieties were found on all the parameters except total soluble solids. Out of three tomato hybrids, Solan Lalima was earliest to reach the marketable maturity (98.11 days) and recorded maximum value for fruit breadth and fruit weight. Naveen 2K+ recorded maximum value for harvest duration and fruit length. Pusa Divya was found promising for most of the traits like pericarp thickness (7.05 mm), number of fruits/plant (20.67), fruit yield/plant (1.36 kg) and fruit yield/ha (504.81 qt) (*RHRSS and KVK, Tabo*).
- ❑ Shoot regeneration through leaf derived callus in tomato cv. Solan Lalima was reported after 6-7 weeks of incubation. MS supplemented with 1.0 mg/l BA and 0.5 mg/l NAA resulted in highest percentage shoot regeneration of 60% among all the combinations (*BT, Nauni*).



Indirect shoot regeneration in tomato cv. Solan Lalima using leaf explant

- ❑ Direct shoot regeneration was observed in hypocotyl explants excised from *in vitro* seed raised cultures after three-four weeks of incubation. MS supplemented with 1.0 mg/l BAP and 1.0 mg/l kinetin was found to be highest with 78.50% average shoot regeneration among all the combinations (*BT, Nauni*).



Direct shoot regeneration in tomato cv. Solan Lalima using hypocotyls explant

- ❑ There was significant interaction effect of seed rates and line spacing on the parameters like % seed germination in field, pod length, pod yield/plot (kg) and pod yield/ha (qt). Maximum green pod yield/plot (2.37 kg) and per ha (118.67 qt) was observed in treatment combination of seed rate of 150 kg/ha and line spacing of 30 cm in tomato. Same treatment combination also recorded the highest benefit cost ratio of 1:1.62 (*RHRSS and KVK, Tabo*).



- ❑ Five hybrids of snow pea viz., green, Snow green, Mithi phalli, Arka Sampurna and Go green Snowpeas Carboys were evaluated for their performance under polyhouse and net house conditions. All the genotypes recorded better performance under polyhouse than net house conditions. Among all genotypes, Go Green Snowpeas Carboys recorded highest pod yield/plant (168.57 g/plant) followed by Snowgreen (154.00 g/plant) and Green (153.23 g/plant) under polyhouse conditions (*RHR&TS, Jachh*).
- ❑ Pea seeds were coated with 20 treatment combinations containing essential oils out of these seed coating with *Acros calamus* (@ 0.250 ml/kg) and polymer coating (@ 20ml/kg) independently as well as in combination gave best results w.r.t. plant growth, yield in field and seed quality under storage conditions. The combination of seed coating with *Acros calamus* (@ 0.250 ml/kg) and polymer coating (@ 20ml/kg) resulted in seed yield of 37.94 q/ha with 92.5% seed germination (*SS&T, Nauni*).
- ❑ Integrated application of FYM @ 20 t/ha and Jeevamrit @ 5 per cent drenching and two foliar

sprays @ 3 per cent recorded maximum plant height (64.53 cm), number of fruits per plant (29) and fruit yield per hectare (366.42 q) in organic production of sweet pepper followed by vermicompost @ 7 t/ha and Jeevamrit application (*VS, Nauni*).

- An INM module comprising of 75% NP+VC and EC@ 2.5 t/ha + PGPR in a cropping sequence (cabbage- capsicum-radish) resulted in a significantly highest annual net return to the tune of Rs 12.41 lacs per hectare with a B: C ratio of 2.43. This treatment module also resulted in good build up of post harvest nutrient status (NPK) of soil as envisaged through 49.87, 83.06 and 14.26 per cent increase in NPK over the initial status. The study concluded that application of 75% NP (RD)+VC and EC@ 2.5 t/ha + PGPR to cabbage-capsicum- radish can result in saving of 25% fertilizers (NP), better growth, higher yield, and higher annual net returns and also enhanced soil health (*VS, Nauni*).



- In an experiment on effect of growing media and fertigation on capsicum production under naturally ventilated polyhouse in cold desert region, a significant individual effect of growing media and fertigation levels was observed on all the parameters except fruit breadth (cm). Second level of fertigation level i.e. 200 kg/ha recorded maximum value for fruit length, pericarp thickness, average fruit weight, number of fruits/plant, fruit yield/plant, fruit yield/m² and fruit yield/ha. However, parameters like fruit length, pericarp thickness, and average fruit weight were found statistically at par with third level of fertigation i.e. 250 kg/ha. Soilless growing media comprising of vermicompost and sand (2:1) recorded maximum value for plant

height, harvest duration, fruit length, fruit breadth, pericarp thickness, average fruit weight, pericarp thickness, number of fruits/plant, fruit yield/plant, and fruit yield/ha. Among interaction effects, soilless growing media comprising of vermicompost : sand (2:1) and highest level of fertigation 250 kg/ha recorded the maximum value for harvest duration, plant height, average fruit weight (g), fruit yield/plant, fruit yield/m² and fruit yield/ha. (*RHRSS and KVK, Tabo*).

- Experiment was laid out on three vegetable crops cabbage var. Golden Acre, cauliflower var. Pusa Snowball K1 and broccoli var. KTS-1 and effect of growing method, biofertilizer application and fertilizer doses. Biofertilizer application and fertilizer doses have significant direct effect on curd/head weight and yield/ha in all the crops. However, growing method has significant direct effect on broccoli and cabbage. Ridge method of cultivation, 100% recommended dose of fertilizer and application of *Azospirillum* recorded higher yield in broccoli and cabbage. In cauliflower 75% recommended dose of fertilizer and application of *Azospirillum* recorded significantly higher yield (*RHRSS and KVK, Tabo*).
- The conjoint application of organic, inorganic and bio fertilizers was found best with respect to yield and yield attributing characters in cauliflower cv. Pusa Snowball K-1. The incidence of black rot disease was also found minimum in the above treatment (*RHR&TS, Jachh*).
- Five genotypes of Broccoli viz., Matsuri, Palm kanchan, Palm Samridhi, Lucky, Fiesta and Palm Vichitra were evaluated for different horticultural traits under polyhouse and net house conditions. The experimental results revealed that performance of different genotypes/hybrids of broccoli was recorded better under net house conditions than the polyhouse conditions. Under net house condition Lucky recorded highest yield (699.10 g/plant) followed by Fiesta (637.87 g/plant) and Palm Samridhi (528.53 g/plant) (*RHR&TS, Jachh*).
- Different levels of irrigation (100% evapotranspiration (ET), 80% ET and 60% ET) and fertigation (100% Recommended Dose, RD) of Water Soluble Fertilizers (WSF), 80% and 60%

of RD) under drip were tried on broccoli in conjunction with black polyethylene mulch with control having surface irrigation. Drip irrigation at 100% ET + 60% fertigation of RD recorded maximum yield of 245.3 q/ha which was statistically at par with drip irrigation at 80% ET+ fertigation with 100% RD (235.6 q/ha) and irrigation at 60% ET + fertigation of 100% RD (231.8 q/ha). The control with no mulch and surface irrigation + conventional application of fertilizers performed poorly and recorded yield of 184.5 q/ha (*SS&WM, Nauni*).



- ❑ Okra seeds (cv. P-8) were pelleted with 12 different treatment combinations out of which treatment combination containing turmeric powder @ 300 g per 200 g seeds and turmeric powder + clay powder @150 g each per 200g seeds resulted in better plant growth and yield. The fresh fruit yield with this treatment observed was 171.57 q/ha and seed yield was 28.01 q/ha. The seed quality parameters like, germination and vigour of seeds pelleted with turmeric powder @ 300g per 200g seeds and turmeric powder + clay powder @ 150 g each per 200g seeds were also better than other treatments. Under storage conditions, the seed quality, however, decreased with increase in storage time but the rate of deterioration of pelleted seeds was lower than the unpelleted control (*SS&T, Nauni*).
- ❑ In okra bio-organic nutrient sources, namely, farm yard manure (FYM), vermicompost (VC), *Azotobacter* (AZ), and phosphorus solubilizing bacteria (PSB), along with 100, 80, 60, 40% of the recommended dose (RD) of chemical fertilizers (N-P-K) were evaluated in 18 treatment combinations along with a control treatment.

Maximum fruit yield of 90.9 q ha⁻¹ was obtained with the application of farm yard manure (10 t ha⁻¹) + vermicompost (10 t ha⁻¹) + NPK (75:50:50 kg ha⁻¹) + *Azotobacter* along with PSB (Seed treatment). Other characters like first effective node, days to flower, internodal length, no of nodes per plant, average pod weight and pod length were also significantly influenced by the same treatment (*RHR&TS, Dhaulakuan*).

- ❑ The investigation was carried out using okra cultivar 'P-8'. Twenty four treatments comprised of combination of four different spacings and six different days of pinching after sowing. The results showed that spacing 60×30 cm and pinching 30 DAS (S₁P₄) gave best results for plant growth parameters and treatment spacing 60×20 cm and pinching 30 DAS gave best results for all the seed yield characters and also performing significantly at par with best treatments with respect to some of the growth and seed quality parameters. (*SS&T, Nauni*).
- ❑ In radish cv. Japanese White the treatment combinations comprised of four different mulches, three row layouts with constant population, and two plant layouts. Analysis of variance showed significant differences among the treatment combinations for all the characters studied. The treatment combination black mulch, double row (75+45) ×30 cm and triangle method of planting (M₂L₂P₂) was found superior over all other treatments in terms of growth characters, seed yield characters, seed quality characters and had maximum benefit: cost ratio (*SS&T, Nauni*).
- ❑ Seed germination of *Asparagus recemosus* was found to be enhanced (75%) when its seeds were treated with 1% GA₃ (*COH&F, Neri*).
- ❑ Studies of some nursery and crop management practices on growth and yield of sweet pepper concluded that the bio-inoculation of seed and seedlings raised in either substrates coco-peat in pro-trays or field soil in earthen pots and their early planting on April, 05 resulted in better growth, higher yield (326.68 q/ha), net returns (Rs. 5.03 lacs/ha) and B : C ratio of 3.35 along with enhanced soil health in mid-hill conditions of Himachal Pradesh. (*VS, Nauni*).

- ❑ Growing media comprising of soil, coco peat, vermicompost and FYM in the ratio of 2:1:0.5:0.5 v/v, respectively and plant spacing of 45 × 45 cm produced highest fruit yield (16.57 kg/m²) and maximum benefit: cost ratio (2.23) in two years experimentation in sweet pepper cv. Orabelle under protected conditions (*VS, Nauni*).
- ❑ Forty four best performing genotypes of ginger were analyzed for quality traits. The dry matter content (%) and crude fibre (%) ranged between 16.900 (SG-15-07(SG-1124)) to 22.293 (SG-1130) and 3.867 (SG-1095) to 5.600 (Ranchi Local), respectively. Essential oil (%) and oleoresin contents (%) varied from 0.813 (SG-939) to 1.587 (SG-12/04) and 3.530 (SG-1079) to 4.770 (SG-26-04 (Giriganga) and Mahima), respectively. The high yielding genotype SG-26-04 (Giriganga) was found superior/ comparable for dry matter content, essential oil, oleoresin and crude fibre contents to the check Himgiri (*VS, Nauni*).
- ❑ Forty best performing genotypes of turmeric including checks were analyzed. The dry matter content (%) and curcumin (%) ranged between 16.000% (ST-15-08(ZEERA)) to 26.473% (ST-15-02(ST-907)) and 3.447% (PCT-13) to 6.123% (ST-15-03(PCT-14)), respectively. The high yielding genotype ST-15-02(ST-907) was found superior/ comparable for dry matter content and curcumin (%) to the checks Palam Lalima and Palam Pitamber (*VS, Nauni*).
- ❑ In seed spices the demonstrations were given in Methi. In methi cultivar IC-74 and Pusa Early Bunching was provided to the 5 farmers in two districts of the state for popularization of organic farming technology of the crop. Simultaneously, its demonstration at both the farms of the department was also laid out to demonstrate the technology to the farmers (*SS&T, Nauni*).



Produce of the demonstration trials on organic farming of coriander and garlic



Large scale quality planting material production in garlic and turmeric

- ❑ Produced and sold 37.36 of breeder, foundation, certified and truthful level seeds/ planting material of the vegetable, spice, oil seeds and pulse crops amounting to Rs. 6,77,072.50. The seed produced has been fully utilized by way of supplying it to the farmers for direct use and to the state department of Agriculture, National Seed Corporation (NSC), and other agencies for further multiplication or distribution (*SS&T, Nauni*).
- ❑ For off season production of vegetables, seed sowings under protected structures during first fortnight of February for early summer harvest and in the second fortnight of August for autumn-winter crop harvest were found optimum for obtaining higher fruit yields in tomato, brinjal, chilli, okra and bottle gourd (*RHR&TS, Jachh*).



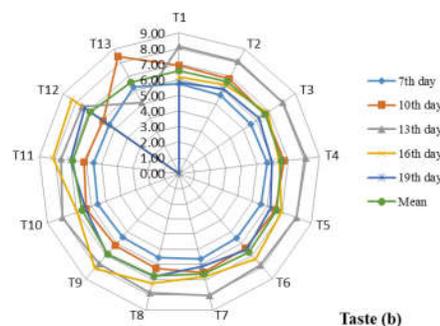
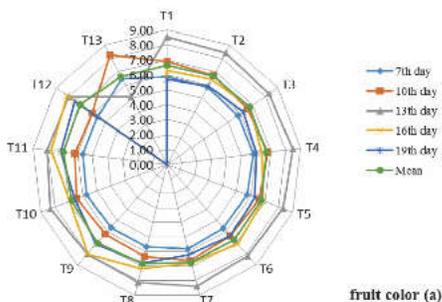
- ❑ Two bitter gourd lines have been identified which gave higher fruit yield (366.3 and 345.8 q/ha), had better horticultural traits and are desirable for stuffing as well as vegetable purposes. These lines are high yielding and resistant to fruit fly (*RHR&TS, Jachh*).
- ❑ The experiment on effect of transplanting dates and plant population on quality seed production of cauliflower for three years, concluded that cauliflower var. PSBK-1 should be transplanted in the last week of October at a spacing of 60x60 cm for getting higher and quality seed yield (3.42 q/ha) (*VS, Nauni*).

- ❑ The experiment on effect of integrated weed management on growth, fruit and seed yield of capsicum var. Solan Bharpur conducted for three years concluded that use of black polythene mulch is most useful for controlling the weed population, conserving the soil moisture which, ultimately resulted in highest seed yield (98 kg/ha) and B: C ratio of 3.10 (*VS, Nauni*).
- ❑ The experiment on the effect of planting densities on seed production of carrot has been conducted for three years, concluded that carrot stecklings spaced at 30 x 30 cm resulted in maximum seed yield (6.52q/ha) (*VS, Nauni*).
- ❑ A hydroponic system installed in the polyhouse to study the feasibility of growing vegetable crops through nutrient film technique (NFT). Lettuce crop was tried and grown in Hoagland solution with and without jeevamrit (5%). Growth parameters of lettuce with jeevamrit viz. number of leaves, root length, leaf area and yield were 24.34, 18.62, 17.98 and 16.32 per cent higher, respectively, under NFT as compared to grow bags. The crop took 61 days to mature in grow bags compared to 31 days under NFT (*SS&WM, Nauni*).



Lettuce under NFT and in grow bags

- ❑ Active packaging of kiwifruits in LDPE bags containing sachet of potassium permanganate @ 5g/kg fruit was the most effective treatment for extension of shelf- life and retention of storage quality of kiwifruit under ambient and refrigerated storage (*FST, Nauni*).



Effect of active packaging on sensory quality of kiwifruit in storage under ambient and refrigerated conditions at 2±1°C

- ❑ 3% CaCl₂ dip for 30 min had a beneficial effect on shelf life of pear fruits, and maintained the storage quality of the fruits (*FST, Nauni*).



Effect of postharvest CaCl₂ treatments on sensory quality (color and taste) of pear fruits under ambient storage.

- ❑ Technology for the preparation of tutti-frutti and preserve from ripe pumpkin has been standardized (*FST, Nauni*).



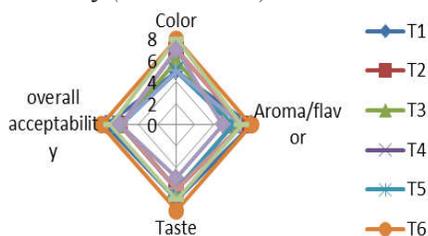
Tutti-frutti from ripe pumpkin and utilization in bakery products and ice-cream

- Seedling mango fruits from eight locations like Bhoranj, Ghumarwin, Gopalpur, Sulah, Bhawarna, Una Sadar, Nahan and Ponta Sahib have been found suitable for the commercial production of pickle out of 24 locations of Himachal Pradesh (*FST, Nauni*).
- Papaya powder has been prepared by steam blanching of grated fruit for 3 minutes followed by dipping in 0.2% KMS for 30 minutes and drying in a mechanical dehydrator at 55°C. This powder was used for the preparation of several RTE products (*FST, Nauni*).



Papaya powder and powder based halwa

- Guava-jamun blended drink has been standardized by using 60 per cent of guava pulp and 40 per cent jamun pulp (G60:J40) with 15 per cent fruit part and 15°B TSS. Further, the drink prepared by using 5 per cent Aloe vera juice [i.e. 15% fruit part of guava-jamun (60:40) + 5% Aloe vera juice] was also found suitable (*FST, Nauni*).
- The *Aloe vera* fortified guava-jamun low calorie health drinks prepared by using 75 per cent and 85 per cent substitution of sucrose with stevioside (energy value of 15.90 Kcal/100g) and sucralose (energy value of 11.40 Kcal/100g), respectively were prepared successfully (*FST, Nauni*).
- The palatable seasoned vinegar consisting of 70% vinegar (4.5% acidity), 10% honey, 1% black salt, 3% black pepper, 4% cumin seed, 1% large cardamom, 2% pudina, 4% ginger powder, 5% lemon juice has also been developed successfully (*FST, Nauni*).



Web diagram of sensory qualities of seasoned vinegar

- Herbal Apple-Whey blended drink has been standardized by blending apple juice (75%) with whey (25%) having 13.0° B TSS, 0.30% acidity and spices and herbs extract (Jal jeera) @ 2.5% (*FST, Nauni*).
- Protease enzyme from kiwi fruit has been isolated, characterized and utilized for the development of food products like cottage cheese, bread, and buns and, tenderization of spent hen chicken (*FST, Nauni*).
- Among the different low cost storage structures tried, earthen pot followed by coated bamboo basket (clay : cow dung, 1:1). have been found best to retain the quality of stored ginger (*FST, Nauni*).



Earthen pots



Clay:mud (1:1) coated bamboo baskets

- Mechanical method for extraction of aloe vera gel and technology of juice extraction and preparation of aloe vera beverages like appetizer and syrup has been optimized (*FST, Nauni*).
- For the continuous osmotic dehydration of fruits a pilot plant consists of two parts, one part rectangular main frame (775×480×1225 mm) fabricated by using 50×50×6 mm mild steel L angle to hold osmotic reactor, motor, and pump assembly and another frame was fabricated. The specifications of the machine are : capacity - 15-20 kg fruits per cycle/unit; weight - 145 kg; material of make - stainless steel (*FST, Nauni*).



Osmotic dehydration unit in operation

Flower Crops

- New plant species viz. *Zephyranthes*, *Haemanthes* (pink), *Caladium*, *Amaryllis*, *Nerine*, *Zantedescia*, *Alpinia*, *Iris*, *Zephyranthes* have been added to the existing germplasm. Some potted bulbous/succulent plants such as *Poinsettia*, *Ruellia brittoniana*, palms Cycades, and *Kalanchoe* were introduced. Four cvs. of sweet pea, small zinnia and zinnia cultivars, cosmos and annual chrysanthemum (yellow and white) were added to the germplasm of seasonal annuals. Two new cultivars namely 'Rose Supreme' and 'Muscagini' of gladiolus were also introduced. Similarly 'Red Collection' and 'Yellow Collection' of alstromeria were added to already existing collection to a tally of 12 cultivars. In liliium, 14 newly introduced cultivars consisting of 5 cvs of Asiatic Hybrids (Navona, Prato, Tressor, Shiraj and Elite), 2 of Oriental Hybrids (Viviana and Sapporo), 4 of LA hybrids (Eyeliner, Ceb Dazzle, Best Seller and Pavia) and 3 of OT Hybrids (Yelloween, Celesta and Montego Bey) were added. In addition to twenty four native plant of ornamentals spp, six new ornamental plants namely *Prunus cerasoides*, *Pistacia integerrima*, *Caesalpinia sepiaria*, *Celosia argentea* (pink), *Aerva scandens* and *Strobilanthes glutinosus* (white) were added. Rose germplasm was enriched with the addition of 45 new cultivars (*FLA, Nauni*).
- Ten cultivars of China aster (*Callistephus chinensis* L.) were evaluated for growth and flowering besides genetic parameters. Wide range in mean performance has been reported in characters such as plant height (41.15.102.25 cm), plant spread (23.79.55.70 cm), days to first flower opening (77.25.106.25 days), flowering duration (25.65.41.30 days) and weight of flowers per plant (84.50.174.42 g). Higher genotypic and phenotypic coefficient of variation was observed for plant height and plant spread. High heritability (> 80%) was recorded for all traits except number of harvests of loose flower. The genetic advance ranged from 1.36 for individual flower weight to 57.15 for weight of flowers per plant. High values of genetic gain were recorded for plant height (69.81%), followed by weight of flowers per plant (50.97%). Weight of flowers per plant was significantly and positively correlated both at genotypic and phenotypic level to plant height, plant spread, flower head diameter, number of flowers per plant and individual flower weight. Path coefficient analysis using correlation coefficients revealed that number of flowers per plant contributed highest positive direct effect on weight of flowers per plant, followed by individual flower weight and plant height (*FLA, Nauni*).
- In gladiolus 'UHFSGLa 2.24' was found to be the most superior for early flowering, number of florets/spike, number of florets open at a time, size of floret, whereas 'UHFSGLa 11.10' was found superior w.r.t. corm multiplication and size of the corm (*FLA, Nauni*).
- The plants of rose cv. Super Star were pruned at different dates at one month interval w.e.f. 21st October, 2014 to 20th February, 2015. Among different pruning dates, plants pruned on 20th December resulted superior growth and flowering i.e. numbers of shoots (12.60), numbers of leaves (14.02), numbers of cut stems (11.30), stem length (62.16 cm), diameter of cut stem (10.48 mm), longer vase life (10.83 days), maximum weight of cut stem (41.33 g), numbers of flower buds (13.10), length of flower bud (50.35 mm), diameter of flower bud (40.25 mm), diameter of flower (10.41 cm) and flower yield (13.23). However, plant height (90.42 cm) and petals per flower (47.78) obtained in October and November pruning, respectively. The earliest flower bud initiation (36.17 days) and maximum pedicel length (9.20 cm) was seen in plants pruned on 20th February flowering flushes, flush I

resulted better in all vegetative and flowering parameters as compared to flush II and III. Hence, it can be concluded that pruning performed on 20th December is best for all growth and flowering parameters except few, under mid hill zone of Himachal Pradesh (*FLA, Nauni*).

- A suitable combination of NPK and biofertilizers for maximizing flower yield in China aster cv. 'Kamini' revealed that maximum plant height (56.67 cm), number of leaves per plant (103.93), flowering branches per plant (8.23), plant spread (32.32 cm), number of flowers per plant (28.58), number of flowers per plot (428.67), duration of flowering (27.20 days), flower yield per plant (73.21 g), flower yield per plot (1098.20 g), shelf life of flowers (6.43 days) at ambient conditions were recorded in plants receiving 75% NPK (22.5:11.25:7.5 g NPK/m²) + *Azotobacter* + PSB. Plants supplied with 100% NPK (30:15:10 g NPK/m²) + *Azotobacter* + PSB were noticed with maximum leaf area (15.76 cm²), whereas, largest flower diameter (5.41 cm) and fresh weight of individual flower head (2.70 g) were found in plants receiving 50% NPK (15:7.5:5 g NPK/m²) + *Azotobacter* + PSB (*FLA, Nauni*).
- Effect of planting dates on growth, flowering and multiplication of gladiolus cv. 'Solan Mangla' revealed earliest sprouting, slipping, bud break and flowering for 28th July planting. Whereas, 13th February gave 100% sprouting, maximum no. of florets (15.06), size of corm (3.99 cm), no. of cormels/plant (97.40), weight of corms/plant (24.64 g) weight of cormels/plant (24.78 g) and 28th February planting was found to be at par with 13th February planting for all these parameters as well. 28th February planting also recorded highest no. of spikes (2.50), vase life (7 days) and duration of flowering (39.33 days). However, maximum size of floret (10.33 cm) and heaviest spikes (89.03 g) was recorded for 30th March planting. This planting was also in accordance with 13th February and 14th April plantings for maximum number of florets (14.13) and spike length (93.54 cm). Hence, 13th February, 28th February and 30th March plantings were found to be the best for flower spike production.
- Moreover, 13th February also recorded the best results for corm and cormel production in equivalence with 28th February planting for most of the corm and cormel parameters. However, for marketable spikes, it is advisable to conduct staggered planting from February to April (*FLA, Nauni*).
- Effect of planting density and foliar application of nitrogen on multiplication of gladiolus showed the lowest density i.e. 100 cormels/m² recorded maximum values for plant height (35.97 cm), number of leaves per plant (5.25), leaf length (31.93 cm), leaf width (1.54 cm), number of cormels/plant (6.35), weight of cormels/plant (1.25 g), cormel size (0.89 cm), weight of corms/plant (27.29 g), corm size (3.56 cm), propagation index (4001.81), NPK content of leaves (2.43, 0.24, 2.37%), available NPK content of soil (222.60, 35.94, 225.53 kg/ha), total chlorophyll content of leaves (1.43 mg/g). However, number of cormels/m² (439.93), weight of cormels/m² (91.66 g), number of corms/m² (70.33), weight of corms/m² (1399.34 g), minimum crop duration (205.55 days) was recorded with the highest density of 140 cormels/m². As regards the effect of foliar spray of nitrogen, plant height (36.57 cm), number of leaves per plant (5.41), leaf length (32.46 cm), leaf width (1.59 cm), number of cormels/plant (7.51), number of cormels/m² (573.90), weight of cormels/plant (1.51 g), weight of cormels/m² (117.74 g), cormel size (0.92 cm), number of corms/m² (70.83), weight of corms/plant (28.41 g), weight of corms/m² (1569.77 g), corm size (3.87 cm), propagation index (4395.13), NK content of leaves (2.52, 2.42%), available NPK content of soil (229.47, 37.10, 234.27 kg/ha), total chlorophyll content of leaves (1.48 mg/g) were recorded with the highest number of foliar spray of nitrogen i.e. 16 numbers of foliar spray of nitrogen (500 ppm). However, minimum crop duration (199.56 days) was recorded in control where no foliar spray of N has been given (*FLA, Nauni*).
- In gladiolus cultivars, 'Nova Lux', 'Red Beauty' and 'Mayur' can be recommended for cut flower production and 'Nova Lux', 'Tiger Flame',

'American Hybrid', 'Mayur', 'Red Beauty' and 'Spic and Span' for corm production (*FLA, Nauni*).

- Growing medium consisting of sand + soil + FYM (1:1:1; v/v) + vermicompost + cocopeat (2:1:1; v/v) was found to be the best substrate for advanced bud and flower formation (157.67 days and 161.83 days; respectively) in alstoremeria cv. Capri with greater number of stems, and flowering stems per plant (44.58 and 34.80; respectively). It also recorded maximum plant height (123.54 cm), length of cut stem (103.83 cm) and weight of cut stem (61.80 g) along with increased duration of flowering (120.50 days). However, growing media did not have any significant effect on the thickness of stem. Whereas, growing media consisting of sand + soil + FYM (1:1:2; v/v) was observed best with respect to number of florets per stem (16.14), size of floret (5.75 cm), and vase life (13.77 days). The maximum number of rhizomes (12.83) and rhizome portions with rhizome tip and tuberous roots (11.00) along with maximum weight of rhizome cluster per plant (923.94 g) was noticed in growing medium consisting of cocopeat + FYM (1:1; v/v) (*FLA, Nauni*).
- Propagation of liliun cultivars revealed, maximum weight of bulblets/scale (0.51 g) and propagation index (41.90%) was recorded in cv. 'Batistero', maximum number of bulblets/scale (2.53) in cv. 'Jazz It Up' and bulblet diameter in cv. 'Courier' (8.60 mm). Among the different auxin treatments, dipping the scales in NAA 500 ppm before planting produced best results for per cent sprouting (65.56%), days taken for sprouting (66.19 days), sprout length (15.83 cm), number of leaves/scale (2.21), percentage of scales showing bulblet formation (69.63%), number of bulblets/scale (2.68), weight of bulblet(s)/scale (0.57 g), bulblet diameter (9.42 mm), and propagation index (39.77 %). Out of the media, per cent sprouting (66.67%), days taken for sprouting (73.36 days), sprout length (16.41cm), percentage of scales showing bulblet formation (67.50%), number of bulblets/scale (2.67) and propagation index (38.16%) was maximum in 'cocopeat' whereas, number of leaves/scale (2.22), weight of bulblet(s)/scale (0.68 g) and bulblet diameter (9.86 mm) was observed maximum in perlite + vermiculite. It was concluded that an application of 500 ppm NAA and planting in cocopeat was found to be the best treatment for propagation of liliun through scaling. In the second experiment, the scales of fifteen Asiatic and LA hybrid lily cultivars were planted in cocopeat after dipping in NAA 500 ppm, it was found that, cv. 'Batistero' excelled others with respect to most of the parameters and maximum propagation index (80.48 %) was also recorded in this cultivar (*FLA, Nauni*).
- In ornamental Kale among different levels of nitrogen, N_5 (30 g N/m²) recorded maximum values for plant height (59.83 cm), stem length (49.00 cm), stem diameter (21.96 mm), head size (16.42 cm), weight of cut stem (387.57 g), vase life (21.96 days), volume of water consumed (583.50 ml) and per cent weight loss (43.11%). However, minimum number of days taken for head formation (62.67 days), minimum number of days taken for colour development (76.21 days) and cropping duration (85.46 days) was recorded with the lower level of nitrogen i.e. N_1 (10 g N/m²). As regards the effect of potassium, maximum plant height (51.26 cm), stem length (41.08 cm), stem diameter (18.70 mm), head size (14.80 cm), weight of cut stem (312.91 g), vase life (21.37 days), volume of water consumed (451.30 ml) and per cent weight loss (41.92%) were recorded with the application of K_4 (20 g K/m²). However, minimum number of days taken for head formation (75.67 days), minimum number of days taken for colour development (77.13 days) and cropping duration (85.53 days) were recorded with the lower level of potassium i.e. K_1 (5 g K/m²). The interaction, $N_5 \times K_4$ i.e. 30 g N/m² and 20 g K/m² recorded maximum values in terms of most of the growth and quality parameters of commercial importance. Hence, it is concluded that for better growth and quality cut stems, the ornamental kale plants be fertilized with NPK @ 30:20:20 g/m² (*FLA, Nauni*).
- Out of 14 cultivars of daffodils only 11 cultivars flowered. Cultivar 'Lemon Beauty' was the earliest to flower and maximum flower diameter was observed in cv. 'Blues' (*FLA, Nauni*).



Ice King



Lemon Beauty



Blues



Mon Dragon

Newly introduced cultivars of daffodils

- Out of 8 liliun cultivars evaluated for growth and flowering parameters, cultivars; 'Red Alert' 'Pollyana' and 'Frans Hals' are found to be superior for producing more stem length and number of flower buds/plant (*FLA, Nauni*).



View of the experiment on liliun germplasm evaluation

- The growing media for Liliun LA hybrids, for obtaining earliest flowering, more number of flowers/spike, better stem length and vase life, growing of bulbs in a medium containing sand + soil + FYM (1:1:1, v/v) + (vermicompost + cocopeat) (2:1:1, v/v) was found most suitable. However, for bulb multiplication growing of bulbs in a medium containing sand + soil + FYM (1:1:1, v/v) is most suitable (*FLA, Nauni*).
- Standardization of growing medium for growth and flowering performance of alstroemeria cv. 'Capri', revealed that sand + soil + FYM (1:1:1;

v/v) + vermicompost + cocopeat (1:1:1; v/v) was found best for early bud formation, plant height, number of stems per plant, length of cut stem, number of days taken to flowering, number of flowering stems per plant,. However, vase life was recorded maximum in growing medium consisting of sand+ soil + FYM (1:1:1; v/v) + vermicompost + cocopeat (2:1:1; v/v). Growing media has also significant effect on rhizomes characters of alstroemeria. Growing media consisting of cocopeat + FYM (1:1), was found best for number of rhizomes developed/plant, weight of rhizomes cluster/plant and number of rhizomes portions with rhizomes tip and tuberous roots (*FLA, Nauni*).



Yellow Collection



Red Collection

- Standardization of irrigation and fertigation schedules for alstroemeria under three shade colour nets (blue, green and light green), 3 irrigation levels @ 100% , 80 and 60 evapotranspiration (ET) and 3 fertigation levels (100% recommended dose) of Water Soluble Fertilizers (WSF), 80% and 60% of RD) revealed that crop water requirement divided into initial, middle and late season based on crop coefficients and 100% ET_c came out to be 0.64, 0.89 and 1.1 l/plant, respectively (*SS&WM, Nauni*).



Alstroemeria crop under blue, and green shade net houses

- Testing of new genotypes of chrysanthemum revealed variable results with respect to different parameters such as number of flowers per plant and cultivar 'Arka Kirti ' was found superior whereas, maximum flower size was obtained in 'Arka Chandrika' (*FLA, Nauni*).

- In chrysanthemum, maximum plant height was noticed in cv. 'Yellow Star' (62.7 cm) and minimum in cv. 'Daily White' (25.8 cm). Plant spread was maximum in cv. 'DKC-Yellow' (37.2 cm) and minimum in cv. 'Pink Cloud'. Early flowering cultivar was 'Surf' (60 days) and cv. Yellow Giant was last to flower (95 days). Maximum number of flowers were found in DKC-Button Yellow (120). Largest flower size was observed in cv. 'Apricot Parasol' (11.5 cm) and smallest in cv. 'DKC-Button Yellow' (3.2 cm). Longest flowering duration was found in cv. 'Thaiching Queen' (43 days), whereas minimum in cv. 'Pusa Centennary' (25 days) (*RHR&TS, Dhaulakuan*).
- Out of all the cultivars under evaluation, only cv. 'Pusa Anmol' flowered twice in a year on the same plants (Nov end-January mid and May 1st week-June mid). Same plants of chrysanthemum (Pusa Anmol) after taking first flush of peak flowering during Dec-Jan and cutting back in February, 2017 performed better w.r.t. growth and flowering characteristics during May-June under low hill conditions of HP (*RHR&TS, Dhaulakuan*).



All cultivars in full bloom in Nov-Dec

'Pusa Anmol' in bloom again in May-June

- The data collected on various growth, flowering, seed yield and quality parameters of annual chrysanthemum (*Chrysanthemum coronarium* L.) showed maximum values for plant height (132.12 cm), plant spread (25.62 cm), number of flowers per plant (257.93), flower diameter (5.81 cm), number of branches per plant (26.41), number of seeds per flower head (234.41), seed yield per plant (9.19 g), seed yield per plot (82.63 g), 1000 seed weight (1.54 g), germination percentage (81.75 %) and seedling length (9.42 cm), seedling dry weight (7.31 mg), SVI-I (772.67), SVI-II (599.33), EC (48.24 μ S/cm) in $N_3K_3M_4$ i.e. when plants were fertilized with 40 g/m² N + 30g/m² K and planted in black plastic mulch (M_4). The application of N_3K_3 (40 g N + 30 g K/m²) recorded maximum for plant height (136.37 cm), plant spread (34.35 cm), number of flowers per plant (264.38), flower diameter (5.59 cm), number of branches per plant (31.77), number of seeds per flower head (240.35), seed yield per plant (9.78 g), seed yield per plot (88.09 g), 1000 seed weight (1.57 g), germination percentage (85.68 %) and seedling length (10.30 cm), seedling dry weight (7.56 mg), SVI-I (882.88), SVI-II (648.15), EC (35.30 μ S/cm). the interaction of $M_4 \times N_3K_3$ (black plastic mulch + application of (40 g N + 30 g K/m²) recorded maximum value in terms of various growth, flowering and seed quality parameters of commercial importance (*SS&T, Nauni*).
- In African marigold seed crop, maximum plant height (116.67 cm), number of flowers per plant (58.33 cm), number of seeds per capitulum (212.44), seed yield per flower (0.99 g) and 1000 seed weight (3.14 g) was observed in M_3G_3 i.e. when plants are applied with silver mulch (M_3) and GA_3 application @ 100 ppm (G_3) and planting was done in first week of July (*SS&T, Nauni*).
- Four newly evolved genotypes of marigold were evaluated for their growth and flowering performance. Among these, maximum yield was produced by 'Arka Agni' which was found to be at par with 'Arka Alankara' and 'Arka Bangara', whereas largest flower diameter was recorded in 'Arka Alankara' (*FLA, Nauni*).
- Seed propagation studies were conducting in *Sophora mollis* (Royle) Baker, a rare ornamental shrub of western Himalayas. Seeds were sown in different media namely; sand, cocopeat + sand (1:1), vermiculite + sand (1:1) during March, 2017 in mist chamber. It was found that seeds were early to germinate with highest per cent germination, maximum root and shoot length, no. of roots and leaves in media vermiculite + sand (1:1) (*RHR&TS, Dhaulakuan*).
- In sweet William, maximum plant spread (39.17 cm), number of flowers per plant (106.11), size of flower (1.86 cm), number of pods per plant (67.84), number of seeds per pod (44.90), seed yield per plant (4.57 g), 1000 seed weight (0.98 g), germination percentage (89.67%), seedling



length (7.45cm) dry weight (4.81mg), SVI-I (669.30) and SVI-II (432.57) were obtained in wider spacing of 30x30 cm. Whereas number of flowers per plot (2600), seed yield per plot (106.06 g), plant height (40.07 cm) was obtained with closest spacing of 20x20 cm. Regarding the effect of GA₃ application @ 100 ppm, resulted in maximum plant height(41.50 cm), plant spread (32.76 cm) number of flowers per plant (95.75), number of flowers per plot (2328.75), size of flower (1.83 cm), number of pods per plant (62.67) number of seeds per pod (44.90), seed yield per plant (4.08 g), 1000 seed weight (0.96 g), germination percentage (88.88%), seedling length (7.11 cm), dry weight (4.68 mg), SVI-I (633.86) and SVI-II(416.96) (*SS&T, Nauni*).

- ❑ Twelve cultivars of China aster were evaluated for growth and flowering performance. Among these, 'Local White' recorded maximum loose flower yield and maximum shelf life. For cut flower production, vase life was found maximum in cv. 'Arka Purnima' (*FLA, Nauni*).
- ❑ The holding solution comprising of sucrose 2% + NaOCl (25 ppm) improved the postharvest parameters such as amount of holding solution consumed (59.08 ml), appearance of cut bloom (4.56), flower diameter (13.21 cm), vase life (9.25 days) and minimum weight change (13.64%) of the cut stems of dahlia (*FLA, Nauni*).
- ❑ Pulsing solution comprising of sucrose 10% + 8-HQC (400 ppm) + BA (50 ppm) for 16 hours improved the postharvest parameters such as amount of pulsing solution consumed (11.56 ml), amount of vase solution consumed (44.37 ml), appearance of cut bloom (4.72), flower diameter

(12.75 cm), vase life (8.70 days) and minimum weight change (6.01%) of the cut stems (*FLA, Nauni*).

- ❑ In post harvest studies, effect of ethylene inhibitors for prolonging keeping quality of cut stems of five carnation cvs. was studied. Maximum vase life (12.34 days) and other parameters were recorded when cut stems harvested at paint brush stage were pulsed in a solution of AOA (50 ppm) for 30 minutes (*FLA, Nauni*).
- ❑ Studies on storage of pulsing and holding solutions revealed that these can be stored under ambient as well as refrigerated conditions for 14 months. These solutions can be packed in small packets and marketed for consumer use (*FLA, Nauni*).
- ❑ Various types of native and cultivated crops/ornamental plants were explored for preparation of different value added products. (*FLA, Nauni*).



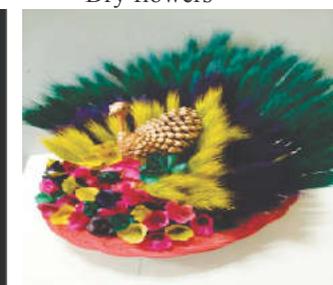
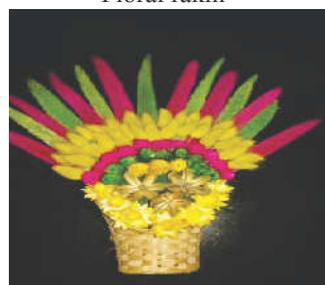
Greeting cards



Floral rakhi



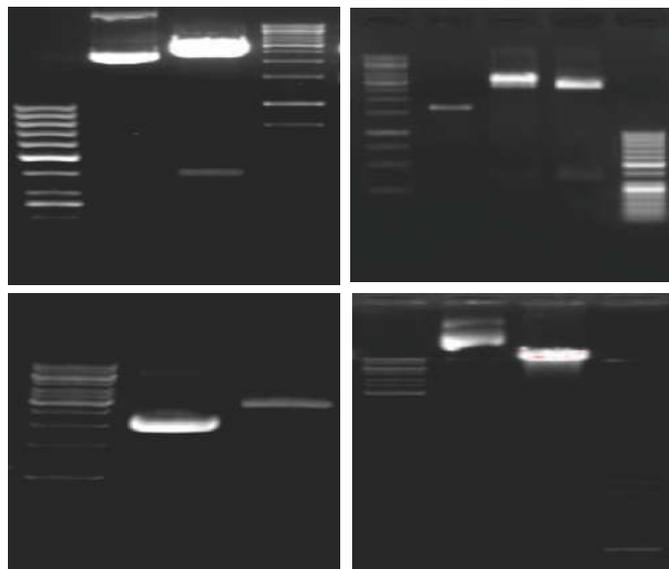
Dry flowers



Dry flower arrangements

Value added product prepared from dry flowers

- ❑ Aesthetic plant parts of *Agave americana*, *Chukrasia tabularis*, *Helichrysum bracteatum*, *Ornitogalum thyrsoides*, *Pinus walliciana*, *Pinus roxburgii*, *Lagerstroemia torelli*, *Cassia alata*, *Mitragynae* sp., *Terminalia* sp., black bamboos, wheat spikes, barley sticks, were collected from lower and mid hill areas of Himachal Pradesh and Uttarakhand during 2016-17. Value added products like dry floral arrangements, greeting cards, pot pourries, dry floral drift woods were prepared by air drying, press drying methods and dyeing with acrylic paints, and chemical dyes etc (*RHR&TS, Dhaulakuan*).
- ❑ In carnation 22 novel mutants with different flower colours having significant variation over parents. These mutants can further be released as new indigenous varieties. These new varieties can be further registered and propagation rights could be claimed. In the first phase, molecular characterization of 8 mutants along with parents have been done which revealed that mutants are genetically different from parents (*FLA, Nauni*).
- ❑ Lusture (carbendazim 25% + flusilazole 12.5%) 37.5SE was evaluated against *Marssonina coronaria* (Marssonina blotch) and found most effective to control (78.9%) the disease at 0.04% concentration (*RHR&TS, Mashobra*).
- ❑ Partial sequences of HSP90 and calmodulin genes isolated from fungus *Marssonina coronaria* and confirmed after cloning and sequencing experiments. Sense strand of the target sequence HSP90 and calmadulin genes amplified and cloned in pGEM-T Easy vector, as a part of making a gene construct for RNAi. Bioassay of Marssonina blotch on apple varieties standardized (*BT, Nauni*).



Scar marker development for fungal resistance in apple

Plant Protection

- ❑ Survey on suppressive soils was conducted in apple orchards and high frequency of occurrence of microbial population of fungal isolates like *Cladosporium* sp., *T. harzianum*, *T. hamatum*, *T. viride*, *T. polysporum*, *Bacillus* sp., *Pseudomonas* sp. was recorded. Soil application of formulation comprising of *T. harzianum*, *T. viride* and *Pseudomonas* sp. in pots resulted in 43 to 50 per cent reduction in root rot in apple seedlings (*PP, Nauni*).
- ❑ Two sprays of Nativo 75 WG (trifloxystrobin 25% + tebuconazole 50% WG) (0.04%) at petal fall and walnut stage of the fruit provided effective control of *Marssonina* blotch, scab and powdery mildew diseases of apple (*PP, Nauni*).
- ❑ Custodia (azoxistrobin 11% + tebuconazole 18.3%) SC formulation was evaluated against powdery mildew disease (*Podosphaera leucotricha*) and *Marssonina* blotch (*Marssonina coronaria*) of apple on Royal Delicious variety and provided 81.37 and 70.68% control, respectively at 0.1% concentration (*RHR&TS, Mashobra*).
- ❑ Two sprays of Capgold (captan 50WP) (0.3%) (green tip stage and 20-25 days before harvest); one spray of Hexcone (hexaconazole 5%WP) (0.05%) (petal fall/ pea size fruit stage) and one spray of Diozole (difenoconazole 5%WP) (0.015%) (pink bud stage) provided effective control of apple scab in the multi-location trials (*PP, Nauni*).
- ❑ Bioefficacy and phytotoxicity studies of different fungicides on apple diseases revealed that custodia (2ml/l) was most effective and resulted in 3.30 per cent apple scab severity as compared to 76.81 per cent severity in control followed by custodia (1.5ml/l) whereas custodia (1ml/l) was next best in order while Sulphur (4g/l) was least effective. Similarly fruit yield was highest in

custodia treatment. Custodia was quite effective in controlling apple powdery mildew as compared to unsprayed treatment. Custodia (0.5%) resulted in minimum disease severity of 3.12 per cent followed by Custodia (0.3%) which was significantly superior from other treatments and statistically at par with each other. These were followed by tebuconazole (0.05%) and custodia (0.25%) with a disease severity of 5.53 and 6.32 per cent severity, respectively. However, custodia (0.2%) were also effective in reducing powdery mildew severity in apple with severity of 10.28 per cent (*RHR&TS and KVK, Sharbo*).

- Proquinazid was found quite effective in controlling apple powdery mildew in comparison to unsprayed treatment. Proquinazid (8ml/10L) resulted in minimum disease severity of 2.72 per cent followed by Proquinazid (4.0ml/10L) which was significantly superior from other treatments and statistically at par with each other. These were followed by Proquinazid (2.5 and 2.0 ml/10L respectively) with a disease severity of 8.78 and 12.42 per cent severity respectively. Ergon (2 ml/L) resulted in minimum disease severity of 3.02 per cent followed by Ergon (1.0 ml/L) with disease severity of 5.27 per cent respectively, which was significantly superior from other treatments and statistically at par with each other. These were followed by Ergon (0.5%) and Ergon (0.4%) while, hexaconazole (0.05%) which were also effective in reducing disease severity of 10.28 per cent. Maximum fruit yield (65.29 kg) was recorded in ergon (2 ml/L) which was statistically superior to other treatments (*RHR&TS and KVK, Sharbo*).
- Under chemical testing, 13 brand name fungicides were evaluated against apple powdery mildew (*Podosphaera leucotricha*) out of which proquinazid @ 0.025%, Custodia (Azoxystrobin 11% + tebuconazole 18.3% SC) @ 0.15%, Rubigan D @ 0.03% and hexaconazole @ 0.05% were found as effective fungicides (*RHR&TS, Bajaura*).
- Maccani (1g/L) was quite effective in controlling apple scab (4.96%) in comparison to unsprayed treatment followed by Maccani (0.8 & 0.6 g/l) which resulted only 6.22 and 7.40 per cent disease severity than control (43.68%). However,

propineb (0.3 g/l) was next best in order exhibiting 8.55 per cent disease severity. Similarly, Lustre (0.03%) was also quite effective in controlling premature leaf fall (11.72%) in comparison to unsprayed treatment followed by Lustre (0.022 & 0.015 %) which resulted only 13.29 and 14.69 per cent disease severity than control (72.42%). However, carbendazim (0.0125%) was next best in order exhibiting 14.74 per cent disease severity. Maximum fruit yield was also recorded in Lustre (0.03%) which was statistically superior to other treatments followed by Lustre (0.022%). It was also quite effective in controlling Alternaria leaf spot (7.98%) in comparison to unsprayed treatment followed by Lustre (0.022 & 0.015%) which resulted only 8.70 and 13.47 per cent disease severity than control (49.64%). However, flusilazole and hexaconazole were next best in order exhibiting 8.77 and 8.81 per cent disease severity. Maximum fruit yield (48.39 kg) was recorded in Lustre (0.03%) which was statistically superior to other treatments followed by Lustre (0.022%) with fruit yield of 34.37 kg (*RHR&TS and KVK, Sharbo*).

- Among 29 fungicides tested against apple scab , Custodia (azoxystrobin 11% + Tebuconazole 18.3% SC) @ 0.15%, Rubigan D @ 0.03%, tebuconazole @ 0.15%, Taqat @ 0.1%, Score @ 0.015%, MACT-01 @ 0.03%, Dizole @ 0.015%, Karara @ 0.015% and Krizole @ 0.015% were found as highly effective (*RHR&TS, Bajaura*).
- Taqat (1.0%) was quite effective in controlling premature leaf fall in apple (7.51%) in comparison to unsprayed treatment followed by Taqat (0.75% and 0.5%) with 9.33 and 13.55 per cent severity. Mancozeb (0.3%) provided next best control with 13.92 per cent severity. Maximum fruit yield (52.01 kg) was recorded in Taqat (1.0%) which was statistically superior to other treatments followed by Taqat (0.75%) with fruit yield of 38.40 kg. It was also quite effective in controlling Alternaria leaf spot in apple (6.12%) in comparison to unsprayed treatment followed by Taqat (0.75% and 0.5%) with 9.28 and 13.37 per cent severity. Hexaconazole (0.5%) provided next best control with 13.58 per cent severity. Maximum fruit yield (51.55 kg) was recorded in Taqat (1.0%) which was statistically

- superior to other treatments followed by Taqat (0.75%) with fruit yield of 43.33 kg (*RHR&TS and KVK, Sharbo*).
- ❑ One spray of Riva (copper oxychloride) @ 0.3% after fruit harvest provided effective control of pink canker of apple at all the test locations (*PP, Nauni*).
 - ❑ One spray of Goldstin (carbendazim 50% WP) @ 0.05% at petal fall- pea size stage, two sprays of Gold M-45 (mancozeb 75% WP) @ 0.30% at pink bud and walnut size of the fruit stage and two sprays of Trust (thiophanate M) @ 0.05% at petal fall and pea size stage of the fruit provided effective control of premature leaf fall at all the test locations (*PP, Nauni*).
 - ❑ Taqat 75 WP (Captan 70% + hexaconazole 5%) has been found effective in providing disease control against *Alternaria* leaf spots (74.11%) and *Marssonina* blotch (72.38%) at 0.1% concentration (*RHR&TS, Mashobra*).
 - ❑ Out of 11 fungicides, Ergon @ 0.05, hexaconazole @ 0.05% and Lustre @ 0.03% were found highly effective against *Alternaria* blotch (*A. alternata/mali*) (*RHR&TS, Bajaura*).
 - ❑ Out of 23 fungicides evaluated against premature leaf fall (*Marssonina coronaria*), Custodia (azoxystrobin 11% + tebuconazole 18.3% SC) @ 0.15% and tebuconazole @ 0.15% were highly effective (*RHR&TS, Bajaura*).
 - ❑ Papery bark canker was recorded attacking different cultivars of apple being grown at the station farm and spray solution with copper oxychloride (3mg/litre) and in severe cases Bordeaux mixture sprays were given to curb the incidence of canker (*RHRSS and KVK, Tabo*).
 - ❑ Die back and canker observed on the almond trees and *Chaubatia* paste was applied after proper removal of the dead or diseased part of the tree (*RHRSS and KVK, Tabo*).
 - ❑ *Phytopythium*- a newly generated genus has been found to cause check in some locations in Himachal Pradesh. Protective sprays of mancozeb (0.3%) or Ridomil Gold (0.25%) or Curzate M-8 (0.25%) at 3 weeks interval along with application of straw mulch and staking were found effective for the management of the disease (*PP, Nauni*).
 - ❑ Previously, MM106 tolerant shoots were developed on 70 and 72% FCF (Fungal Culture Filtrate) of collar rot pathogen *Phytophthora cactorum*. Multiplication of these tolerant shoots were carried out. Along with, more number of shoots were cultured in selective medium to get more tolerant shoots and to check the reproducibility of our previous standardized protocol. Roots of tolerant/selected regenerants were induced by culturing the shoots in rooting medium. 1.5g/l activated charcoal was found effective to inhibit callus formation. After a month, 66% rooting and good root system was observed. After developing the root system *in vitro*, rooted plantlets of unselected and tolerant were transferred to peat pots. 50% survival rate was found. During hardening, frequent wilting was observed in decreased humidity which resulted in death of new leaves and also affected the survival and growth of plants. The hardened plants were transferred to the pots with soil containing potting mixture (*BT, Nauni*).



Hardened plants of MM106 tolerant to collar rot

- ❑ Spray schedule comprising of spray of copper oxychloride (0.2%) followed by Streptocycline (0.05%) and Bronopol (0.05%) on single stem system of training was found effective with 65.8 per cent reduction in bacterial blight of pomegranate disease index (*PP, Nauni*).
- ❑ The bio-efficacy testing of six fungicides/bactericides against diseases of pomegranate



- (Bacterial blight, Alternaria blotch and Anthracnose) revealed that the combi treatment of copper oxychloride (0.25%) + streptomycin (0.03%) and Conika 50%WP (Kasugamycin 5% + copper oxychloride 45%) @ 0.3% were highly effective against bacterial blight disease (*Xanthomonas axonopodis* pv *punicae*) and Kitazin @ 0.1% against anthracnose disease under field conditions (*RHR&TS, Bajaura*).
- ❑ Two sprays of Salicylic acid (systemic acquired resistance inducing chemical) @ 0.075 per cent at 10 days interval were found effective for the management of mango anthracnose disease caused by *Colletotrichum gloeosporioides* (*PP, Nauni*).
 - ❑ Green synthesis of silver nano-particles has been done from plant species namely tulsi (*Ocimum sanctum*), neem (*Azadirachta indica*), garlic (*Allium cepa*), safeda (*Eucalyptus* sp.) and Euphorbia (*Euphorbia* sp.), which were found effective against post-harvest pathogen of citrus (*Penicillium digitatum*) (*PP, Nauni*).
 - ❑ Botrytis grey mould rot caused by *Botrytis cinerea* was found to be a serious problem of strawberry in Dhaulakuan area of district Sirmaur with incidence ranging from 6.0 to 24.0 per cent on the fruits. The fungus was also found causing leaf spots in strawberry. In addition, incidence of leaf spotting fungi namely *Pestalotia* sp. and *Phomopsis* sp. was also recorded to affect the foliage seriously (*PP, Nauni*).
 - ❑ Talc based formulation of *Agrobacterium radiobacter* strain UHFBA-218 (0.1%) applied as root dip treatment (30 min.) on peach seedlings was found effective for the management of crown gall (*PP, Nauni*).
 - ❑ Leaf and bark samples from stone fruits (peach, plum, apricot and cherry) showing visible symptoms of PNRSV were indexed through DAS- ELISA to establish the host range of PNRSV. DAS- ELISA results have been able to establish the host range of PNRSV in these stone fruits as the leaf and bark samples drawn from the infected plants tested positive in DAS- ELISA. However, samples from almond did not react positively with antiserum against PNRSV (*PP, Nauni*).
 - ❑ Effect of soil application of three arbuscular mycorrhizal (AM) fungal consortia and Phosphorus (P) doses was observed on seed crop production in tomato cv. Solan Lalima. The higher plant growth, fruit yield, seed yield and lower incidence of diseases viz, Fusarium wilt and Alternaria blight were observed upon application of AMF isolate-3 plus recommended dose of P. It was followed by the treatment of AMF isolate-2 plus recommended dose of P. The AMF isolate-3 increased all the plant growth characters and reduced disease incidence significantly. This AMF isolate also resulted in increased plant growth, fruit yield, seed yield and reduced the disease incidence even when applied with half of recommended dose of P than the non mycorrhizal plants applied with full dose of P. Hence 50 per cent dose of P fertilizers can be saved upon inoculation of AMF isolate-3 to tomato at the time of seed sowing and transplanting (*SS&T, Nauni*).
 - ❑ The usage of integrated management module involving the use of *Trichoderma viride* for tomato seed treatment (4g/kg) and soil application 10g/kg during nursery raising in combination with periodic sprays (6 no.) started after 25 days of transplanting at 10 days interval with Fipronil 5% SC @ 1.5 ml/l + copper hydroxide 77% WP (2.0g/l) rotated with imidacloprid 70% WG @ 2g/15 l + fenamidone 10% + mancozeb 50% WDG (0.25%) proved most effective in limiting all the diseases like early blight (11.60), buckeye rot (8.47), bacterial leaf spot (6.40), bacterial canker(3.60) and leaf curl (3.80) and provided highest fruit yield (390.7 q/ha) (*VS, Nauni*).
 - ❑ Seedling dip (45 minutes) and two sprays of systemic acquired resistance inducing chemicals (SARs) namely Acibenzolar-S-methyl (0.002%) followed by DL- β -amino-n-butyric acid (BABA) (0.01%) and salicylic acid (0.002%) after 35 days of transplanting were effective in managing foliar diseases namely Phytophthora leaf blight and fruit rot of capsicum and *Fusarium* wilt. Root dip in SAR chemicals were found more effective than usually drenching with the carbendazim (0.2%) for the management of *Fusarium* wilt in capsicum (*PP, Nauni*).

- ❑ Soil drenching of carbendazim (0.2%), carbendazim + mancozeb (0.25%) and tebuconazole + trifloxystrobin (0.1%) were also found effective in reducing the incidence of Fusarium wilt and increasing the fruit yield in capsicum (*PP, Nauni*).
- ❑ Sprays of proquinazid 20 EC @ 40 and 50 g a.i./ha dose at 15 days interval were found highly effective and superior over other treatments for the management of powdery mildew of pea as compared to control with 85.17 and 89.28 per cent reduction in disease severity, respectively (*PP, Nauni*).
- ❑ Sprays of Metiram + Pyraclostrobin (@ 0.1%) and Famoxadone + cymoxanil (@ 0.1%) were found effective in reducing the severity of Phytophthora leaf blight and fruit rot of capsicum (*PP, Nauni*).
- ❑ Nano-particles of CoFeO and NiFeO at 400 ppm concentration were very effective in reducing the Fusarium wilt of capsicum and gave hundred per cent disease reduction (*PP, Nauni*).
- ❑ Typical ring spot symptoms on leaves of bell pepper and development of red spots on fruits have been observed in crops mainly raised under protected structures. Molecular detection studies were conducted to identify of causal virus infecting bell pepper. BLASTn analysis of sequence of complete nucleocapsid gene showed 99 per cent nucleotide similarity with *Capsicum Chlorosis virus* (genus *Tospovirus*, family Bunyviridae) CaCV isolate from tomato (Accession No. EU216023) and phylogenetic studies revealed that isolate under study shared common ancestry with CaCV isolate from *Amaranthus* species (HG917416) (*PP, Nauni*).
- ❑ Polyhouse soil become sick due to perpetuation of the pathogens by continuous growing of the same crops consecutively for various years. Capsicum (Nun 3020, Mekon) and parthenocarpic cucumber (Kian) were grown under polyhouse conditions during September-February months after giving soil treatments viz. fumigation with formalin + *Trichoderma harzianum*, soil solarization + *Trichoderma harzianum*, hydrogen peroxide + *Trichoderma harzianum* in already constructed poly structures. On the basis of one year study, it was noticed that formalin +

Trichoderma harzianum treatment was found best followed by Hydrogen peroxide + *Trichoderma harzianum* in both the crops (*RHR&TS, Jachh*).



Capsicum and cucumber in polyhouse after treating soil with Formalin + *T. harzianum*

- ❑ The effect of hot water seed treatment of capsicum with three temperature ranges (47-49°C, 50-52°C and 53-55°C) and three time duration (30 min, 45 min and 60 min) was observed on seedling growth parameters like total emergence, seedling height, seedling dry weight, seed vigor index-I, seed vigor index-II and disease incidence in bell pepper cv. Solan Bharpur under nursery as well as field conditions. The seeds treated with hot water at temperature range of (50-52) °C for 30 min. showed maximum seedling emergence (87.78%), seedling height, seedling dry weight, seed vigor index-I and seed vigor index-II and lower incidence of damping off and viruses as compared to untreated control. Under field conditions the hot water treated seed at temperature (50-52) °C for 30 minutes attained better plant height, fruit weight, number of fruit/plant, fruit yield/plant as compared to untreated and control and other treatments. The incidence of various diseases like anthracnose, cercospora leaf spot and viruses was significantly less as compared to control plots (*SS&T, Nauni*).
- ❑ The results of management of diseases of capsicum in polyhouse revealed that the use of *Trichoderma viride* @5g/kg seed and incorporation of FYM mixed neem cake @ 1kg/10 m² *Trichoderma viride* @ 2.5g/10 m² at the time of bed preparation followed by the six periodic spray with Bordeaux mixture @0.8% at 15 days interval beginning from 30 days after transplanting proved most cost effective in limiting all diseases like collar rot/root rot (3.10), powdery mildew (15.30), YLCV (12.50) and provided significantly high (660.7 q/ha) fruit yield of colored capsicum under poly house conditions (*VS, Nauni*).

- ❑ For integrated management of vector borne virus diseases of chilli, use of maize as border crop and reflecting mulches in combination with periodic sprays (5 no.) of neem oil @ 2ml/L with different insecticides viz; Acephate @ 1.5ml/L, Fipronil @ 1.0ml/L, Imidacloprid @ 0.5ml/L and Cyzper @ 1.8ml/L in rotation at 10 days interval started after 28 days of transplanting was found promising against the leaf curl of chilli and increased green chilli yield (124.7 q/ha) (*VS, Nauni*).
- ❑ Average incidence and severity of grey mould of gladiolus was observed in different parts of Himachal Pradesh which ranged from 14.8 to 64.9 per cent in different locations of Solan, Shimla, Kullu, Sirmour, Mandi and Bilaspur districts of H.P (*PP, Nauni*).
- ❑ Surveys conducted during cropping season of 2016 in 24 locations of Solan and Sirmour districts of Himachal Pradesh growing chrysanthemum revealed viral incidence ranging between 5.33 to 54.48 per cent. The characteristic symptoms exhibited by present isolate were severe mosaic, vein clearing, vein banding to mild mosaic on leaves along with stunted growth of plants. The strongest reaction to *Chrysanthemum virus B* antibody was shown by C₂ isolate from Khundidhar in DAS-ELISA tests. Serological detection of *Chrysanthemum virus B* in different chrysanthemum cultivars indicated that cultivar Ajay showing characteristic symptoms of severe mosaic and vein banding resulted in highest O.D. value followed by Purnima. Hence, based on the results of identification parameters particularly host range, transmission and serological detection; the present virus isolate had been identified to be *Chrysanthemum virus B* (*PP, Nauni*).
- ❑ Treatment comprising of soil solarisation with transparent polyethylene mulch followed by sowing of crops establishing vesicular-arbuscular fungi like methi (*Trigonella* sp.) and green gram (*Vigna radiata*), 50 to 60 days before transplanting and application of *Trichoderma viride* formulation or neem cake or neem granules was found effective for the management of Rhizoctonia stem rot of chrysanthemum. The treatment also resulted in higher growth of the plants with higher number of quality flower yield (*PP, Nauni*).
- ❑ Molecular characterization of *Botrytis cinerea* isolates was done using 16 ISSR primers, all primers amplified except two ISSR-2 and ISSR-16 with a total of 143 bands amplified, out of which 28 bands were unique showing DNA polymorphism among the isolates collected from Himachal Pradesh (*PP, Nauni*).
- ❑ Fungicide SAAF® was evaluated for its bio-efficacy against anthracnose, preharvest drop and sooty mould of Mandarin. Out of three diseases under test, only one disease i.e. sooty mould appeared in the orchard. SAAF at all concentrations could manage the disease. Among the three concentrations, maximum disease control (67.72%) was recorded in the trees sprayed with SAAF @ 0.18%, followed by at 0.15 and 0.12% (*COH&F, Neri*).
- ❑ Among five strains of *Agaricus bisporus* viz. AVT-16-01 to AVT-16-05 evaluated on short method of composting, strain AVT-16-03 recorded a highest yield of 21.5 Kg/ 100 kg compost (*PP, Nauni*).
- ❑ New wild edible mushrooms have been collected from different localities of Himachal Pradesh and accession no. DMRO-899 and DMRO-900 have been allotted by Directorate of Mushroom Research, Chambaghat, Solan (*PP, Nauni*).



Wild mushroom DMRO-899 and DMRO-900



Shiitake mushrooms on saw dust

- ❑ Shiitake (*Lentinula edodes*) is one of the prized mushrooms and production technology is standardized for the same. Among different strains of shiitake evaluated at Nauni, strain OE-388 was found to be the best with biological efficiency of 35% on saw dust substrate (*PP, Nauni*).
- ❑ It was also successfully cultivated on saw dust amended with wheat bran under sub tropical conditions (*Nauni and COH&F, Neri*).
- ❑ A production technology was devised for the cultivation of oyster mushroom under dry temperate zone of the state by using local flora (Fungma and Poplar) during the most suitable time of the year. Among the different locally available substrates tested for oyster mushroom cultivation under natural hut conditions in Neri, saw dust proved best next to standard check wheat straw exhibiting 60.00 per cent biological efficiency as compared to 77.5 per cent in wheat straw (*COH&F, Neri*).



Substrate preparation of oyster mushroom and cultivation by the farmer

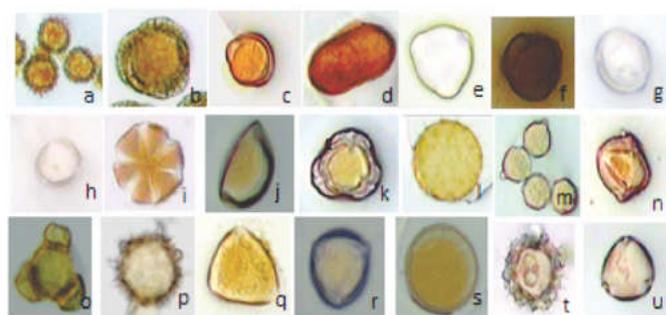
- ❑ Microbial contaminants adversely affect the quality of the spawn and fungi like *Fusarium chlamydosporum*, *Phoma exigua*, *Aspergillus Niger*, *Penicillium chrysogenum*, *Aspergillus fumigatus* and *Fusarium pallidroseum* were the major fungal contaminants isolated from *Agaricus bisporus* spawn (*PP, Nauni*).
- ❑ Out of thirty silver nanoparticles synthesizing bacterial isolates, four bacterial isolates exhibiting maximum silver nanoparticles synthesizing activity were characterized at molecular level. *Bacillus sralis* strain UMBS1.1 was selected for *in vitro* biosynthesis of silver nanoparticles, which were characterized using UV-visible spectroscopy, Fourier transform infrared spectroscopy (FTIR), X-rays diffractions (XRD), Scanning Electron Microscopy (SEM)

and Dynamic Light Scattering (DLS). Silver nanoparticles and bacterial culture preparation could degrade textile dyes, had antifungal activity against fungal plant pathogens and antibacterial activity against bacterial plant pathogens. They could also degrade Chlorophyris (*BT, Nauni*).



Change of colour in solution and SEM images of silver nanoparticles

- ❑ Isolation and screening of chitinase producing microbes from soil samples of apple orchards of Kinnaur by plate assay method was conducted and out of 21 chitinase producing bacterial isolates, seven were found to produce extracellular chitinase. All of them were gram positive (*BT, Nauni*).
- ❑ Palynological studies carried out to examine bumble bee (*Bombus haemorrhoidalis*) flora of Nauni area revealed the presence of total 68 pollen types. These pollen types belonged to 27 families with Asteraceae (9) and Fabaceae (9) as dominant followed by Solanaceae (8) and Lamiaceae (7) (*Ento, Nauni*).



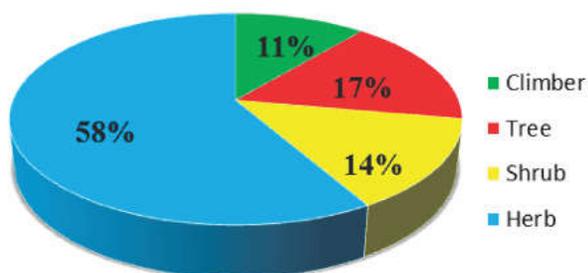
Photomicrographs of pollen grains of principal forage plants of *Bombus haemorrhoidalis*.

a. *Zinnia elegans* b. *Peltophorum ferrugineum* c. *Moluccella laevis* d. *Justicia adhatoda* e. *Lupinus hartwegii* f. *Actinidia deliciosa* g. *Digitalis lanata* h. *Digitalis purpurea* i. *Salvia moorcroftiana* j. *Agapanthus umbellatus* k. *Capsicum annum var grossum* l. *Hibiscus syriacus* m. *Solanum lycopersicum* n. *Solanum melongena* o. *Oenothera biennis* p. *Dahlia pinnata* q. *Clitoria ternatea* r. *Cassia sophora* s. *Martynia annua* t. *Dahlia imperialis* u. *Cassia fistula*

- Forty three plant species belonging to 21 families regularly visited by bumble bee for nectar and/or pollen. Among these, maximum number of plant species were of family Fabaceae (6) followed by Solanaceae (5), Lamiaceae (5) and Asteraceae (4). Of these plants 33 provided both nectar and pollen, 3 only nectar and 7 provided only pollen. Twenty two plant species belonged to 13 families were recorded as minor flora. Out of which 14 provided pollen and nectar, 6 nectar and 2 pollen only (*Ento, Nauni*).

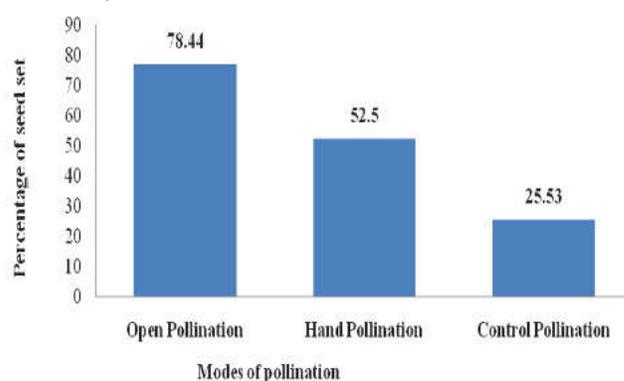
*Zinnia elegans**Agapanthus umbellatus**Tecoma grandiflora**Digitalis purpurea*

- Palynological analysis of pollen loads from the Nauni area recorded, dominance of herbs (58%) with sparse distribution of tree species (17%), shrubs (14%) and climbers (11%) among the pollen plants (*Ento, Nauni*).



- Studies were carried out on flower biology and pollination of mustard (*Brassica juncea* L). The flower bud took 10 to 15 days to pass from first stage of flower formation to full bloom. A single flower remained open for 3-7 days. The flowering period was 38 ± 2 days. The average length of sepal was 0.53 cm and that of petal 0.74 cm. The average length of stamens was 0.7 cm and 6 in

number/flower. The anthesis starts at 0800 hrs and continued till 1800h. Maximum anthesis was recorded between 1000 to 1200h. Stigma was found to be receptive upto 3 days after anthesis. The insect visitors collected by different sampling methods showed that mustard crop was visited by 85 insects belonging to 60 genera under 27 families and 8 orders. Highest seed set was obtained by open pollination which gave 78.44 percent seed set followed by hand pollination (52.50%). The minimum seed set (25.53%) was observed in case of controlled pollination (*Ento, Nauni*).



Effect of different modes of pollination on seed set



1. Pollinator's Exclusion



2. Open pollination



Pollination



Bagging after pollination

3. Hand pollination

- Six treatments viz., T1 (control), T2 (2.5g/L of Bt varkurstaki 0.5% WP), T3 (5g/L Bt varkurstaki 0.5% WP), T4 (8g/L Bt varkurstaki 0.5% WP), T5 (delta trap/*dorsata* trap), and T6 Wax moth trap (fermentation mixture consisting of a cup of water + a cup of sugar + half cup vinegar + one peeled banana) were evaluated for the management of

wax moth in *Apis cerana* under field and laboratory conditions. The desired concentrations of Bt varkurstaki 0.5% WP for the treatments T2, T3 and T4 were prepared and used in three separate experiments (*Ento, Nauni*).



Larva of wax moth

Bt spray on *Apis cerana* comb

Delta trap

- In experiment 1, where insecticide was sprayed on the drawn combs without *A. cerana* brood 10 and 20 % mortality of wax moth larvae was recorded at treatments T3 (5g/L of Bt varkurstaki 0.5% WP) and T4 (8g/L of Bt varkurstaki 0.5% WP), respectively. In experiment 2, where empty frames were dipped in treatment concentrations 20-30 % larval mortality was observed. In experiment 3, where insecticide was sprayed on the combs with *A. cerana* brood 56.00% mortality was recorded in treatment T4 (8g/L of Bt varkurstaki 0.5% WP). No adults catches were obtained in delta trap and wax moth trap. Hence, it

can be recommended that *Bacillus thuringiensis* varkurstaki 0.5% WP 8g/L of water is effective for management of wax moth at low larval population (*Ento, Nauni*).

- Studies were carried out on effect of neonicotinoids on colony performance of *Apis mellifera* L. in mustard. The data on mortality of honeybee was taken for 14 days after spraying the mustard crop at 50 % flowering with imidacloprid @ 0.2 ml/L and thiamethoxam @ 0.1 gm/L. The mortality of adult worker bees was found after 2 hours of spray in field as well as semi field condition. The mean mortality after 2 hours was found to be 424 in treated and 21 number in untreated (only water) semi-field condition and continued in the subsequent days, whereas, in case of field condition, the mean mortality was 103.5 in treatment and no mortality was found in the control. The mortality in field condition was decreased after 3 days of spray (means bees recovered from thiamethoxam poisoning). The mean forging time before spray was 19 flower/min, whereas, after spray of thiamethoxam it was found to be 4.66 flowers/min under semi-field condition. Under field condition, it was recorded 18.33 and 23.66, respectively. The mean foraging speed (time spent/flower) before spray was 3.10/second, whereas, after spray of thiamethoxam it was 1.66 flowers/second under semi-field condition and under field condition it was recorded 3.1 and 2.66, respectively. The brood area was completely perished after the spray of thiamethoxam under semi field condition, while in case of field condition brood area was successfully developed without any effect on development. The mean number of incoming bees before spray was 15.77 and after two hours of spray, it was 9.33/minute in case of thiamethoxam treatment under semi-field condition. Under field condition, it was observed to be 48.66 and 45.66, respectively. The mean number of outgoing bees before spray was 13.12 and after two hours of spray it was 9.16/minute was recorded in case of thiamethoxam treatment. Under semi-field condition and under field condition it was observed to be 50.33 and 51.33, respectively. No disease incidence was recorded under both conditions after the spray of thiamethoxam (*Ento, Nauni*).



Dead brood after spray of thiamethoxam



Dead adult bees after 24h of thiamethoxam spray

- The field trials against motile stages of European red mite in apple showed that combination of half concentration of recommended dose of acaricides with Horticultural Mineral Oil (HMO) (0.5 and 1.0%) was superior to individual acaricide and HMO spray and kept the mite population below economic threshold level up to 28 days. Among the combination treatments, fenpyroximate + Mak all season HMO (0.0025+0.5%) proved most effective with 1.33 motiles/leaf, followed by fenazaquin + Mak all season HMO (0.00125+0.5%) and spiromesifen + Mak all season HMO (0.0035+1.0%), recording mite population of 2.00 and 2.10 per leaf, respectively (RHR&TS, Mashobra).
- The studies on the effectiveness of Horticultural Mineral Oil under laboratory conditions established that Mak all season HMO at 2.0% concentration was highly effective against overwintering eggs of *P. ulmi* and the treatment close to egg hatching at pink bud stage seems to be the most appropriate stage. (87% control of winter eggs) (RHR&TS, Mashobra).



Winter eggs of European red mite on branch European mite infested leaves of apple



- New acaricide Etoxazole 10% SC @ 1 ml/2.5 L of water proved highly effective against European red mite and reduced mite population to 0.80/leaf after 28 days as against 17 mites/leaf in control treatments (RHR&TS, Mashobra).

- Infestation of European red mite, *Panonychus ulmi* and two spotted spider mite, *Tetranychus urticae* was observed during June-September with its peak activity from second week of May to mid of August (RHR&TS and KVK, Sharbo).
- New miticide Cyenopyrafen 30% EC at 0.06%, 0.075% and 0.09% was found effective against the phytophagous mites on apple for 28 days in comparison to the standard SIMBAA (0.057%) which was effective only for 14 days. It was found safe to the predatory mites was the standard SIMBAA (RHR&TS, Bajaura).
- New HMO's SERVO, BALMEROL BALSpray and VEEDOL SPRAY OIL at 1% conc. were found effective against the phytophagous mites on apple for 14 days. All the above tested HMO's recorded low to nil populations of predatory mites for 2 weeks. However, predatory mites appeared after two weeks of the spray (RHR&TS, Bajaura).
- For the management of apple root borer, *dorysthenes hugelii*, although chlorpyrifos (0.06%) was the most effective treatment resulting in 83.2% mortality of the root borer grubs, *Metarhizium anisopliae* was equally effective resulting in 68.3% mortality of the pest (Ento, Nauni).
- A field trial was laid out to test the efficacy of chlorpyrifos (Goldban 20EC) against woolly apple aphid (WAA) (*Eriosoma lanigerum*) on apple trees, during October-November. Among three treatments, chlorpyrifos @ 2.5 ml/L of water provided effective suppression of woolly apple aphid for 21 days after spray (RHR&TS, Mashobra).
- A new molecule thiamethoxam (Thomson 25WG) evaluated against WAA (*E. lanigerum*) on apple trees, indicated that thiamethoxam 1 g/L provided good control of woolly apple aphid (0.20 aphid colonies/twig) after 7 days as against 7.20 aphid colonies/twig in control (RHR&TS, Mashobra).
- The sticky bands have been used by most of the researchers only to monitor the movements of WAA. In this method the use of physical barriers i.e. sticky bands were advocated on the trunks of the plants having the aerial population. The method was found to kill woolly aphid by mass

trapping if installed on the trunks of apple tree on the onset of winters. The installation of sticky bands during this particular time prevents the downward moving population of WAA from entering the root zone, thus killing the insect either by the lack of feeding site or by the adverse conditions, where the temperature reached to the negatives of degree Celsius. The sticky monitoring bands of 10 cm width were installed 1 ft above the ground on infested apple tree trunk. Every fortnight the bands were replaced to make woolly apple aphid movement count as well the movement direction. Over the two working seasons from March to December for two consecutive years the population of insect was monitored. The aphid movement was noticed throughout the year in the above mentioned period and there were two major movements. First major movement was an upward during June and July where average 62.40 (site-1) and 88.72 (site-2) numbers of first instar nymphs were found to be trapped in per square cm area of band in 2015 (site-1) and 2016 (site-2) respectively. The second major movement was downward during the months of October where 330.9 and 264.18 number of first instar nymphs of WAA were found to be trapped during the year of 2015 and 2016, respectively. On site-1 where the application of sticky bands was done resulted in reduction of colony development for the year of 2016. During the year 2016 the maximum number of colonies per 10 cm length of the shoot was found reduced as compared to the control. Whereas few of the aphids which were present on the plants under band application having maximum colony size of 6.8 mm² as compared to 59.2 mm² in control indicating huge reduction in the aphid population (*RHR&TS and KVK, Sharbo*).



Installation of sticky band WAA trapped in sticky band

- Against greenhouse whitefly, the bio-pesticides viz. *Chrysoperla zastrowisillemi* (1 larva/plant), *Lecanicillium lecanii* (5 g/L of 10⁸ conidia/g) and azadirachtin (1500 ppm; 3 ml/L) were moderately and statistically equally effective resulting in 50.9-54.3% reduction in the whitefly population over control as compared to imidacloprid (0.0075%) which reduced the population by 94.1% over control (*Ento, Nauni*).
- Among bio-agents/biopesticides, *Neoseiulus longispinosus* (10 mite/plant) and azadirachtin (1500 ppm; 3ml/L) were the effective treatments for the control of *Tetranychus urticae* in tomato resulting in 60.3 and 51.2% reduction in the mite population over control. Both these treatments, however, were significantly less effective than fenazaquin (0.0025%) which caused 91.1% mortality over control (*Ento, Nauni*).
- A survey for occurrence and incidence of the American pin worm, *Tuta absoluta* revealed that the presence of pest in almost all the tomato growing mid-hills of Himachal Pradesh. At these locations 42-89% of the tomato plants were infested with *T. absoluta* with the number of mines/leaf/infested plant varying from 1-11 and fruit damage varying from 0-6% at different locations. The severity of the pest was more on tomato than on brinjal and potato (*Ento, Nauni*).
- Under polyhouse conditions 78-100% tomato plants were infested with the pest resulting upto 100% crop loss in one of the polyhouses. In brinjal and potato 84 and 92% plants contained leaf mines with their density varying from 6-16 and 3-8, respectively. Survey study revealed that the pest is more severe under polyhouse conditions than in open field and prefers tomato over other host plants (*Ento, Nauni*).
- During the survey, a mirid predatory bug, *Nesidiocoris tenuis* was recorded preying on eggs and early instars of the leafminer. Besides, a parasitoid *Neochrysocharis Formosa* was also associated with the pest (*Ento, Nauni*).
- *Chrysoperla zastrowisillemi* (1 larva/plant), *Lecanicillium lecanii* (5 g/L of 10⁸ conidia/g) and azadirachtin (1500 ppm; 3 ml/L) were statistically equally effective against green peach aphid, *Myzus persicae* resulting in 54.8-61.2% reduction



- of the aphid population over control, but, were less effective than imidacloprid (0.0075%) which was the most effective treatment resulting in 87.2% aphid reduction (*Ento, Nauni*).
- Among different bio-agents evaluated against *Tuta absoluta* in tomato, azadirachtin (1500 ppm; 3 ml/L), *T. achaeae*, *T. pretiosum* (each @ 50000/ha) and Bt (1L/ha) were equally and more effective (56.8-69.6% reduction) than *M. anisopliae*, *L. lecanii* and *B. bassiana* (32.5-33.9% reduction), but, less effective than indoxacarb (2 ml/L) 07 days after the 2nd treatment (*Ento, Nauni*).
 - For the management of leaf minor in tomato, a treatment module comprising; erection of yellow sticky traps (1-2@ 5 -100 m²) + foliar spray of imidacloprid 200 SL @ 0.5 ml/L at 20 and 30 DAT + spray (mixture of malathion 2 ml and 10 g jaggery or gur in 1 litre after flowering) + spray of indoxacarb 14.5 SC or 15.8 EC @ 1 ml/L at 15 days intervals at the initiation of flowering + spray fenazaquin 10 EC @ 2 ml at the appearance of mite observed minimum larvae/leaf (0.27) as compared to untreated crop which recorded highest larvae population of 1.93/leaf (*VS, Nauni*).
 - White fly population in tomato after ten days of spray was observed minimum (1.33 No./leaf) with treatment module comprising; Erection of yellow sticky traps (1-2@ 5 -100 m²) + foliar spray of imidacloprid 200 SL @ 0.5 ml/L at 20 and 30 DAT + spray (mixture of malathion 2 ml and 10 g jaggery or gur in 1 L after flowering) + spray of cypermethrin 25 EC @ 0.5 ml/L at 15 days interval at the initiation of flowering + spray fenazaquin 10 EC @ 2 ml/L at the appearance of mite, vis a vis 19.33 flies in untreated control (*VS, Nauni*).
 - Out of 06 different treatment schedules, the treatment M₅ (Erection of yellow sticky traps (1-2@ 5 -100 m²) + foliar spray of imidacloprid 200 SL @ 0.5 ml/L at 20 and 30 DAT + spray (mixture of malathion 2 ml and 10 g jaggery or gur in 1 litre after flowering) + spray of chlorantraniliprole 18.5 Scrynaxypyr 20 EC @ 0.5 ml/L at 15 days interval at the initiation of flowering + spray fenazaquin 10 EC @ 2 ml/L at the appearance of mite) was quite effective in managing insect pests of tomato and Maximum yield (458.87 q/ha) was recorded (*SS&T, Nauni*).
 - Among different bio-pesticides evaluated against rose aphid, *Macrosiphum rosaeiformis*, azadirachtin (1500 ppm; 3 ml/L), *Hippodamia variegata* (10 beetles/plant) and *Lecanicillium lecanii* (5 g/L of 10⁸ conidia/g) were equally effective resulting in 50.8-69.1% reduction in the aphid population over control. These bio-agents were, however, significantly less effective than imidacloprid (0.0075%) which reduced the aphid population to the tune of 96.6% over control (*Ento, Nauni*).
 - The extent of fruit fly (*Bactrocera dorsalis* and *B. zonata*) infestation in peach, nectarine, mango and guava ranged from 60-65, 70-80, 55-60 and 60-70%, respectively, at Nauni, Hamirpur and Jachh, respectively. Cherry fly, *Drosophila suzukii* infestation ranged between 40-50% in cherry growing belts of Shimla district (*Ento, Nauni*).
 - The bioefficacy of some new group insecticides and biopesticides was evaluated against pomegranate fruit borer, *Deudorix epijarbas* infesting pomegranate. Among the new group insecticides, rynaxypyr (0.006%), spinosad (0.002%), emamectin benzoate (0.002%) and cyazypyr (0.0075%) with 16.11, 16.67, 17.78 and 17.78% infestation, and avoidable loss values of 75.38, 74.19, 72.41 and 71.93%, respectively proved effective. The benefit cost ratio (BCR) was highest in spinosad (31.4:1) followed by cyazypyr (20.0:1). The biopesticides namely azadirachtin, Bt and *B. bassiana* were less efficacious, where the fruit infestation recorded was 27.78, 29.44 and 30.56%, respectively. Among non-chemical methods, in clay treatment, 34.17% mean fruit infestation was recorded in comparison to 72.50% in control. In bagged fruits no infestation of pomegranate fruit borer was recorded, though some of the fruits showed rotting symptoms. The quality of the fruits in both clay and bagging treatments was not appreciable. No phytotoxicity symptoms were recorded in any of the treatments (*Ento, Nauni*).
 - Horticultural Mineral oils Petrostar and Servo orchard spray oils proved effective against

overwintering eggs of European red mite, *Panonychus ulmi*. The egg hatch recorded after 4 weeks of spray was only 15.15 and 15.05%, respectively, in Petrostar and Servo orchard spray oil treatments in comparison to 14.88% in earlier recommended Orchol. The egg hatch in control was 91.12% (Ento, Nauni).

- During summer, Servo orchard spray oil was evaluated against phytophagous apple mites in apple orchard. The mite count was taken after 7, 14, 21 and 28 days of spray application by observing 20 randomly selected leaves/ tree. Servo orchard spray oil proved effective at 1 and 2% concentrations, both being on par. The mite count after 28 days was 1.30 and 1.13/leaf at 1 and 2% concentrations, respectively, in comparison to 1.46/leaf in Orchol 13 (the earlier recommended oil) and 24.59/leaf in control. Hence the lower concentration (1%) of the test oil i.e. Servo orchard spray oil be used for mite management (Ento, Nauni).
- Spinosad (0.002 and 0.004%) proved most effective in checking the cherry fly, *Drosophila suzukii* infestation in both single and double spray modules. The infestation recorded in Spinosad (0.002%) treatment was 7.33 and 5.33%, respectively, in single and two spray modules. The respective figures at higher concentration i.e. 0.004% were 5.67 and 4.00%. Lambda cyhalothrin was next in order of effectiveness followed by cypermethrin and malathion. Imidacloprid, thiamethoxam, and azadirachtin did not prove effective in checking the cherry fly infestation (Ento, Nauni).
- Studies on status of root-knot nematode in the State confirmed the identity of 04 species of root-knot nematodes i.e. *Meloidogyne incognita*, *M. javanica*, *M. graminicola* and *M. arenaria*. Of these, while the former was consistent in distribution in all the agro-climatic zones, others like *M. javanica* and *M. graminicola* were confined to the sub-tropical climate of Shivalik zone. *M. arenaria* was recorded for the first time from the State registering its presence in okra and tomato in mid hill zone (Ento, Nauni).
- Two new species of entomopathogenic nematodes viz. *Steinernema indicus* from Bhaira

(district Sirmour) and *S. spardhai* from Amarkoti (district Solan) were identified on the basis of morphological identification and molecular characterization (Ento, Nauni).

- Aqueous leaf/seed extracts of 9 plants when tested at 1, 2 and 5% concentrations against egg hatch and juveniles of *M. incognita* revealed garlic clove extract at 5% to be the best egg hatch inhibitor closely followed by Calotropis egg hatch. Neem leaf extract caused highest per cent juvenile mortality under *in vitro* conditions followed by calotropis, parthenium, tagetes and lantana in decreasing order of efficacy. Garlic clove extract at 5% caused cent per cent juvenile mortality within 120 hours (Ento, Nauni).



Living J2s of *M. incognita*
(control)



Dead J2s of *M. incognita*
(Garlic 5%)

- Seedling root dips in 5% extracts of neem, calotropis, parthenium, tagetes and lantana separately, followed by their transplanting in nematode infected soil with respective extracts improved the vegetative growth and tomato fruit production and reduced soil population of juveniles and root galling significantly with respect to control. Highest yields were attained in the treatments receiving garlic clove or neem leaf extracts (Ento, Nauni).



Garlic



Neem

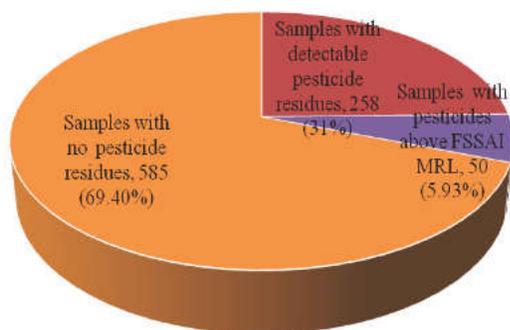


Control

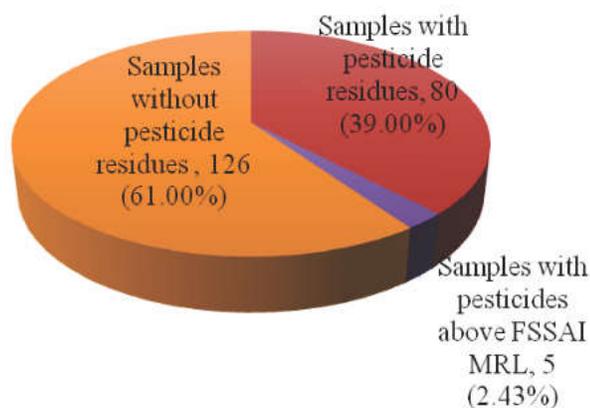
Root galling in tomato plants raised from root dipped (garlic and neem extracts) seedlings

- ❑ Among the 12 cultivars of brinjal screened against *M. incognita*, only Arka Sheel and Rampur Local cultivars showed their resistant and moderately resistant reaction, respectively, while others were rated susceptible- highly susceptible (*Ento, Nauni*).
- ❑ Early transplanted brinjal (first - last week of April) was found with very mild infestation of root-knot nematode (*M. incognita*) in comparison to late transplanted (first-week of May- last week of June), with considerably higher yield in the early crop (*Ento, Nauni*).
- ❑ Commercial fruits (apple, apricot and almond) and vegetable (pea, potato and cabbage) crops of tribal district Kinnaur were found harbouring heavy populations of phyto-parasitic nematodes viz., lesion nematode (*Pratylenchus coffeae*), spiral nematode (*Helicotylenchus dihystera*), stunt nematode (*Tylenchorhynchus mashhoodi*) and juveniles (J2) of root-knot nematode (*M. incognita*) in their rhizosphere. Among fruit crops, apple orchards showed highest populations of all the nematodes, with lesion nematode as most predominant both in terms of its frequency of occurrence and population density. Among vegetable crops, pea was found most sensitive to nematode infestation (*Ento, Nauni*).
- ❑ With the objectives to work out proper sampling site for estimating plant parasitic nematodes status in apple rhizosphere, spatial distribution studies were carried out in the apple orchards of three age groups viz., 8-10 year, 13-15 years and 18-20 years. Soil samples were collected from four different distances (30, 60, 90 and 120 cm) and depths (15, 30, 45 and 60 cm) combinations. In the first two age group orchards nematode populations were found increased with the increase in sampling distance away from the tree trunk. Contrary to this, with the increase in vertical gradient (sampling depth) in the rhizosphere, nematode populations were found decreased. In these orchards (8-10 and 13-15 years old) a combination of 120 x 15 cm was found most appropriate sampling site. However, in 18-20 years old orchard, 120x30 cm combination was found supporting the maximum nematode population (*Ento, Nauni*).
- ❑ A new nematicide, Q8U80 500 SC from has been evaluated against root nematode, *M. incognita* in cucumber, tomato and brinjal. The nematicide has been found highly effective against root knot nematode at doses of 0.0125, 0.025 and 0.0375% in all the crops (*Ento, Nauni*).
- ❑ Out of 843 marketable vegetables, fruits and other edible commodity analyzed for the presence of pesticide residue, 258 (30.60%) samples were found to contain residues and amongst these 50 (5.93%) samples were carrying residues above FSSAI MRL (Maximum Residue Limit). In total 67 samples (7.95%) were above FSSAI / codex MRL. Maximum 167 samples of vegetables were found contaminated and out of these 32 were above FSSAI MRL. Thirty-five (35) samples of fruits, 12 of red chilli powder and 44 samples of tea were contaminated. The most commonly encountered pesticides in vegetables and fruits were cypermethrin, chlorpyrifos, malathion, profenofos, quinalfos, ethion, fluvalinate, lambda cyhalothrin and EBDC (dithiocarbamate fungicides). Ethion, quinalfos, dicofol and cypermethrin were encountered in tea and ethion and cypermethrin in red chilli powder (*Ento, Nauni*).
- ❑ Amongst vegetables, maximum samples containing residues were of tomato followed by cauliflower, capsicum, brinjal, okra, French bean, cabbage, and bottle gourd, whereas, amongst fruits, maximum samples containing residues were of apple followed by mango, guava, and grapes. In tomato maximum residues were encountered of chlorpyrifos followed by EBDC, cypermethrin, and profenofos; in cauliflower maximum were of chlorpyrifos followed by malathion, cypermethrin, quinalphos, profenofos, and EBDC; in capsicum maximum residue were of cypermethrin followed by ethion, profenofos, EBDC, and deltamethrin; in brinjal these were of quinalphos, ethion, EBDC, cypermethrin, profenofos, deltamethrin, and hexaconazole; in okra maximum residue were of malathion followed by cypermethrin and fluvalinate; in French bean these were of cypermethrin, deltamethrin, fenvalerate, profenofos, malathion, and chlorpyrifos; in pea cypermethrin, and

malathion; in cabbage, bottle gourd and cucumber only single pesticide i.e. cypermethrin, chlorpyrifos, and profenofos, respectively were encountered. However, in organic vegetable samples no pesticide was detected. Amongst fruits maximum samples containing residues were of apple which were encountered with chlorpyrifos, and EBDC followed by mango with malathion, Lambda cyhalothrin, fluvalinate, and EBDC, guava with cypermethrin and quinalphos, and grapes with EBDC only (*Ento, Nauni*).



Pesticide residues status in food commodities (n=843)



Pesticide residues in farmgate vegetable and fruit samples (n=206)

- The genetic diversity of different populations of diamondback moth (*Plutella xylostella*) from different geographical areas of north India using RAPD markers, was studied. Samples of the insect were collected from 08 different localities and from different altitude representing Himachal Pradesh (Solan, Theog and Palampur), Punjab (Fatehgarh Sahib), Haryana (Hisar), UP (Saharanpur), Uttarakhand (Pantnagar), and Delhi to study genetic variations among population of these localities. Genomic DNA was isolated from these population and PCR was

conducted. A total of 20 random decamer oligonucleotide primers were used, out of which only 12 resulted in amplified DNA products. On the basis of the similarity coefficients, the populations of 8 localities were found to be clustered into 2 main clusters. Cluster 1 was further divided into 2 subclusters. In subcluster 1, the population collected from Fatehgarh Sahib and Saharanpur depicted 66% similarity, whereas in subcluster 2, Solan, and Theog populations showed the highest similarity of 70%. On the other hand the population collected from Palampur showed similarity more than 65% with other 2 population of group in subcluster 2. In cluster 2, the population from Delhi and Hisar showed similarity of 66% and more than 55% similarity with other sample grouped in cluster 1, whereas Pantnagar population of the diamondback moth was found to be the most distant among all the population in the present study (*Ento, Nauni*).

- The developmental biology of the pea leafminer was studied on 4 pea varieties namely 'Pb-89', 'Solan Nirog', 'VL-3' and 'VL-7' under laboratory conditions at $25 \pm 1^\circ\text{C}$ with relative humidity of 60-65% and 12:12h photoperiod. There was no significant difference in the incubation period on all the four varieties. However, a significant difference in the larval duration of the pest was found among different pea varieties. It was found to be minimum (5.93 days) on 'VL-3' variety and was at par with the larval duration of 6.01 days as observed on 'Solan Nirog' variety. Maximum larval duration of 6.11 days was found on 'Pb-89' variety and it was statistically different from the larval duration recorded on other varieties. Similarly, the duration of pupa was significantly longer on 'VL-3' variety (9.44 days). This was followed by larval duration of 9.11 days on 'Pb-89' and 'VL-7' varieties. The pupal duration on 'Solan Nirog' variety (9.10 days) was statistically at par with the pupal duration of 9.11 days as observed on 'Pb-89' and 'VL-7' varieties (*Ento, Nauni*).
- Life fertility of the pea leafminer, *Chromatomyia horticola* was studied on two pea varieties viz. VL-3, and VL-7. The intrinsic rate of natural increase (r_m) which is a good indicator of

temperature at which the growth of a population is most favourable, because it reflects the overall effect of temperature on the development, reproduction, and survival characteristics of a population was found to be higher on 'VL-7' variety (0.176 female/female/day) as compared to 'VL-3' variety (0.152 female/female/day) thus indicated the suitability of 'VL-7' variety (*Ento, Nauni*).

- Evaluation of different pest management modules in cucurbits concluded that the module comprising seed treatment with thiamethoxam 70WS 5-10 g/kg seed, removal of cotyledonary leaves 7 days after germination, spraying Emamectin benzoate 25 WG @ 0.4 g/L, spraying neem oil 3000 ppm @ 5 ml/L, installation of cue lure traps 15/acre, and spraying spinosad 45SC @ 0.3 ml/L was quite effective in combating the menace of red pumpkin beetle, white fly, leaf minor and fruit fly infestation and consequently leading to highest yield (172.40 q/ha) in cucumber (*VS, Nauni*).
- In an experiment on eco-friendly management of insect-pests of cabbage, significantly highest yield (234.07 q/ha) was recorded through difenthiuron 50 WP @ 1 g/L after its two spray at 10 days interval on account of least aphid population (5.56) as compared to 16.9 aphid/plant before spray. In untreated plots, the pest population increased to 36.28 aphid/plant as

compared to pre spray count of 17.4 aphids/plant, and consequently recorded lowest yield of 153.40q/ha among all treatments (*VS, Nauni*).

- Among the organic treatments, application of vermicompost @ 50 q/ha + *Azotobacter* root dip @ 2.5 kg/ha + PSB root dip @ 2.5 kg/ha + NSKE 5% (T_0) and application of FYM @ 100 q/ha + *Azotobacter* (root dip @ 2.5 kg/ha) + PSB root dip @ 2.50 kg/ha + NSKE 5% (T_3) were equally effective and both the treatments were statistically at par with recommended dose of fertilizers + malathion (0.05%) (T_1) for the traits studied viz., growth parameters [plant height (105.98 cm), days to 50% flowering (102.17), number of branches/plant (11.09), siliqua length (6.03 cm), and number of siliqua/plant (450.73)], seed yield parameters [number of seeds/siliqua (5.21), seed yield/plant (19.03 g), and seed yield/hectare (845.68 kg)], and seed quality parameters [thousands seed weight (13.33 g), seed germination (95.08%), seed vigour index I (2329.07), and seed vigour index II (10.44) and attracted maximum number of pollinators on D_1 i.e. 4th November (Foraging rate: 5.91 visit and Foraging speed: 7.66 seconds/flower) as compared to D_2 date i.e. 19th November (Foraging rate: 5.88 visit and Foraging speed: 7.09 seconds/flower), and D_3 i.e. 4th December (Foraging rate: 4.90 visit and Foraging speed: 6.85 seconds/flower) of radish (*SS&T, Nauni*).



Forestry

- ❑ Floral composition and diversity of understory shrub and herb vegetation in four differently managed *Quercus leucotrichophora* forests viz., Protected, Reserved, Musterqua and Unclassified Forest was found to vary along the altitudinal gradient. In all, 22 families with 32 genera and 33 plant species that included 10 forbs, 5 grasses, 2 sedges, 2 ferns and 14 shrubs were recorded. 23 plant species were recorded in Reserved, 19 in Protected and 20 species each in Unclassified and Musterqua Forest (SAF, Nauni).
- ❑ A wide variation in nutrient contents of different tree species was observed. Similarly different seasons depicted profound effect on the nutrient content of leaves. The dry matter (16.32-63.41%), total ash (4.25-26.25%), calcium (0.76-11.93%), zinc (1.17-65.70 ppm), and nitrate (0.00-28.03 ppm) contents were highest during autumn season while crude protein (6.50-22.75%), tannins (0.10-12.07%), manganese (24.10-578.60 ppm) and hydrocyanic acid (0.00-0.15 mg/100g) contents were highest during spring season. Summer season recorded highest phosphorous (0.01-0.41%) and nitrogen free extract content (22.25-65.56%), while maximum crude fibre (11.15-57.85%), ether extract (1.77-7.53%), acid detergent fibre (10.30-50.33%), neutral detergent fibre (18.59-67.23%), copper (11.43-31.43ppm), phenols (0.37-22.20%), saponins (2.1-32.40%), carbohydrates (52.97-85.14%), organic matter (73.75-95.75%) and mimosine (0.80-1.22%) contents were estimated during winter season. *M. serrata* was found to be the best species for spring and summer seasons, while *G. optiva* was best for autumn and winter seasons (SAF, Nauni).
- ❑ Nutritive value of leaf fodder of *Leucaena leucocephala* showed significant variation in different months. There was significant increase in dry matter content, ether content, crude fibre content, neutral detergent fibre, acid detergent fibre, total ash content, acid insoluble ash content, and calcium content from the month of August to January with the increasing maturity of *Leucaena leucocephala* leaves. However, crude protein content, nitrogen free extract, and phosphorus content showed decreasing trend with advancement of maturity of *Leucaena leucocephala* leaves (SAF, Nauni).
- ❑ Palatability study demonstrated that *L. leucocephala*, *B. variegata*, *G. optiva*, *M. serrata* and *A. catechu* were the most palatable species (SAF, Nauni).
- ❑ Maximum germination percentage (8%) in *Vitex negundo* was achieved by immersing seed in cow urine for 6 hours followed by sowing in the growing media comprised of soil: sand: FYM in 1:1:1 ratio (SAF, Nauni).
- ❑ Three bird species from the family Pycnonotidae, namely Redvented bulbul (*Pycnonotus cafer*) Black bulbul (*Hypsipetes madagascariensis*) and Himalayan bulbul (*Pycnonotus leucogenys*) were found sipping nectar from 18 forest species thus contributed to cross pollination. *Bombax ceiba*, *Erythrina indica*, *Woodfordia fruticosa*, *Indigofera pulchella* and *Rubus ellipticus* were the most preferred forest plant species by all the bird species. *Prunus cerasoides* was only visited by red vented bulbul. While, *Cassia fistula*, *Ougenia oojainensis*, *Debregeasia hypoleuca*, *Adhatoda vasica*, *Hypericum perforatum* and *Robinia pseudoacacia* were visited only by Himalayan bulbul (SAF, Nauni).
- ❑ Employing tongue and cleft grafting to raise thornless robinia plants, highest (82%) plant survival was recorded with tongue method, whereas cleft method exhibited 76% plant survival (RHR&TS, Bajaura).



Grafted thornless robinia plants

- ❑ In soapnut, tongue method of grafting gave 72.14% survival, whereas, chip budding exhibited 47.15% survival (RHR&TS, Bajaura).



Grafted soapnut plants



Grafted soapnut plant in bearing

- Body weight and average daily gain (g/day) was higher in the animals under *L. leucocephala* fed treatment group as compared to control group. *L. leucocephala* leaves feeding @ 10% of DM intake/animal/day did not have any adverse effect on the growth performance, and haematological profile of the crossbred calves, and the values of different parameters were well within the normal physiological range of the species. All the blood biochemical parameters were indicative of a positive nutritional status of the animals in *L. leucocephala* treatment group (SAF, Nauni).
- Studies on growth performance parameters of *Cedrus deodara* populations were conducted under field trial. The saplings of deodar were of different populations from different districts of Himachal Pradesh viz., Chamba, Lahaul & Spiti, Kullu, Shimla, Kinnaur and Sirmour and populations were coded as P₁, P₂, to P₂₀. The plants were planted at a spacing of 3 x3 m distances. Size of pits were 60x60x60 cm, and uniform cultural management practices were employed to screen out the best genotypes and best families growing under similar conditions at Kotkhai. Study concluded that the family and population P₁₃ (Kufri), P₁₅ (Hatu Peak) and P₁₁ (Manali) were found superior over other families and populations in respect of growth parameters indicating that these populations and families are genetically superior and can be taken for further breeding potentials and programmes which have shown eye catching growth performance in the open field conditions. Study also concluded that geographic diversity may not be related with the genetic diversity (TH&FRS, Kotkhai).
- Total biomass production of pastoral agroforestry systems was observed higher in PSH, whereas, in three altitudinal zones, it was recorded maximum in zone II. Highest total biomass production was recorded in Medium farmers (SAF, Nauni).
- The use of organic manures improved the growth parameters viz., plant height, no. of branches, no. of leaves, LAI and leaf area of the medicinal herb namely *Ocimum sanctum*. Higher dose of Jeevamrit was most effective in increasing the growth parameters of medicinal plant at a distance of 3m away from tree row except no. of branches which were found maximum at a distance of 1m away from tree row (SAF, Nauni).
- Integrated nutrient management and tree spacing influenced the growth parameters of *Zea mays* in terms of plant height, ear length, 1000 grain weight, grain yield and straw yield. Growth parameters were found higher in S₃(without trees) and lowest in S₂ (4m X 4m). Combined use of organic manures with inorganic fertilizers improved the growth parameters of *Zea mays*. Improved production potential of *Zea mays* was found in poplar based agroforestry system (SAF, Nauni).
- A Clonal bank of poplar clones has been established in Naganji nursery. About 15 clones (L-30/06, L-621/84, G-48, L-6105, S₇C₁₅, S₇C₈, WSL-22, WSL-39, 6503, 5503, 1007, L-200/86, PL-3, PL-6 and PL-7) were planted. The draft DUS guidelines were prepared and submitted to PPV & FRA, New Delhi (TIGR, Nauni).
- Hybrids developed by crossing different genotypes of *Populus deltoides* were planted in the nursery along with known clones to evaluate their performance. A total of 22 clones were planted in the randomized block design with three replications. Maximum height (454 cm) was observed in clone no. 13 whereas, minimum in clone no. 12. Diameter was highest (2.54 cm) in clone no. 1 and lowest in clone no. 12. Check clone WSL 22 was at par with clone no. 13 (TIGR, Nauni).
- The 98 clones developed from seed sourced from USA were planted in the departmental experimental area in RBD design. Observations recorded revealed that maximum plant height (4.52 m) was obtained for clone PXE-4, whereas,



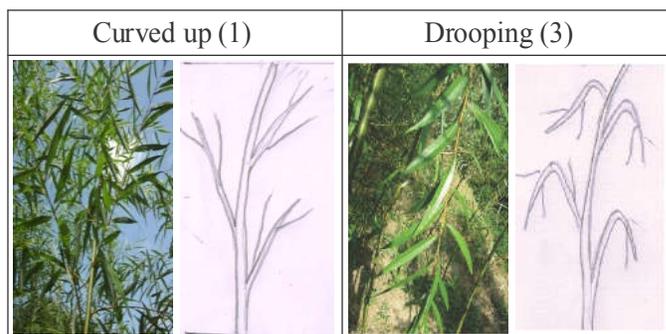
Clonal bank of poplar clones

minimum (2.16 m) in clone no. PD-90. Collar diameter was maximum (3.80 cm) in 40-N and minimum (1.68 cm) in 42-N. Leaf area varied from 663 cm² to 163 cm² and was maximum in clone 9002 (*TIGR, Nauni*).

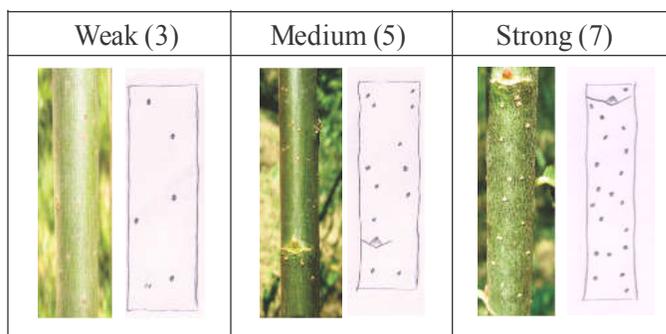
- Nursery evaluation of 42 willow (*Salix* spp.) clones was undertaken. These clones were selected based on their performance from initial screening experiment done on the basis of plant height and collar diameter in the departmental nursery. Ten ramets/cuttings of each clone of standard size were planted at 40×40 cm spacing in 4 replications in RBD design. The growth and biomass characters viz., plant height, basal diameter, volume index, number of branches, number of nodes, inter nodal length, leaf area, fresh root weight, dry shoot root weight, and total dry biomass, depicted highly significant differences among all the clones. (*TIGR, Nauni*).
- The hybrids along with check clones were evaluated for growth traits. Maximum plant height was recorded in clone UHFS103 (11.5 m), which was at par with clones UHFS087 (10.87m), UHFS296 (10.75m), UHFS286 (10.5m), UHFS208 (10.5m), UHFS075 (10.25m), UHFS297 and UHFS248 (9.75m) and check clones NZ1002, and Kashmiri. The girth at breast height was recorded maximum in clone UHFS087 (41.25cm) followed by UHFS340 (39.5cm), UHFS296 and check clone kashmiri (38.25cm), UHFS103 (35cm), NZ1002 (34.25cm), UHFS286 (34cm) and UHFS248 (33.75cm). Stem volume index was calculated maximum in clone UHFS087 (0.193m³) that is at par with clones UHFS103 (0.165m³), UHFS296 (0.156m³), Kashmiri (0.145m³) and UHFS340 (0.144m³) (*TIGR, Nauni*).

- Progeny of *Salix* families developed by University were screened with check clones in nursery in a spacing of 30cm x 30 cm and growth and biomass were recorded after three years. To compare the clonal differences the whole plant biomass, and biomass of 2m stick of each plant was recorded. Maximum plant height, basal diameter and volume was recorded in check clone Kashmiri willow (481.11cm, 3.07cm and 3628.41cm³, respectively) that is at par with clones of families PN227xSI-64-007, PN227 x *S. tetrasperma* and check clone AUSTREE. Wet above ground biomass was recorded more in the family PN227 x NZ1140 (198.37 qt/ha) which was at par with PN227 x SI-64-007 (180.31 qt/ha), PN227 x *S.tetrasperma* (152.00 qt/ha) and check clones Kashmiri willow (190.67 qt/ha) and Austree (143.92qt/ha) (*TIGR, Nauni*).
- Brief plant descriptors test guidelines apply to vegetative propagated arborescent clones of *Salix tetrasperma*, *S. matsudana*, *S. alba*, *S. acmophylla* and their hybrids developed and draft DUS guidelines were prepared and submitted to PPV & FRA New Delhi (*TIGR, Nauni*).

View of Characteristic Branch: Attitude in *Salix* clone to develop as one plant descriptor



Characteristic 4: Main shoot: protrusion of lenticels



Characteristic and main shoot protrusion of lenticels

- Evaluation of growth performance 16 *Salix* clones (03 years old plants) under Bajaura conditions, concluded that clone J-799 exhibited maximum plant height (9.33 m) and diameter (9.70 cm) followed by clone S1-64-017 (8.87 m and 7.60 cm) and clone Kashmiri (8.83 m and 5.63 cm). Minimum (2.00 m) plant height was noticed in clone V-99 following clone PN-731 (2.30 m). Minimum plant diameter (0.80 cm) was observed with clone V-99 followed by clone S1-63-016 (1.77 cm) (RHR&TS, Bajaura).



Salix Clone evaluation

Salix clone J-799

- Growth performance evaluation of Clonal Seed Orchard of *Grewia optiva Drummond* established at UHF campus, was evaluated at the age of 6 years for growth performance. Overall the results indicated the maximum value in height trait (4.90m) for Family 20 followed by Family 13 (4.80m), Family 12 and 16 (4.70m), Family 18 (4.65m), Family 2 and 11 (4.60m), Family 15 (4.55m), Family 21 (4.50 m), Family 6 (4.38m), Family 3 (4.30 m), Family 5 (4.29m), Family 1 (4.00m) and Family 23 (3.90m). The minimum value (2.20m) was recorded for Family 10. The mean value in height ranged between 2.20 m to 4.90m. Height is the main indicator and reliable parameter for initial growth performance studies, where as later on number of primary branches will be considered the main trait for fodder productivity (TIGR, Nauni).

View of seedling seed orchard and clonal seed orchard of *Grewia optiva*

- Vegetative propagation studies in *Dendrocalamus strictus* (Male bamboo) was undertaken among 23 genotypes collected from low and mid hill zones of Himachal Pradesh. Overall, treatment NAA 100 ppm showed best for survival of cutting of *Dendrocalamus strictus* (Male bamboo) and genotype G₁₄ (Kulhwa, district Kangra) showed maximum survival 93.3 per cent (TIGR, Nauni).
- Experiments were conducted to standardize vegetative propagation techniques of Lasura (*Cordia dichotoma*) and Rudraksh (*Elaeocarpus genitrus*) so as to produce true to type plants of elite genotypes of these species. Twenty five per cent survival percentage was found in Lasura, when its seedlings were chip budded in the first week of March. Whereas, eighty per cent success rate was recorded when seedlings were grafted using side veneer method during the same period. Out of the two methods tried, side veneer grafting was found better method of vegetative propagation in Lasura. Sixty per cent success was recorded in Rudraksh when air layering was done in the month of July (COH&F, Neri).
- Seeds collected from already identified seed sources (plus bamboo stands) in respect of *Dendrocalamus strictus* (male bamboo) showed 92% germination and after six month interval 70% success and survival under mist chamber conditions (TIGR, Nauni).



Bamboo experimental field

- Standardization of vegetative propagation technique for *Taxus baccata* stem cuttings were treated with 10 different concentrations of rooting hormones viz. 5000, 7500 and 10,000 ppm of IAA, IBA and NAA including a control under glass house in sand bed during 2013.

Observations on survival and growth parameters recorded in March, 2017 revealed that treating the cuttings with 10,000 ppm IBA showed better survival (70%) and growth in terms of plant height (29.9 cm). However, maximum root length (28.00 cm) and root number (7) was recorded in treatment 5000 ppm IBA (*RHR&TS, Bajaura*).



Survival and growth performance of *Taxus baccata* in glass house

- Genetic evaluation study conducted in nine major gene pool areas under three conditions of seabuckthorn in Spiti valley of Himachal Pradesh for seed oil evaluation. All major gene pool areas, growing conditions and interaction effect of (GC \times GPA) showed a significant variation on per cent seed oil, acid value, iodine value, saponification value of seed oil traits and crude protein, starch content and total sugar of deoiled cake. Refractive index and specific gravity showed non significant variation among different major gene pool area along with different growing conditions. Maximum % seed oil (5.23%), acid value (4.77 mg KOH/g), iodine value (151.37 g I₂/100 g), saponification value (231.51 mg KOH/g) in oil trait, while crude protein (31.51%), starch content (53.99%) and total sugar content (59.99%) were recorded in deoiled cake for GPA-3 (Sheigo) major gene pool area, while minimum percent seed oil (4.25 per cent), acid value (3.96 mg KOH/g), iodine value (137.65 g I₂/100 g), saponification value (184.79 mg KOH/g) in oil trait, crude protein (28.34%), starch content (51.32%) and total sugar content (5.70%) in deoiled seed cake recorded for GPA-9 (Hurling) major gene pool area. For seed oil traits and deoiled seed cake traits GPA-3(Sheigo) major gene pool area are the best for further utilization. Over all GC-3 (crop land) was found superior for

all traits among different growing conditions among different major gene pool areas (*TIGR, Nauni*).



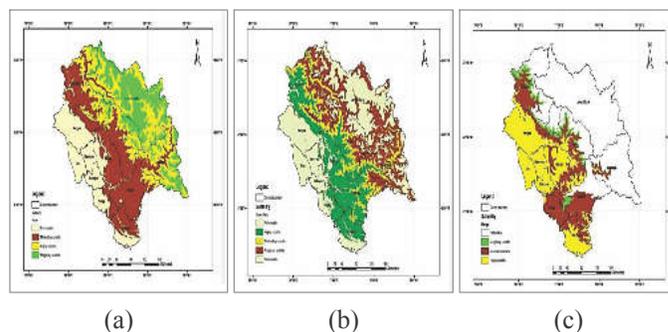
Studies on genetic evaluation of seabuckthorn

- Variability studies on *Quercus leucotrichophora* populations in Himachal Pradesh was completed in four districts of Himachal Pradesh viz., Solan, Shimla, Kullu and Chamba among nine sites and 3 diameter classes among each site. Variation was observed in seed and progeny performance germination traits and physical and chemical evaluation of seed oil and nutritional value of de oiled cake. Analysis of variation showed that site S 8 (Salooni-Chamba) showed best results for most of the morphological parameters followed by site S6 (Manikaran-Kullu). This indicates that direct selection from the altitude ranging between 1700 to 1900 m amsl for the improvement of species can fetch better results (*TIGR, Nauni*).
- Analysis of variance on the basis of diameter classes revealed clearly that contents related to oil %, physio chemical traits and nutritional value of de oiled cake, highest value was showed by trees in the larger diameter class i.e. >60 cm. This diameter class also proved best in morphological parameters except leaf length and number of primary branches. In case of germination traits medium diameter class (30-60 cm) showed best results (*TIGR, Nauni*).



- ❑ Studies on phyto-diversity of Shilly Wild Life Sanctuary of district Solan (HP) was initiated. In total of 306 plant species belonging to 207 genera from 108 families have been identified initially. Out of 306 plants species 261 belonged to dicots, 26 to monocots and 8 to gymnosperms. Approximately 40 species recorded which may be of ethno botanical use (*TIGR, Nauni*).
- ❑ Studies on Progeny Analysis in wild pomegranate (*Punica granatum* L.) was undertaken to study phenotypic character of parent trees and nursery performance of the progeny and selection of trees based on desirable fruit characteristics. Paternity or pedigree analysis of hybrid using RAPD was also undertaken. Control pollination and hybridization studies were also undertaken to get improved genetic gain in the planting material under investigation. The controlled crosses were made by applying diallel mating design with the selected parental trees. Nursery growth performance of progeny was evaluated based on desirable traits. RAPD markers were used for analysis of F1 progeny arising from open pollinated and cross pollinated parents already screened (*TIGR, Nauni*).
- ❑ Data recorded pertaining to growth performance of harar and aonla planted under Agro forestry model in the year 2011 revealed average height and average collar diameter of harar plants to be 142.23cm and 11.85 mm, respectively. Whereas, average height and average collar diameter of aonla plants were 228.27 cm and 19.87 mm, respectively. Number of branches, no. of leaves and spread (cm) of harar plants were to the tune of 6.5, 77.23 and 136.15 cm (EW) and 115.38 cm (NS) whereas in case of aonla the values of these parameters were 12.13, 165 and 217.00 cm (EW) and 176.06 cm(NS), respectively (*COH&F, Neri*).
- ❑ Ninety percent success has been achieved in Harar grafting when it was done through veneer grafting in the month of March-April and the scion wood was covered with a polytube for moisture retention (*COH&F, Neri*).
- ❑ The study revealed that due to climate change, the suitability of apple fruit crop of the state has largely changed from earlier moderately suitable

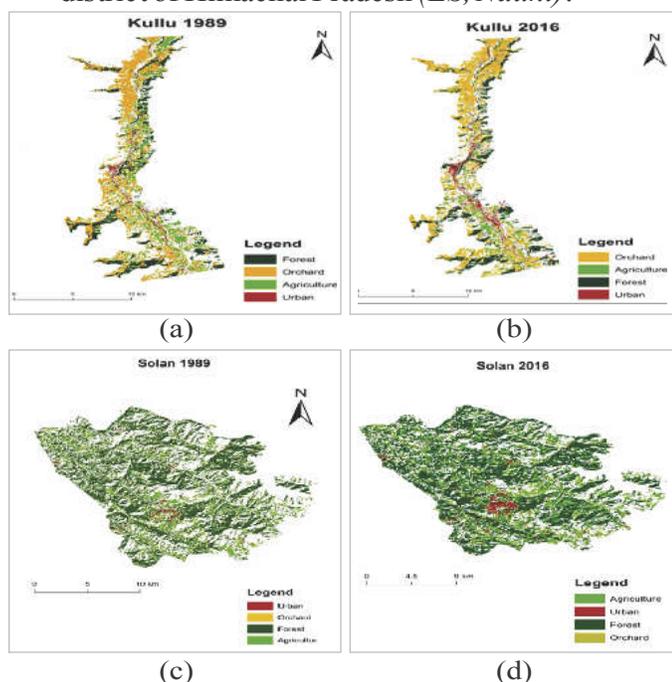
to marginal. However, stone fruits and mango crop were least affected by prevailing climatic conditions (*ES, Nauni*).



Climate suitability maps (a) Apple, (b) Stone fruits (c) Mango

- ❑ Under changing climate, the scope for crops of hot climate hold promise for expansion of horticultural crops horizon. A new fruit crops i.e. sapota and grafted Jack fruit has been planted in HDP on undulated sloppy wasteland having typical southern aspect (*COH&F, Neri*).
- ❑ The study conducted in all the urban areas of Solan district of Himachal Pradesh indicated that ambient air quality varied from moderately polluted to polluted. The industrial areas of Nalagarh and Baddi registered air quality index of 76.82 and 90.45 indicating the poor status of ambient air (*ES, Nauni*).
- ❑ The developmental activities in the urban areas have been found to generate lot of dust as indicated by PM_{10} values ranging from 64.37 – 132.90 $\mu g m^{-3}$. However, the areas of high vehicular activity and commercial sites noticed to have PM_{10} concentration to the tune of 132.90 $\mu g m^{-3}$ which is beyond permissible limits of 100 $\mu g m^{-3}$ (*ES, Nauni*).
- ❑ Due to recent rise in traffic and commercial activities in Solan city, seasonal variation in the concentrations of PM_{10} in ambient air near DC office have been noticed to the tune of 114.51 and 115.34 $\mu g m^{-3}$ during pre and post monsoon months indicating towards poor air quality (*ES, Nauni*).
- ❑ Further, the foliage of urban plantation was noticed to contain leaf dust load to the range of 1.01-4.21 $mg m^{-2}$ containing various toxic metals out of which Cd and Fe were beyond the permissible limits (*ES, Nauni*).

- The calculation of Air Pollution Tolerance Index (APTI) based on four biochemical parameters for commonly growing plants alongside the National Highway 21 falling in the region of Bilapsur and Mandi district indicated that *Toona ciliata* and *Melia azedarach* because of their high tolerance should be suggested for the development of green belt (*ES, Nauni*).
- The study indicated that presently the mid hill regions of Kullu district are experiencing a sharp decrease in area under agriculture use whereas, urban, forest and orchard land use have been found to increase over the year 1989 (a and b). However, the areas falling in Solan district exhibited increase in agriculture, urban and forest land use along with a slight decrease in orchards land use (c and d). Such trends have been noticed due to shifting of apple belt under changing climatic situations and instinct of farmers to adapt by using alternative crops like pomegranate, kiwi and vegetables in Kullu as well as adoption of vegetable farming at commercial level in Solan district of Himachal Pradesh (*ES, Nauni*).



Land use map of mid hills of Kullu (a. 1986), (b. 2016) and Solan district (c. 1986), (d. 2016)

- The urban solid waste generation rate and its methane emissions potential was calculated as per IPCC methodology. Quantification of urban solid waste of Dharamshala and Shimla town was done at generation source on wet weight basis. The

electronic balance with a capacity of 5kg for household buildings was used to determine the actual quantity of urban solid waste generated at generation source. The Dharamshala and Shimla town generated 14.28 and 61.5 tonnes of urban solid waste per day. The Dharamshala town with residential population of 54000 generated 0.26 kg/capita/day of urban solid waste. However, Shimla town with residential population of 1,84,000 generated 0.33 kg/capita/day of urban solid waste. The annual urban solid waste generation rate of Dharamshala and Shimla town was 5212.2 and 22447.5 tonnes respectively. The total per capita methane (CH_4) emission from urban solid waste of Dharamshala town was 2652.48 Gg which of CO_2 equivalent 55702.08 per annum. Whereas, total per capita methane (CH_4) emission from urban solid waste of Shimla town was 39196 Gg which of CO_2 equivalent 823116 per annum (*ES, Nauni*).

- The yield forecast at planting stage (F1); mid-season (F2) and pre-harvest yield (F3) for tomato crop varieties (2853, Red Gold and Solan Lalima) were prepared using weather (maximum and minimum temperature, rainfall and relative humidity) indices regression models. The yield was regressed with 30 weather indices prepared from the weekly weather data and time by using step wise regression with the help of statistical package software (SPSS). The tomato yield predicted under F1, F2 and F3 forecast for Solan district were 44839.65, 44272.744 and 40844.63 kg/ha with an error percentage of 1.21, 1.71 and 9.4 per cent, respectively during the year 2016 indicating high accuracy of forecast (*ES, Nauni*).
- The highest oleoresin yield and leaf biomass in chir pine was recorded from the diameter class of >55 cm from the borehole drilled in the month of May at 40 cm height from the base. Dharamshala latitudinal clines (-32° to 33° N) was recorded with maximum oleoresin yield from the trees having dark green coloured needles and growing at altitude of 1500-2000 m. The highest melting point was observed for the rosin obtained from oleoresin of white colour collected in the month of June. The highest rosin content was found for the oleoresin collected from the trees of Piplughat (Arki) site whereas, the turpentine content from

oleoresin collected from the trees of Nauni Campus was highest. The treated wood samples have shown more fixation of Chromium trioxide as compared to untreated wood samples. The maximum Chromium absorption was recorded with *Ageratum conyzoides* L. extract treated wood samples whereas, the maximum variation in wood weight after Chromium absorption on dry weight basis (Swelling) was found in *Lantana camara* L. treated wood samples (FPU, Nauni).



Standardization of borehole height

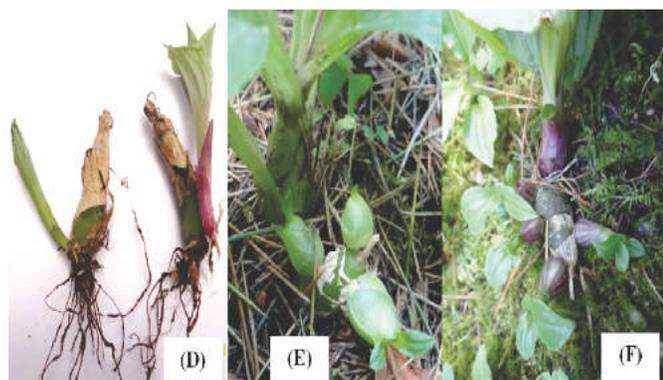
Rosin and turpentine sample

- The variation in wood weight after Chromium leaching on dry weight basis (Swelling) was found to be maximum for wood samples treated with petroleum ether extract whereas, on wet weight basis (Shrinkage) for *Ageratum conyzoides* L. treated wood samples (FPU, Nauni).
- The treatment of wood samples with *Nerium oleander* L. leaf extract had shown an increase in specific gravity values than control and the maximum specific gravity was recorded in *Celtis australis* L. Maximum swelling and shrinkage were observed in tangential plane followed by radial and longitudinal planes, respectively. The per cent swelling and volumetric swelling coefficient were recorded to be maximum for *Pinus roxburghii* Sargent wood samples. The highest value for per cent variation in weight of treated and untreated wood on dry weight basis (swelling) was recorded in *Bombax ceiba* L. wood samples. Maximum per cent shrinkage and volumetric shrinkage coefficient were recorded for *Pinus roxburghii* Sargent wood samples. The per cent variation in weight of treated and untreated wood on wet weight basis (shrinkage) was recorded maximum in *Bombax ceiba* L. Maximum moisture content has been observed in

wood samples collected from Nankhari site whereas, the highest specific gravity and tracheid length were observed for the samples collected from Chopal. Samples collected from Kandyali site have shown maximum cold water and hot water solubility and alcohol-benzene extractives. Highest lignin content has been recorded for Chichhad site while, maximum holocellulose content has been found in Dahiya site. Comparative analysis on different wood quality parameters of exotic and native species of *Shorea* indicated that Dark Red *Meranti* is the best substitute of native Sal for construction and structural purposes. The maximum specific gravity of wood was recorded in Sal. The longest fibre length and ray height were observed in Light Red *Meranti* while maximum fibre diameter and ray width were found in Teak. The maximum vessel element length and vessel element diameter were recorded in Dark Red *Meranti* whereas, the highest vessel frequency was found in Yellow *Meranti* (FPU, Nauni).

- All the distinct and unique characters of this Solan selection morphotype observed consistently up to successive 4th growing season w.e.f. 2013 to 2016, are greenish basal sheath, yellowish green floral buds (Fig.A), yellow coloured flowers without any purple tinge on their surface (Fig.A) and green coloured sheath on pseudobulbs (Fig.E) as against the normal condition of purple basal sheath (Fig.B), purple coloured floral buds, flowers with purple tinge (Fig.C), and purple coloured sheath on pseudobulbs (Fig. F) in plants of all other eight wild populations. These characters have been found stable across four different growing seasons and hence Solan selection is a candidate strain for registration as unique germplasm in *Malaxis acuminata* (FPU, Nauni).





A – F. *Malaxis acuminata*; A-Yellowish green floral buds & flowers of Solan selection; B- Wild type (right) & Solan selection plant (left); C- floral buds & flowers of wild plants; D- Wild (right) & Solan selection plant (left) at sprouting stage; E- green coloured sheath covering pseudobulbs of Solan selection plants; F- purple coloured sheath covering pseudobulbs of wild plants.

- In Asalio, MLH1016 and MLH1007 have performed better under multi location trial and have been recommended for release as varieties for National level and North India, respectively (FPU, Nauni).
- In *Tagetes minuta*, second year evaluation of 32 germplasm have revealed 5 elites in terms of maximum biomass as well as essential oil yield (FPU, Nauni).
- Domestication of ground apple (*Smallanthus sonchifolius*) (Yacon, ground apple) has been successfully domesticated and multiplied at Shilly Farm (altitude 1500 metre amsl, latitude-N 30° 54' 30" and longitude E 77° 07' 30"). The plant is a rich source of non-digestible oligosaccharides (fructo-oligosaccharides and inulin) and is used as functional food having prebiotic advantage (FPU, Nauni).



(a)



(b)



(c)

(d)

(a) *Smallanthus sonchifolius* plant (b) Roots with vegetative propagules (c) edible roots (d) vegetative propagules

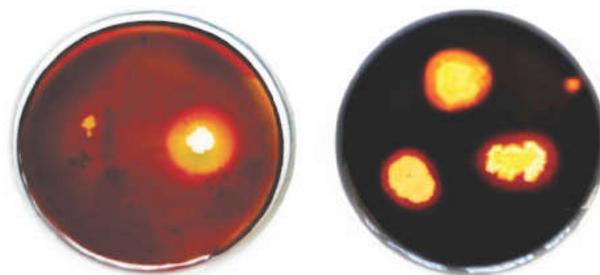
- Application of FYM 10 t/ha + 60 kg N/ha in three equal splits (1/3 at sowing+1/3 at 25 DAS+1/3 at 45 DAS) resulted in maximum growth and yield and gave maximum net return of Rs 59,281/-. The maximum B:C ratio of 2.96 was calculated with application of FYM 5t/ha + 60 kg N/ha in three equal splits (1/3 at sowing+1/3 at 25 DAS+1/3 at 45 DAS). Effect of sowing methods, time and spacing on growth and productivity of *Lepidium sativum*: Sowing of *Lepidium sativum* at 30x10 cm spacing during Oct 22-28 recorded maximum values for seed yield (18.66 q/ha), gross income (Rs 1,86,600/-), net income (Rs 1,53,109.75) and B:C ratio (4.19) (FPU, Nauni).
- Sowing of *Tagetes minuta* through 30x45 cm spacing recorded maximum values for leaf biomass/ha (50.47 q), flowering biomass yield (41.67q/ha), oil yield (48.6 l/ha), gross income (Rs 3,09,108/-), net income (Rs 2,74,603) and B:C ratio (4.94) (FPU, Nauni).
- Developed a validated HPLC method (including sample preparation technique) for simultaneous estimation of Amarogentin, Amaroswerin and Andrographolides in the drug traded as 'Chirayata'. The drug Chirayata, is mostly adulterated/substituted (56.86%) and the major substituent is Kalmegh (98.28%). So the developed method shall be used for testing and quantification of adulteration level of the drug Chirayata with kalmegh (FPU, Nauni).
- Developed a quick spot test for testing the quality of Indian Valerian drug. The therapeutic properties of drug Indian Valerian is due to a group of compounds known as Valepotriates. These valepotriates are thermo-labile compounds and decompose rapidly under acidic or alkaline conditions in water. Keeping in view the unstable

nature of these compounds, the drug activity decreases with storage conditions. The developed easy and quick spot test will be very helpful to test the quality of raw material of drug, Indian Valerian (*FPU, Nauni*).

- ❑ Studies conducted on post-harvest losses of Picroside – I and II in Kutki (*Picrorhiza kurroa*) suggested that rootstock of *Picrorhiza kurroa* should be stored under low temperature conditions (for long term storage) for minimizing degradation loss of its active constituents (*FPU, Nauni*).
- ❑ Genuineness of market samples of drug Chirata (*Swertia chirayita*) and Kutki (*Picrorhiza kurroa*) collected from different markets of Maharashtra, West Bengal, Karnataka, Assam, Himachal Pradesh, Andhra Pradesh, Gujarat, Orissa, Tamil Nadu, Haryana etc. were chemically tested. On the basis of TLC profile and HPLC analysis, it is concluded that in case of Chirata out of 314 samples, only 125 samples (39.81%) and in Kutki out of 259 samples, 245 (94.59%) were genuine (*FPU, Nauni*).
- ❑ Four new species of medicinal plants were introduced in herbal garden viz. *Crateva religiosa* G. Forst, *Oroxylum indicum* (L.) Benth ex Kurz, *Parkia roxburghii* G. Don and *Vernonia amygdalina* Delile (*FPU, Nauni*).
- ❑ A total 322 plant samples supplied by different researchers were identified and 538 visitors from different institutions, organizations, departments, etc. visited the herbarium (*FPU, Nauni*).
- ❑ In the year 2016-17, 15.20 kg quality seeds of different medicinal and aromatic plants were produced (*FPU, Nauni*).
- ❑ Standardization of plant regeneration protocol for *Saussurea costus* (kuth) was achieved using different explants like cotyledonary leaves, hypocotyls and shoot tips, respectively. *S. costus*, being an endangered medical plant of Himalayan region is among the highly prioritized medicinal plants of India as identified by National Medicinal Plant Board, Delhi (*BT, Nauni*).
- ❑ Effect of 15 seed invigoration treatments on seed vigor and germination potential of *Angelica*

glauca was studied. Invigorating seeds with GA₃ 100 ppm for 72 hr resulted in maximum germination (41.11%) compared to control (22.22%). Other germination promoting treatments were KNO₃ 500 ppm for 48 hrs, PEG 6000 at -0.5 MPa for 12 hrs and thiourea 200 ppm for 30 mins. This was accompanied by early onset, completion of germination and shorter mean germination time and higher seedling vigour indexes (*BS, Nauni*).

- ❑ Presowing treatment of seeds of *Rauvolfia serpentina* with GA₃ 200 ppm for 48 hr resulted in maximum germination percentage (36.67%) coupled with early onset of germination whereas untreated seeds did not show germination. These seeds also showed maximum emergence index, speed of germination and germination energy. Other germination promoting treatments were GA₃ 100 ppm for 48 hrs and KNO₃ 1% for 48 hr (*BS, Nauni*).
- ❑ The high amylase production was obtained with apple pomace as low cost substrate, after 72 h of incubation, at pH 9.0 and temperature of 45°C. The crude amylase was characterized using RSM and gave optimum activity 2.75 starch concentration at 55°C at 9.70 pH. The 1 per cent concentration of amylase was beneficial to increase the yield and for clarification of apple and kiwi juices (*BS, Nauni*).

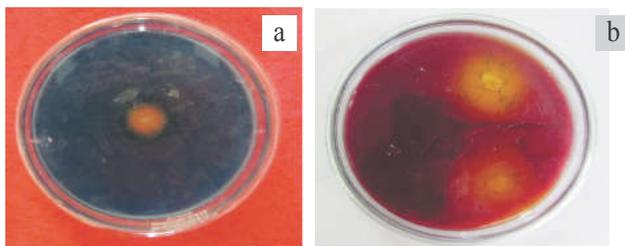


Growth of selected amylase producing bacterial isolates M13 and J2 on starch nutrient agar medium

- ❑ Isolation of the Rhizobia from 48 rhizospheric and endo-rhizospheric samples from all agro-climatic zones of the state revealed that all were P-solubilizers and showed growth on Jensen medium, 33% were siderophore producers and only 2% were HCN producer. Antagonism activity of rhizobial isolates depicted 58%

inhibition against *Fusarium oxysporum*, 36% against *Pythium aphanidermatum* and only 22% against *Rhizoctonia solani*. The optimum pH and temperature for the growth of the isolates was found to be 7.0 and 30°C, respectively (SS&WM, Nauni).

- Isolation of the Rhizobia carried out from kidney bean (rajmash) growing districts of Himachal Pradesh. A total of 25 Rhizobia isolated and screened for PGPTs, viz. P-solubilization, siderophore production and HCN production. It was noted that 20 (80%) Rhizobia were able to solubilize TCP (Tri calcium phosphate) on PVK medium, whereas, 11 (44%) were siderophore producers and only 9 (36%) were able to produce HCN (SS&WM, Nauni).



In vitro screening of the rhizobial isolates for multifarious plant growth promoting traits

(a) Siderophore production (b) Phosphate solubilization

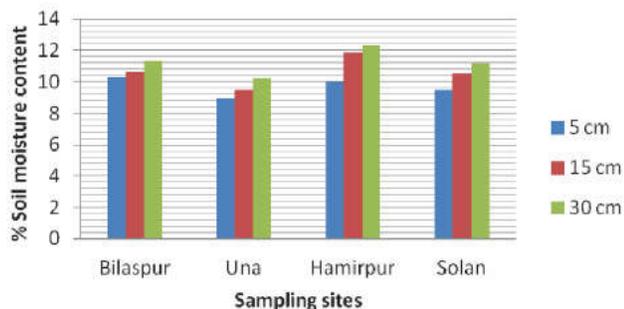
- The efficacy of selected PGPR *Bacillus subtilis* T1 and *Bacillus licheniformis* CKA1 at different doses of N, P and K on growth and yield of tomato revealed that co-inoculation of PGPR with chemical fertilizers significantly improved the root and shoot parameters compared to control (full rate of fertilizers without PGPR) as well as single inoculation of PGPR. The maximum per cent increase in root length (58.32%), shoot length (12.53%) and plant biomass (54.30%) was recorded with *B. subtilis* T1 + 100%. Application of *B. subtilis* T1 and chemical fertilizers (N₉₀, P₄₅ and K₃₀) gave 38.23% higher yield over recommended dose of nutrients without PGPR besides a saving of 25% N (30 kg/ha), P (15 kg/ha) and K (10 kg/ha) (SS&WM, Nauni).
- A study was conducted to analyze the common property resources (CPR) and their management systems in Kinnaur district of Himachal Pradesh. The results of the study revealed that around 18 per cent of the household's, income being derived

from CPRs based activities and lower caste households were found highly dependent on CPRs (26.87% of total income). The Ginni coefficient of income from CPR's in case of upper caste was 0.51 and in case of lower caste it was 0.44. On an average the employment generated through CPR based activities were found 253 man days with an opportunity cost of Rs. 63250 annually. The dependency of households for animal grazing showed that CPRs supported 113 animal units grazing per households, which confirm heavy dependence of tribal people on these resources. Factors like social participation, family size, livestock population significantly and positively affected the dependence on CPR's whereas, caste, education and non-farm income affected negatively. Devta committee leads in the benefit sharing and management of CPR's (11% involvement of locals) followed by Gram Panchayat (5.67%) and Mahila Mandals (5.33%). The main factors responsible for the degradation of CPRs were the construction of hydroelectric projects followed by excessive lopping of trees for fodder and firewood collection, population pressure, overgrazing, forest fire etc. (SS, Nauni).

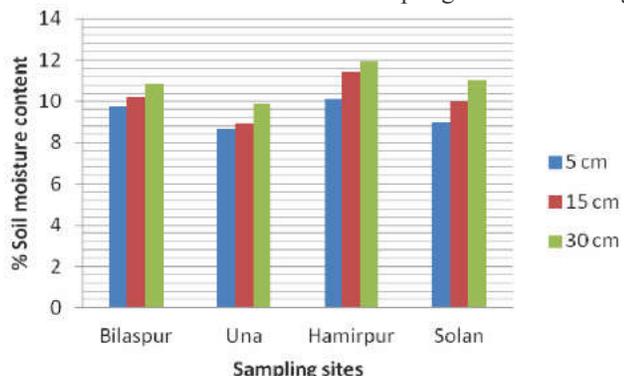
- In wheat high soil moisture during early growth increased the number of internodes and the number of spikelets formed, whereas high soil moisture during heading increased the length and strength of the stalks and the number of flowers which developed on the spikelet. Sufficient soil moisture content during heading stage is a very important factor in increasing the yield of straw and grain. Variation in soil moisture (%) content was observed at different locations under study during the crop growth period. Moisture content of five different crop stages was recorded at 5, 15 and 30 cm soil depth and represented in figures (1-5), separately. Per cent soil moisture content at crown initiation stage was recorded maximum (10.3%) in Bilaspur district and minimum (9%) in Una district at 5 cm soil depth. The average soil moisture content for the same depth in all districts was calculated to be 9.70%. But, at 15 cm depth, soil moisture content was recorded to be maximum (11.9%) for Hamirpur district and minimum (9.5%) for Una district. Average soil moisture content for the same depth was found to be 10.6% (COH&F, Neri).



Percent soil moisture content was found to be maximum (12.3 %) in Hamirpur district and minimum (10.2 %) in Una district at 30 cm soil depth. Mean soil moisture content at the same depth was found to be 11.3 % in all sampling sites at crown initiation stage. Moisture content was found to decrease as the crop progresses to tillering phase of growth. Moisture content at tillering stage was recorded maximum (10.1 %) in Hamirpur district and minimum (8.7 %) in Una district at 5 cm soil depth. The average soil moisture content for the same depth was found to be 10.0 % in all districts. Similarly, at 15 cm depth, the maximum (11.4 %) and minimum (9.0 %) soil moisture was found in the soils of Hamirpur and Una districts, respectively. Mean soil moisture for the same depth was found to be 10.2 % in all the districts. Moisture content (%) was recorded to be maximum (11.9 %) in soil samples of Hamirpur district and minimum (9.9 %) in Una district at the 30 cm depth. Average soil moisture content at the same depth was found to be 10.9 % in all the districts during tillering stage of crop (*COH&F, Neri*).



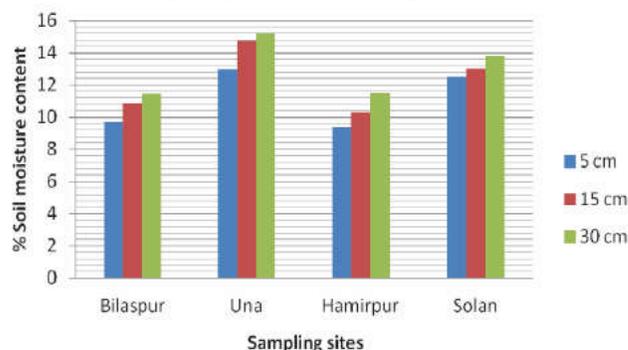
% soil moisture content in different sampling sites at CRI stage



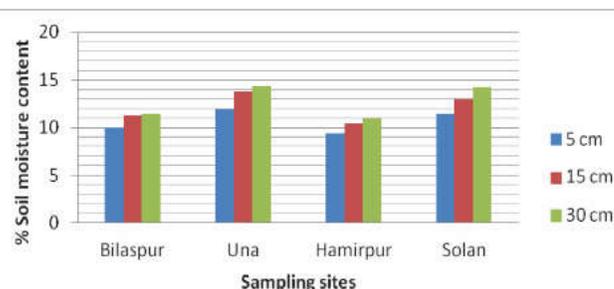
% soil moisture content in different districts in Tillering stage

Likewise, at 15 cm depth, soil moisture content was recorded to be maximum (14.8%) for Una

district and minimum (10.4%) for Hamirpur district. Average per cent soil moisture content for the same depth was calculated to be 12.3% in districts under study. In this stage of crop development minimum and maximum of moisture content w.r.t districts was reversed as compared to tillering phase of growth. At the 30 cm depth, moisture content was found to be maximum (15.2%) for soil samples of Una district and minimum (11.5%) for Bilaspur district. Mean soil moisture content was calculated to be 13.0% for all districts at the same depth at jointing stage of growth. At 5 cm soil depth, soil moisture content at flowering stage was recorded maximum (12.0%) in Una district and minimum (9.4%) in Hamirpur district. The average soil moisture content at the same depth was found to be 10.7% in all the four districts. Further, per cent soil moisture content was recorded to be maximum (13.8%) for Una district and minimum (10.4%) for Hamirpur district, respectively at 15 cm depth. Mean soil moisture content for the same depth was found to be 12.2%. At the 30 cm depth, moisture content was found to be maximum (14.4 %) for soil samples of Una district and minimum (11.0%) for Hamirpur district. Mean soil moisture content for the same depth was found to be 12.8 % at flowering stage of wheat crop (*COH&F, Neri*).

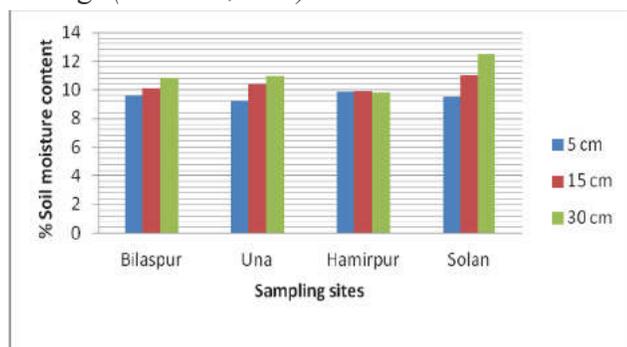


Per cent soil moisture content in different districts in Jointing Stage



Per cent soil moisture content in different districts at Flowering Stage

- Per cent moisture content data of maturity stage revealed that, it was recorded to be maximum (9.85%) in Hamirpur district and minimum (9.2%) in Una district at 5 cm soil depth. The average soil moisture for the same depth was found to be 9.6% in observed districts. At 15 cm depth, soil moisture content was recorded to be maximum (11%) for Solan district and minimum (10.0%) for Hamirpur district. Mean soil moisture content at this depth was found to be 10.40%. For the 30 cm depth, moisture content was found to be maximum (12.5%) for soil samples of Solan district and minimum (9.80%) for Hamirpur district. Mean per cent soil moisture content for the same depth was found to be 11% in districts under investigation at 30 cm depth in ripening stage (COH&F, Neri).



Per cent soil moisture content in different districts at ripening stage

- Wheat productivity in different districts was recorded to be maximum (35.90 q/ha) in Hamirpur district and minimum (6.6 q/ha) in case of Solan district. In Bilaspur district, maximum and minimum productivity was recorded to the tune of 31.2 q/ha and 9 q/ha, respectively. Mean productivity of this district was found to be 20.1 q/ha. Likely, in Una district, maximum and minimum crop productivities were recorded to be 29.9 q/ha and 7.5 q/ha, respectively. Mean crop productivity of the same district was found to be 18.7 q/ha. Similarly, in case of Hamirpur district, the maximum and minimum crop productivities were recorded to be 35.9 q/ha and 7.6 q/ha,

respectively. Mean crop productivity of the district was calculated to be 21.8 q/ha. In Solan district, maximum crop productivity was 24.6 q/ha and minimum was 6.6 q/ha, respectively. Average maximum and minimum productivity in all the studied four districts was calculated to be 30.4 q/ha and 7.7 q/ha, respectively. Average wheat productivity of all the four districts was 19 q/ha (COH&F, Neri).

- The evaluation and benefit sharing of Joint Forest Management Committees (JFMCs) in Himachal Pradesh revealed that there has been an increase in the total number of the Forest Development Agencies (FDAs) from 11 to 36 from 2007 to 2011, however, the funds outlay to the FDAs decreased significantly from 644.11 lakhs in 2007-08 for 11 FDAs to 62.59 lakhs in 2014-15 for 36 FDAs. Since the inception of JFMCs 336 ha area was covered under new plantation, 69 check dam/retaining walls, 26 water harvesting structures, 10 vermi-composting pits, 3 nurseries and 21 path construction, *tialas, kuhls*, road repair work etc. were carried out in the area. The results of the people participation at various stages of JFMC programme revealed that at an overall level the participation index in the planning, implementation and maintenance stages was found to be 60.29, 51.32 and 61.53 per cent, respectively. There is almost equal participation of the households of general caste and the other castes and the APL as well as BPL at an overall level (SS, Nauni).
- Scarcity of labour in commercial farming study of tehsil Kasauli, Solan revealed that higher wages prevailing in the non-agricultural works like carpentry, electrical and plumbing, which are locally available, attract the labour. Lack of facilities and low wages are some other reasons for scarcity of labour in commercial farming. To overcome labour shortage in the agriculture, farmers should adopt strategies such as providing better facilities, proper wages, shelter, medical facilities etc. to the labourers (BM, Nauni).

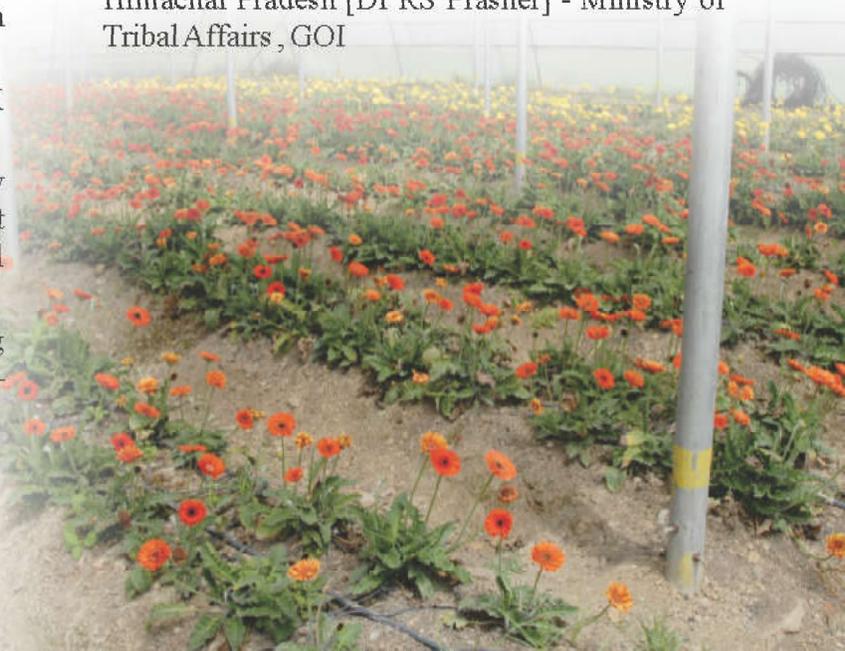
Externally Funded Research Projects Sanctioned (01.04.2016-31.03.2017)

Horticulture

1. Molecular tools for early detection and devising effective management module for premature leaf fall in apple' [Dr Usha Sharma] – MOA, RKVY
2. Refinement and promotion of production and protection technology for protected cultivation of commercial vegetables in Kullu and Mandi districts of HP [Dr BS Thakur] – MOA, RKVY
3. Transfer of Technology on mushroom spawn production to the unemployed youths for Entrepreneurship development [Dr Dharmesh Gupta] – MOA, RKVY
4. Application of native botanical formulations for disease management in tomato, capsicum and cauliflower [Dr HR Gautam] – DST
5. Remapping of fruit growing areas using geo-spatial technologies to support crop planning under changing climate in sub tropics of Himachal Pradesh [Dr SD Sharma] – MOA, RKVY
6. Development of eco-friendly modules in mango and citrus for sustainable fruit production in sub-tropical areas of Himachal Pradesh [Dr Rajesh Kaler] – MOA, RKVY
7. Infrastructure strengthening at RHRTS & KVK, Kandaghat for the production of elite planting material of temperate fruit crops and its popularization as a remunerative venture [Ms Bunty Shylla] – MOA, RKVY
8. Resurrection of strawberry runners in shiwalik foothills [Dr Pramod Kumar] – MOA, RKVY
9. Evaluating impact of neonicotinoids on pollinators [Dr HK Sharma] – MOA, RKVY
10. Intellectual Property Rights (IPR) Cell [Dr K Kumar] – SCST&E, HP
11. Characterization, classification and productivity potential of apple growing soils of North West Himalayas using GPS-GIS techniques [Dr Anil Kumar] - SCST&E, HP
12. Integrated development of scientific beekeeping (IDSB) in Himachal Pradesh [Dr HK Sharma] – MOA, National Bee Board

Forestry

1. Solar power- a renewable source for operation of micro irrigation system in fruits (apple/pomegranate) and vegetables (pea) in different zones of Himachal Pradesh [Mr R S Sepahia] – MOA, RKVY
2. Strengthening of botanical garden through *ex-situ* conservation of rare, endangered, threatened, endemic and economic plant resources of North Western Himalayan Region at Dr YS Parmar University of Horticulture & Forestry (Creation of unique biodiversity garden in North India [Dr Bhupender Gupta] – MOEFCC, GOI
3. Development of novel nutraceuticals fortified with rare fermenting microorganisms isolated from Himachal Pradesh and their commercial promotion [Dr Nivedita Sharma] – SCST&E, HP
4. Development and promotion of solar drier technology for drying of crop products in North –Western Himalayas [Dr RK Aggarwal] – DST
5. Eco innovations and water science communication for capacity building of farmers in context of climate change in Himachal Pradesh [Dr SK Bhardwaj] – DST
6. Propagation, multiplication, demonstration and field testing of selected genetically superior tree willow clones in Bharmour, Disst. Chamba [Dr HP Sankhyan] – HP State Forest Deptt., Shimla
7. Impact of market forces on the pattern of Livelihood: A case Study of the tribal areas of Himachal Pradesh [Dr RS Prasher] - Ministry of Tribal Affairs, GOI



EXTENSION ACTIVITIES

(a) Directorate of Extension Education

Sr. No.	Activity	No. of Participants			
		Farmers		Ext. Workers	Total
		Male	Female		
1.	Institutional Trainings (41)	785	185	-	970
2.	Guided /Exposure Visits (56)	1274	553	69	1896
3.	Visit of Diagnostic Laboratory of DEE (17)	378	149	2	529
4.	Farmer Advisory Services	-	-	-	
	A. Farmers' calls through Kisan Call Centre	-	-	-	297
	B. Courier service	-	-	-	68
	C. Agro-Advisory Services	-	-	-	Enmasse
	D. TV/Radio Talk	-	-	-	8
5.	Installation of University Exhibition	-	-	-	3
6.	Other Extension Education Activities	-	-	-	77
7.	Off Campus Trainings(2)	126	26	-	152
8.	Publication of literature during the year	-	-	-	23
9.	Popular articles	-	-	-	11

Publications of the Directorate

Sr. No.	Name of Publication	No. of Copies
1	सब्जियों में लगने वाले रोग एवं प्रबन्धन	1450
2	किन्नौर कृषि अंक - 1 जनवरी - मार्च	200
3	किन्नौर कृषि अक्टूबर - दिसम्बर 2016	200
4	फल एवं सब्जियों से अचार	3000
5	फल एवं सब्जियों से चटनी	3000
6	शुष्क शीतोष्ण क्षेत्रों में सेब के मुख्य कीटनाशी व बीमारियों का प्रबन्धन	1000
7	शुष्क शीतोष्ण क्षेत्रों में सेब की उपयुक्त व व्यवसायिक किस्में	1000
8	किन्नौर में सेब के रोएंदा र तेल का एकीकृत नियंत्रण	1000
9	फल उत्पादन	1500
10	बागवानी के लिए केंचुआ खाद का उत्पादन एवं महत्त्व	2000
11	कृषि वाणी अंक 1 जनवरी - जून 2016	500
12	कृषि वाणी अंक 1 जुलाई - दिसम्बर 2016	500
13	किन्नौर कृषि अंक 2 अप्रैल - जून 2016	200
14	फूलों की व्यवसायिक खेती	1000
15	फल परिपक्व आधारित सेब का तुड़ान एवं मूल्यवर्धन	1000
16	फल एवं सब्जियों से जैम, मुरब्बा तथा कैडी	1000
17	शीतोष्ण फल वृक्षों की सिंधाई एवं काट छांट	1000
18	सब्जी उत्पादन	1000
19	सेब में पोषक तत्व प्रबन्धन	750
20	पाला नियंत्रण	500
21	Laboratory Manual on Forest Pathology	550
22	Biochemistry Laboratory Manual	100
23	Practical Manual on Beekeeping	500



Exhibition during Divya Himachal Kisan Mela at Solan



Review Meeting of Mera Gaon Mera Gaurav Scheme



SJVN sponsored Skill Development Programme on Horticulture Technologies



Dr (Col.) Dhani Ram Shandil Hon'ble Minister of Social Justice and Empowerment at university exhibition during State Level Shoolini Fair, Solan



Skill Development on Pruning and Training of fruit crops



b) College of Horticulture

Activity	Food Science and Technology	Business Management	Vegetable Science	Floriculture and Landscaping Architecture	Biotechnology	Seed Science and Technology	Fruit Science	Plant Pathology	Entomology
Lectures delivered (on campus)	34	3	-	28	-	2	-	-	14
Lectures delivered (off campus)	1	-	-	40	-	11	-	-	1
Awareness camps	-	-	5	-	-	-	-	-	2
Radio/TV talks	6	-	8	6	-	2	9	4	-
Meetings organized	-	-	-	-	1	-	-	-	1
Workshops/Seminars/Symposia/ Trainings organized	1	-	5	2	1	6	-	5	5
Kisan Mela (organized)	1	-	-	-	-	-	-	-	-
Participation in Conferences, Workshops/Seminars/Symposia /Trainings etc.	5	1	8	4	7	1	3	-	17
VIP Visits	3	-	-	7	-	-	1	-	-
Book/Manual/Comendium	-	1	3	-	-	-	-	2	-
Book chapter	3	-	3	-	1	1	2	13	-
Review articles	-	-	-	-	-	-	-	2	-
Popular articles	2	-	-	-	-	-	-	8	2
Brochures/Booklets/ CDs	7	-	-	-	-	5	-	-	-
Technology folders	9	-	-	-	-	-	-	-	-
Total	69	5	32	87	10	28	15	34	-

c) College of Forestry

Activity	Environmental Science	Silviculture and Agroforestry	Soil Science and Water Management	Tree Improvement and Genetic Resources	Social Sciences	Basic Science	Forest Products
Lectures delivered (on campus)	3	4	-	2	16	-	-
Lectures delivered (off campus)	4	1	-	2	-	-	-
Awareness camps	1	-	-	-	-	-	-
Radio/TV talks	2	3	2	-	-	-	-
Workshops/Seminars Symposia/	3	-	1	-	-	-	-
Participation in Conferences, Workshops/Seminars Symposia/Trainings etc.	6	-	3	6	1	-	-



VIP Visits	4	-	-	-	-	-	-
Books/Manual/ Compendium	-	-	-	-	-	3	-
Book chapter	1	-	-	-	-	1	-
Review articles	-	-	-	-	-	-	-
Popular articles	1	-	-	1	-	-	-
Total	25	8	6	11	17	4	-

d) Horticultural Research and Training Stations

Activity	Jachh (Nurpur)	Bajaura (Kullu)	Dhaulakuan (Sirmour)	Kotkhai (Shimla)	Mashobra (Shimla)	Tabo (Lahaul & Spiti)	Kandaghat (Solan)	Rohru (Shimla)	Chamba	Sharbo (Kinnaur)
Vocational Training Course (1 yr)	-	1	-	-	22	-	-	-	-	-
Lectures delivered	-	10	21	5	-	52	-	375	85	-
Radio/TV talks	-	1	8	-	-	-	2	-	20	1
Meetings organized	-	-	-	-	1	-	1	-	-	-
Trainings organized (on and off campus)	20	5	-	1	-	2	40	69	-	36
Workshops/Seminars	-	8	15	1	-	-	2	-	17	16
No. of farmers visited	-	-	-	-	-	-	40	1087	73	-
Scientists visit to farmers field	-	-	-	-	-	-	-	130	144	-
Popular articles/ booklets/extension booklets/ Success Story/Video Filming	-	1	1	-	1	-	-	12	14	-
Awareness camps	-	-	-	-	25	-	10	-	6	1
Exposure & guided visits of farmers	-	-	-	1	1	-	15	4	4	-
Farmers/students scientists interactions	-	2	2	-	33	13	-	-	-	-
Diagnostic field visit (on and off campus)	-	-	105	-	-	1	20	20	-	2
Sponsored institutional training	-	7	-	-	-	-	-	31	10	-
OFT	-	-	2	-	-	-	8	9	-	5
FLD	-	-	-	-	-	-	15	8	-	-
Lectures delivered in trainings	-	38	43	-	-	-	-	-	-	-
On farm trials/front line demonstrations	-	-	-	-	-	-	29	-	78	1
Field Day	-	1	7	-	-	-	4	12	3	-
Kisan Mela/Kisan Gosthies conducted	-	-	-	-	-	-	1	6	2	-
Total	20	74	204	8	83	68	197	1763	456	62

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 viz. College of Horticulture, College of Forestry at (Nauni) Solan and College of Horticulture and Forestry, (Neri) Hamirpur.

College of Horticulture:

Undergraduate Programme

- B.Sc. (Honours) Horticulture : Four Year Programme

Postgraduate Programmes

- M.Sc. in Entomology, Floriculture & Landscape Architecture, Food Technology, Fruit Science, Molecular Biology & Bio-technology, Nematology, Plant Pathology, Spices Plantation & Medicinal & Aromatic Plants, Seed Science & Technology, and Vegetable Science.
- Master of Business Administration (Agribusiness) and Master of Business Administration.
- Ph.D. in Entomology, Floriculture & Landscape Architecture, Food Technology, Fruit Science, Molecular Biology & Biotechnology, Nematology, Plant Pathology, Seed Science & Technology and Vegetable Science.

○ Total number of students on rolls for the academic session 2016-17

Year	Programme														
	B.SC			M.Sc			Ph.D			MBA			Diploma		
	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls	total	Boys	Girls	Total
1 st year	35	51	86	39	64	103	13	23	36	31	15	46	04	01	05
2 nd year	32	66	98	36	58	94	12	14	26	20	22	42	-	-	-
3 rd year	23	75	98	-	-	-	11	21	32	-	-	-	-	-	-
4 th year	28	34	62	-	-	-	-	-	-	-	-	-	-	-	-
Extra year	04	01	05	07	03	10	21	20	41	-	-	-	-	-	-
	122	227	349	82	125	207	57	78	135	51	37	88	04	01	05

○ ICAR Central Development Assistance Scheme

- During the financial year 2016-17 a sum of Rs.72.75 lakhs was provided to the College of Horticulture under ICAR Development Scheme for different works. Further, the funds were allocated and provided to all the departments of

College of Horticulture for the various purposes. Besides this, a sum of Rs.11.70 lakhs and Rs. 1.44 lakhs was received under REDAY (RAWA) and NTS programme. The detail of the work done is given below:

- Purchase of equipments/instruments to all the departments for laboratories and faculty, chemicals, glassware's, plastic wares and other research material for the practical's of under graduate and post graduate students.
- The repair of instruments and equipments and AMC's of equipments.
- Preparation and publication of practical manuals for UG/PG students.
- Ten faculty members of the college have participated and attended in the national seminars, symposiums & trainings.
- Purchase of medicines, instruments and reagents kits for the university health centre for providing the best health facilities to the students of the university.
- Funds were provided for compulsory educational tour for the students of B.Sc. (Hons) Hort. final year for South India.
- The internet facility to the faculty of the college as well as staff along with the new computers.

- National Talent Scholarship (NTS) to eight students of the college @ Rs. 2000/- p.m. per student.
- Under Students READY programme and Experience Learning Programme (ELP), 62 students of the college undergone the training in different groups under three components.

- Three weeks RAWE camp was also organized for the students of B.Sc.(Hons.) Hort. final year in different Panchyats/villages from 16.01.2017 onwards till 29.3.2017. 30 students were sent to RHTRS Mashobra and Jachh under Rural Awareness and Entrepreneurship Development Programme on commercial horticulture and 32 students underwent in plant training in different canning units and mushroom farms of the state under this programme. All the RAWE students were paid the stipend @ Rs. 3000/- PM for the period of six months.



Students engaged under RAWE & Experiential Learning Programme

- Under “Experiential Learning: Hands on Training” in the discipline of Ist module on Commercial Horticulture under sub modules i) Nursery production and management of fruit plants ii) Protected cultivation of vegetables and flower) Commercial floriculture and IInd module on Processing of fruits and vegetables for value addition under Sub-module: i) Post harvest technology and value addition in horticultural

produce have already been started and sixty two students have worked under this programme in different fields and got the training

- New module on commercial floriculture has been approved by the ICAR

College of Forestry

□ Undergraduate Programme

- B.Sc. (Honours) Forestry : Four Year Programme

□ Postgraduate Programmes

- M.Sc. in Agricultural Economics, Agroforestry, Environmental Management, Environmental Science, Forest Genetic Resources, Medicinal & Aromatic Plants, Microbiology, Silviculture, Soil Science, Statistics, Wood Science & Technology.
- Ph.D. in Agricultural Economics, Agroforestry, Environmental Science, Forest Genetic Resources, Medicinal & Aromatic Plants, Microbiology, Silviculture, Soil Science, Wood Science & Technology.

- The students of B.Sc. (Forestry) 3rd year undertaken an educational tour to North-West and South India in two groups w.e.f. 14.12.2016 to 3.1.2017 and 20.12.2016 to 9.1.2017. During this period they visited various forestry based institutes and industries at Mumbai, Goa, Thiruvananthapuram, Coimbatore, Bangalore and Hyderabad and B.Sc. (Hons) Forestry final year students undertaken RAWE/READY programme for which they were attached in two groups with the State Forest Department during the period from 1.9.2016, 16.9.2016, 1.12.2016 to 15.12.2016 and 19.12.2016 to 2.1.2017 at different places viz. Sai Ropa, Kasol, Rampur, Reckong Peo, Paonta Sahib, Una, Jachh and Sundernagar.



Award of Himalayan Fellowship under “National Mission on Himalayan Studies”

Particulars	Name of the Department						Total
	Environmental Science	Forest Products	Basic Science	Soil Science & Water Management	Silviculture & Agroforestry	Social Science	
HRA	2	1	-	-	-	-	3
HJRF	3	1	3	1	1	1	10

College of Horticulture & Forestry, Neri (Hamirpur)

Undergraduate Programmes :

- B.Sc. (Honours) Horticulture: Four Year Programme.
- B.Sc. (Honours) Forestry: Four Year Programme.
- B.Sc. (Honours) Biotechnology: Four Year Programme.

During the academic session 2016-17, 125 students were enrolled in the college for B Sc (Hons) Horticulture, Biotechnology and Forestry degrees and 84 students in B Sc (Hons) Horticulture and B Sc (Hons) Biotechnology have passed out from this College. During 2016-17, eleven (11) students have qualified the JRF

examination conducted by the ICAR. The students have also excelled in sports activities as two of our students (Mr Lokesh Bhanot-Kickboxing and Ms Sandhya-winter games) have represented at national and international games (COH&F, Neri).

In addition to Commercial Horticulture & Mushroom cultivation, the University has approved Experiential Learning module in the areas of Beekeeping, Processing for value addition, Apiculture & Sericulture, forest nursery raising, Medicinal and Aromatic Plants and Plant Biotechnology to provide choice to the students from academic session 2017-18. For further expansion of research & teaching, the university has also approved the commencement of Post graduate programme leading to M Sc degree in 09 different disciplines (COH&F, Neri).

The admissions for the Academic Session: 2016-17 to the following programmes were made:

No. Sr.	Programme-wise Admissions	No. of Students
1.	B.Sc. (Hons.) Horticulture, COH	98
2.	B.Sc. (Hons.) Forestry, COF	100
3.	B.Sc. (Hons.) Horticulture, COH&F, Neri (Hamirpur)	60
4.	B.Sc. (Hons.) Forestry, COH&F, Neri (Hamirpur)	40
5.	B.Sc. (Hons.) BTC, COH&F, Neri (Hamirpur)	25
6.	M.Sc., COH	108
7.	M.Sc., COF	64
8.	MBA	34
9.	MBA (Agribusiness)	13
10.	Ph.D., COH	36
11.	Ph.D., COF	25
No. of students enrolled		603

❑ No. of Students Passed out & PDCs / Transcript of academic records issued w.e.f. 01/04/2016 to 31/03/2017

College	B.Sc.	M.Sc.	MBA	Ph.D.	Total
College of Horticulture	71	74	48	16	209
College of Forestry	64	48	-	28	140
COH&F, Neri (Hamirpur)	81	-	-	-	81
Total	216	122	48	44	430

❑ 93rd meeting of the Academic Council was held on 27th February, 2017.

❑ 8th Convocation of this University was held on 6th March, 2017. 847 degrees were awarded to the students from 1st December, 2014 onwards as per details given below:

B.Sc. (Hons.) Horticulture	B.Sc. (Hons.) Forestry	B.Sc. (Hons.) Bio - tech.	M.Sc.	M.Sc.	Ph.D.	Ph.D.	MBA
231	117	61	158	104	40	49	87

❑ Besides this, 262 certificates of merit for the Academic Year 2014-15, 2015-16 and 2016-17 and 18 Gold Medals for the Academic Year 2014-15, 2015-16 and 2016-17 in different disciplines were also awarded to the meritorious students.

❑ The honorary (*Honoris Causa*) degree of Doctor of Science was conferred on Dr. Trilochan Mohapatra, Director General, Indian Council of Agricultural Research, New Delhi.

Placement Cell

The placement cell contacted different private/government agencies for the recruitment of university students i.e. NABARD-Chandigarh, Lynchpin-New Delhi, Star Group-Gurgaon, Sheel Biotech-New Delhi, AVM Healthcare-Delhi, IFFCO-Chandigarh, Adani-Rohru, Gretis India-Zirakpur, VNS Seeds-Rajpura, and AXIS Bank. During this year 46 students got the job in private sector whereas 18 students got Government job. Out of the mentioned number, 12 students got the job through the placement cell.



FINANCE

- ❑ To make the university financially sustainable, the following measures have been taken during year and still there is deficit of Rs. 22.50 due to which financial dues of retirees and working staff could not be released.
- ❑ The University has made concerted efforts to bring down the expenditure and utmost economy is being exercised on all spending. The university resources have been raised.
- ❑ The university has taken a lead in providing imported nursery plants free from insect-pest and diseases to the farmers/orchardists during this year which also helped in generating income around Rs. 30 lakh, besides regular indigenous plant material being supplied to the growers generating about 2 crores income annually.
- ❑ The university scientists have been advised and emphasized that there is great potential for enhancing the generation of domestic income by getting new projects.
- ❑ The university has been making austerity measures and structural reforms to compress avoidable expenditure and efforts are also being made to reduce the administration expenses to the bare minimum.
- ❑ No new engagements of labour under any state scheme are encouraged and the work/job is carried out by internalizing the existing manpower or at best through outsourcing.
- ❑ To reduce the burden on state budget, utilization of maximum funds out of externally aided projects is being encouraged.
- ❑ In order to make the Statutory Officers/HODs financially more empowered, necessary changes have been made in the delegation of financial powers.
- ❑ In order to make the university cashless, necessary instructions have been issued to all the functionaries to make use of SWIPE/POS machines and some of the HODs are also using these machines in day to day transactions. There is only 5 per cent transaction through cash, specially to the casual workers and petty payments.
- ❑ In order to go cashless Petro Cards have been prepared for each and every vehicle of the university and the drivers of the concerned vehicles are using these cards to get their vehicles fuelled.

Sources of Funding

State Government

- ❑ Department of Horticulture, Himachal Pradesh, Shimla
- ❑ Department of Forest Farming and Conservation, H.P., Shimla
- ❑ Department of Youth Services and Sports, H.P. Shimla

Government of India

- ❑ Ministry of Agriculture, Government of India
- ❑ Ministry of Energy and Environment, Government of India
- ❑ Indian Council of Agriculture Research, New Delhi
- ❑ Indian Council of Forest Research & Education, Dehradun
- ❑ The university has received Grant-in-Aid from the aforesaid agencies during the financial year 2016-2017 (01.4.2016 to 31.3.2017). The detail of receipts and expenditure is given as under;

Sr. No.	Main source of funding	Grant-in-aid received in lakhs	Domestic income in lakhs	Total receipt in lakhs	Total expdt. in lakhs
1.	Department of Horticulture	9400.00	1953.00	11353.00	11353.00
2.	Department of Forest	42.00	0.00	42.00	42.00
	Total	9442.00	1953.00	11395.00	11395.00
1.	ICAR	538.71	0.00	538.71	538.71
2.	Govt. of India	982.75	0.00	982.75	982.75
3.	Misc	889.99	0.00	889.99	889.99
	Total	2411.45	0.00	2411.45	2411.45
	Grand Total	11853.45	1953.00	13806.45	13806.45

LIBRARY, COMPUTER AND INSTRUMENTATION FACILITIES

Satyanand Stokes library supports the information needs of students, faculty members, and other academic community of the university. It has rich collection of books and journals on horticultural, forestry, allied sciences, and business management in printed and digital form. It is well equipped with modern facilities, and 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 having the credit of being first Agricultural University library in the country, converted into a Wi-Fi Library in 2003-04 for accessing library resources from anywhere in the campus round the clock. The technology savvy library of the university has established multimedia centre in May 2007. This centre has been strengthened with the addition of 16 computers increasing to 40 computers, of which 14 computers have internet facilities. The library has been providing electronic access to 8,000+Journals including 4,000 through CeRA: Consortium for e-Resources in Agriculture.

The whole collection of the library is computerized, and its OPAC is electronically accessible. The e-Resources are HORT-CD 1973-2013, FOREST SCIENCE DATABASE-1939-2013, CAB-CD-1987-95, AGRIS-1975-2001, AGRICOLA- 1984-90, Forestry Compendium, Crop Protection Compendium, National Agricultural Research Database, etc. The facilities of book bank, inter library loan, lamination, photocopy, computerized information services, etc. are available for readers. The library has a collection of about 72,208 documents excluding the books collection at Regional Horticultural Research Stations situated at different parts of the state. The Regional Research Stations and Krishi Vigyan Kendras of the university are linked with the library and connectivity facilities have been established at all the Regional Stations, and KVKs of the university since 2008-09 and 2009-10, respectively. The ICAR grant amounting to Rs. 41.00 lakh was received and Rs. 19,98,962/- was spent for the purchase of books, e-books, journals and e-journals. The competition book collection is also updated with latest collection for the students, preparing for the competitive examinations. The

library has purchased, and installed 16 more computers to strengthen the multimedia centre.

CD-ROM Services

CD-ROM services are being used by the students and faculty members in the university. The searches conducted during the current year are under:

Total number of records generated (CD-ROM services)	20,210
Total number of CD-ROM users	172

E-Services

With the establishment of multimedia centre in the library, the internet and E-mail facilities are available in the library, and are being used by the students, and faculty members. CeRA offers access to 4000+ electronic journals through <http://www.cera.jccc.in>. In addition, 4000_ electronic journals are available through J-gate. The detail of users are as under:

Total number of Internet Users	4,903
Total copies photo stated free of cost	11,407

Current Periodical Section

The current periodicals section has subscribed 49 (41 Indian, 4 Foreign and 4 e-Journals) research periodicals.



Current Periodical Section

Technical Jobs

About 1,277 documents were classified and catalogued and 1,901 documents were digitized in the computer to update the existing database.

Circulation

The books are being issued to the students and the faculty members of the university electronically, and

all the students are entered with photograph in the library database to maintain the record. The circulation of books is as under :

Readers visited	50,665
Books issued	14,772
Books returned	13,602
Books consulted	86,377
No. of reference inquiries	6,209
Journals consulted	1,35,393

Technical Jobs

About 1,277 documents were classified and catalogued and 1,901 documents were digitized in the computer to update the existing database.

Circulation

The books are being issued to the students and the faculty members of the university electronically, and all the students are entered with photograph in the library database to maintain the record. The circulation of books is as under :



Online Public Access Catalogue

Acquisition

Following number of documents acquired during the year:

Books purchased	674
Books received as gratis	154
Periodicals	14
Theses added	176
e-Books	52
Total holdings as on 31.03.2017	72,208
Books	49,127
Periodicals	17,464
Theses	5,102
Others	515



Common Reading Area with AC (Hot & Cool)

Computer and Instrumentation facilities

Computer and instrumentation cell provides facility to all the students, scientists and other staff of the university with more than two hundred regular users on roll. Being a service unit the centre is helping scientists/researchers in transfer of technology by providing related services such as internet/E-mail facilities, and repair and maintenance facilities for instruments. The computer centre is maintaining pay roll system, university accounts reconciliation system, DA arrear system, GPF/CPF accounting system, students semester report system, entrance exam evaluation system and income reconciliation system.

E-mail/Internet and Local Area Network/Website

- 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. Domain based (@yspuniversity.ac.in) email from NIC has been implemented in the university and domain based E-mail accounts have been created for the Officers and Officials of the university during 2016-17. The university website is being regularly updated by incorporating the latest information pertaining to departments/offices of the university.



STUDENTS' ACTIVITIES

The students' activities viz. sports and games, health and hygiene, cultural, literary, NCC, NSS, etc. have been carried out by different students, wardens, teachers organized by Student Welfare Organization of COH, COF and COH&F, Neri and other extra co-curricular activities. Whole hearted efforts are made by this organization to inculcate the feeling of brotherhood, friendship, amity, goodwill, comradeship, love and respect for each other beside promoting discipline among the students. The various activities are as follows :

- ❑ Dheeraj memorial cricket tournament was organized through the Central Students' Association w.e.f. 4th to 8th April, 2016 in which 10 cricket teams participated from the campus and adjoining area. B.Sc. cricket team of the university won the trophy.
- ❑ Badminton championship was organized for the girls of the university w.e.f. 3rd to 7th April, 2016 at the main campus.
- ❑ Organized inter class games for the students of the university w.e.f. 6th to 20th April, 2016 in the main campus in which various games like Football, Kabaddi, Basketball and Volleyball.
- ❑ Through Central Students Association of the university fair in the campus was organized on 8th April, 2016.
- ❑ Organized Annual Sports and Games Meet 2015-16 w.e.f. 21 to 23 April, 2016 at the main campus in which students of all the three colleges participated in the meet with great zeal. Mr Rakesh Kanwar, Hon'ble Deputy Commissioner, Solan was the chief guest on the occasion for opening ceremony whereas Ms Chavi Nainta, Assistant Commissioner was the chief guest on concluding day on 23rd April, 2016 who also gave away the prizes to the winners and runners up of the different events of the Annual Sports and Games Meet 2015-16. Mr Ashish Kaushal was declared best Athlete (Boys) and Ms Neha Verma best Athlete (Girls). The overall trophy was won by College of Forestry for their best performance in all sports events.
- ❑ A cultural night of Central Students Association was organized on 23rd April, 2016. Dr Kartar Singh Verma, Director Extension Education was the chief guest on the occasion. On this occasion, a colourful cultural programme was organized by the students of the university which was greatly appreciated by dignitaries and audience.
- ❑ Hostel function was organized by the residents of Nandani hostel on 27th April, 2016. Dr Vijay Singh Thakur, Hon'ble Vice Chancellor was the chief guest of the function. On this occasion, a colourful cultural programme was presented by the students of the hostel.
- ❑ Collage competition was organized for the students of the university under the National Environment Awareness Programme on 7th April, 2016 in which 18 students participated.
- ❑ Legal services cell was constituted for the students of North-East region and meetings of the same are held at students centre on every Wednesday.
- ❑ Seven day NSS special camp for the B.Sc. 3rd year students was organized at the university campus and adjoining villages w.e.f. 8th to 14th June 2016. 24 NSS volunteers from College of Horticulture and College of Forestry attended the camp out of which 37 were girls and 17 boys. During the camp, main emphasis was on cleanliness campaign at main campus and adjoining villages viz. Dharja, Jatoli, Kotla Panjola, and Dolanji besides other cultural activities like debate, declamation, extempore, painting, group discussion, etc.
- ❑ NCC combined annual training camp was held at Karsog, Mandi w.e.f. 9th to 18th June 2016 in which 56 NCC cadets of this university participated.
- ❑ DDG (Education) ICAR, New Delhi, laid the foundation stone of boys and girl hostels on 20th June, 2016.
- ❑ The International Day of Yoga was celebrated at the gymnasium hall of the university on 21st June, 2016. The hon'ble Vice Chancellor and all the Statutory Officers and about 700 university employees, campus dwellers and students participated in the event. Devrashi Yogtheerath Ji Maharaj of Dhyani Yog Ashram, Kathni

(Subathu), District Solan delivered lecture on Yoga and taught Yoga and Pranayam to the participants.

- ❑ Ten days theater workshop was organized by Department of Theatre and Television, Punjabi University, Patiala at students centre of the university w.e.f. 15 to 24 July, 2016 in which about 30 students participated. Cultural programme was organized on the closing day of the workshop on 24th July 2016. Hon'ble Vice Chancellor, Dr Vijay Singh Thakur was the chief guest on this occasion.
- ❑ Two days entrepreneurship awareness programme was organized by Himachal Consultancy Organization Ltd (HIMCON), Shimla on behalf of Science and Technology, Government of India, New Delhi for the NSS students in which about 80 students participated.
- ❑ Tiranga march was organized at university campus on 22nd August, 2016 in which about 200 NSS volunteers and 50 other students participated.
- ❑ Sanskritik Cultural Yatra 2016 was organized by North Zone Cultural Centre, Patiala in Dr LS Negi Auditorium on 11.8.2016 at 6.00 PM in which students, staff and residents of the university participated. In this programme about 100 artists from all over India presented folk dance, folk songs and played instruments.
- ❑ Swachhta Pakhwara was organized at university campus and adjoining villages w.e.f. 16th to 31st August, 2016 in which about 250 NSS volunteers took swachhta oath and cleaned the surroundings.
- ❑ As per direction of the University Grants Commission, New Delhi, Azadi-70 Yaad Karo Kurbani mass singing of the National Anthem was conducted on 23.8.2016 at 11.00 AM by singing the National Anthem. Painted greeting cards prepared by the students and staff members of the university were sent to 9-Dogra C/O 56 APO, Solan for further transmission to the army personnel posted at the border areas.
- ❑ 13th National Youth Parliament Competition was organized in the university on 8.9.2016 in which

45 students participated. Dr H C Sharma Hon'ble Vice Chancellor of this university was the chief guest on this occasion. Dr SP Singh, Registrar, Chanakya National Law University, Patna (Bihar) was group coordinator of the function. All the Statutory Officers, Heads of the Departments, faculty members, staff members and students of the university participated in the function.

- ❑ The students of Maharashtra state studying in this university including all other students celebrated the Ganesh Festival in the students centre of the university w.e.f. 5th to 10th September 2016. Dr Hari Chand Sharma Hon'ble Vice Chancellor was the chief guest on this occasion.
- ❑ The adventure and trekking camp was held at Atal Bihari Vajpayee Institute of Mountaineering & Allied Sports, Manali (Kullu) w.e.f. 1st to 10th October, 2016 in which 10 students and programme Officer participated.
- ❑ Swachhta Abhiyan was organized on 2nd October 2016 by all the NSS volunteers and hostel residents in their respective hostels. On this occasion a cleanliness drive was undertaken surrounding all the hostels.
- ❑ Digital India workshop was organized at Dr L S Negi Auditorium on 4.10.2016 in which 275 NSS volunteers participated. In the workshop different programmes were organized like quiz, poster making competition, skit and speech regarding how NSS volunteers will spread the message of Digital India in the respective places. Mr Rushi Kansara, Financial Consultant, Mr Jai Bhagwan from Regional Directorate NSS, Chandigarh and Mr H L Sharma, State NSS Officer, HP Secretariat, Shimla participated in the workshop and gave their valuable suggestions to the participants.
- ❑ The nomination to the Central Students' Association of the University for the Academic Session, 2016-17 was held at the campus of the university on 21th October, 2016. Twenty Class Representatives were nominated from both the colleges and following were nominated as the Office Bearers of Central Students' Association:

President	Mr Vishal Sharma	(H-2015-19-D)
Vice President	Mr Puneet Thakur	(F-2013-41-BIV)
General Secretary	Mr Krishan Lal Gautam	(F-2016-18-M)
Jt. Secretary-cum-Treasurer	Mr Pankaj Sharma	(H-2014-57-BIV)

- Volley Ball and Football open tournament was organized through the Central Students' Association w.e.f. 27th September to 7th October 2016. In Volley Ball B.Sc. 3rd year and in Football B.Sc. final year team won the trophy. Dr HC Sharma, Hon'ble Vice Chancellor was the chief guest for concluding function on 7.10.2016 who gave away the prizes to the winners.
- A National Unity Week was celebrated in the university from 31st October to 5th November, 2016 in which all NSS volunteers along with NSS Programme Officers participated. On 5th November, 2016 a Unity Rally was organized. The procession started from Dr L S Negi, Auditorium to the University Entry Gate. Rashtriya Ekta Diwas Pledge was taken by the students in front of Administrative Block. Light refreshment was distributed to all the participants.
- Inter class cricket tournament was organized through the Central Students' Association w.e.f. 25th October to 7th November, 2016 in which 12 cricket teams participated. M Sc horticulture cricket team defeated the MBA cricket team in the final on 7th November, 2016. Dr Rakesh Gupta, Students' Welfare Officer was the chief guest on the occasion on 7th November, 2016 and gave away the prizes to the winners.
- XVII All India Inter Agricultural Universities Youth Festival 2016-17 was held at Rajasthan University of Veterinary & Animal Sciences, Bikaner w.e.f. 22nd to 25th February, 2017 in which 27 students of this university participated in different events. Ms Jyotsna Rana Hati student of M Sc 1st year (Fruit Science) got gold medal in Solo Song.
- XVII All India Agricultural Universities Sports & Games Meet 2016-17 was held at CCS Haryana Agriculture University, Hisar w.e.f. 25th to 29th March, 2017 in which 40 students of this university participated in different events.
- The cultural programme and NCC parade were organized on Republic day at the campus.
- The Students' Welfare Officer manages 14 hostels of this university where about 1020 students including 390 boys and 630 girls are residing.
- Wardens and hostel committees are responsible for running the day to day hostel affairs and also to maintain the discipline in the hostels.
- Different magazines and newspapers are subscribed regularly for all the hostels.
- All the hostels have been equipped with colour TV sets, water purifiers, water coolers, table tennis tables, badminton courts, LPG connections and other indoor games.
- Hostels were visited from time to time and the interaction was made with the hostel office bearers and staff for their problems and solutions.





Students participating in Digital India Programme



Staff & students participating in International Yoga Day



Staff & students participating in Swachta Abhiyan





INFRASTRUCTURE DEVELOPMENT

During the year a sum of Rs. 980.00 lakhs only was spent on various works transferred by the Comptroller with the Estate Organization as development assistance from various funding

agencies viz., ICAR, ICFRE, Govt. of India, State grants, etc. for buildings, roads, water supply, irrigation and electrification, etc. at the main campus, and research stations/KVK's.

Some of the major/minor works completed

Sr. No.	Name of work	Location
1.	Renovation of PG laboratory, Department of Fruit Science	Nauni
2.	Modernization of seminar hall (COH)	Nauni
3.	Construction of 2 numbers Insect net, Department of Vegetable Science	Nauni
4.	Construction of hi - tech polyhouse, Department of Vegetable Science	Nauni
5.	Construction of hi-tech polyhouse, Department of Floriculture and Landscape Architecture	Nauni
6.	Augmentation of irrigation facilities and storage, Department of Floriculture and Landscape Architecture	Nauni
7.	Construction of food preservation block, Department of Food Science and Technology	Nauni
8.	Construction of parking place in auditorium building	Nauni
9.	Renovation of T&V Hostel	Nauni
10.	Renovation of Vice Chancellor's residence	Nauni
11.	Construction of stage for celebrating Republic/ Independence Day	Nauni
12.	Extension of girls hostel - VI	Nauni
13.	Renovation of administrative block	Nauni
14.	Construction of 2 nos. Gabion structure, Department of Soil Science and Water Management	Nauni
15.	Renovation of path/fencing, Department of Forest Product at Shilly farm	Nauni
16.	Construction of mist chamber	Solan
17.	Construction of path and farm development	Kandaghat
18.	Construction of irrigation channel	Kandaghat
19.	Construction of zero energy cold storage unit	Rohru
20.	Renovation of hostel/laboratory building	Mashobra
21.	Providing boundary wall	Kalpa
22.	Developing community bee keeping demonstration and training facility	Sharbo
23.	Construction of trainees hostel	Kalpa
24.	Renovation of KVK building	RecongPeo
25.	Renovation of hostel for ELP students	Seobagh
26.	Construction of RCC tank	Bajaura
27.	Land development	Bajaura
28.	Construction of girls hostel for SC students	Neri
29.	Construction of badminton court	Neri
30.	Providing chain link fencing on the NH road side	Jachh

Works in progress

Sr. No.	Name of work	Status	Location
1.	Construction of 2 nos. threshing and drying shed, Department of SST	Near Completion	Nauni
2.	Renovation of 4 nos. warden residences	Near Completion	Nauni
3.	Extension of boys hostel	Near Completion	Nauni
4.	Modernization of gymnasium	Near Completion	Nauni
5.	Construction of water storage tank, Department of Fruit Science	In progress	Nauni
6.	Construction of seed processing and storage infrastructure, Department of Seed Science and Technology	Near Completion	Nauni
7.	Construction of poly carbonate house, Department of Fruit Science	Near Completion	Nauni
8.	Renovation of hostel	Under process	Nauni
9.	Providing lights in play ground	In progress	Nauni
10.	Construction of path under solar fencing, Department of Mycology and Plant Pathology	In progress	Nauni
11.	Resurfacing, metalling and tarring of road from entry gate to COF	Under process	Nauni
12.	Construction of one no. Gabion structure, Department of Soil Science and Water Management	Under process	Nauni
13.	Construction of water storage tank and structure, Department of Mycology and Plant Pathology	In progress	Nauni
14.	Construction of examination hall below parking	Under process	Nauni
15.	Construction of boys hostel-VII	Under process	Nauni
16.	Construction of girls hostel-VIII	Under process	Nauni
17.	Installation of fertigation system in kiwi block	Near Completion	Nauni
18.	Repair of glass house in kiwi block	Near Completion	Nauni
19.	Repair of poly house in different departments	Near Completion	Nauni
20.	Up-gradation of Katcha farm road in Nando/Oachghat farm	Near Completion	Nauni
21.	Renovation of polyhouses, Department of Floriculture and Landscape Architecture	In process	Nauni
22.	Construction of field laboratory, Department of Floriculture and Landscape Architecture	In process	Nauni
23.	Providing solar fencing, Department of Floriculture and Landscape Architecture	In process	Nauni
24.	Construction of polycarbonate house, Department of Fruit Science	In process	Nauni
25.	Construction of processing and storage infrastructure, Department of Seed Science and Technology	In process	Nauni
26.	Strengthening and development of botanical garden, Department of Forest Product	In process	Nauni
27.	Construction of LDPE tank, polyhouse and polythene growing chamber	In process	Rohru
28.	Renovation of farmer's hostel	In process	Rohru
29.	Construction of remaining portion of ground floor and first floor in plant health clinic laboratory	Near Completion	Neri
30.	Construction of 2 nd and 3 rd floor in plant health clinic laboratory	Near Completion	Neri

Works in progress

Sr. No.	Name of work	Status	Location
31.	Construction of farm road	In process	Neri
32.	Construction of main road	In process	Neri
33.	Construction of vermi compost units	In process	Neri
34.	Renovation of farmers hostel	In progress	Jachh
35.	Construction of farm development	In process	Jachh
36.	Up-gradation of training hall	In process	Jachh
37.	Construction of module lab.	In process	Kandaghat
38.	Construction of farm development at Jadari	In process	Kandaghat
39.	Renovation of polyhouses	In process	Kandaghat
40.	Construction of field laboratory-cum-farmer practical training hall	In process	Kandaghat
41.	Addition/alteration of ground floor in old Coult Cottage	In process	Mashobra
42.	Providing training system of kiwi fruits plants	In progress	Chamba
43.	Construction of approach road and fencing of residential quarters	In process	Chamba
44.	Construction of PVC flooring in administrative block	Completed	Chamba
45.	Renovation of various works	In process	Chamba
46.	Renovation of farmers hostel	In process	Chamba
47.	Providing DG set in farmers hostel	In process	Chamba
48.	Construction of vermi compost in Baghot farm	In process	Chamba
49.	Construction of irrigation tank, Baghot farm	In process	Chamba
50.	Construction of main gate	In process	Sharbo
51.	Construction of shading net house	In process	Dhaulakuan
52.	Construction of polyhouse	In process	Dhaulakuan
53.	Construction of mist chamber	In process	Dhaulakuan



HEALTH CARE ACTIVITIES

University Health Centre is catering to the health check up needs of students, teachers, employees and surrounding villages during this year 14012 patients (9125 new and 4887 old) were treated. Pulse Polio Camps (2 Nos.) organized in collaboration with CMO, Solan and Immunization/Vaccination camps (12 Nos.) were 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 D.H., Shimla/PGI, Chandigarh. Miscellaneous administrative work for the running of the institute including purchase of essential medicines and laboratory reagents were also carried out.

Health care tests conducted during 2016-17

Sr No	Name of test	Total patients
Heamatology		
1	Hemoglobin	618
2	Total leucocyte count	66
3	Differential leucocyte count	65
4	Erythrocyte sedimentation rate	168
5	Bleeding time/clotting time	16
6	Blood grouping plus Rh grouping	440
7	Blood film for malarial parasite	7
8	Blood haematological profile	78
Microbiology (Serology)		
1	CRP	7
2	Widal test	218
3	Syphills VDRL	21
4	RA test	71
Urine		
1	Urine for pregnancy test	45
2	Urine profile	761
3	Urine RE/ME	208
Fecess		
1	Ova/Cyst	1
Sputum		
1	Sputum for AFB (RNTCP)	117
Other		
1	Hb A1C (Glycated heamoglobin)	5

Sr No	Name of test	Total patients
Biochemistry		
Lipid Profile		
1	Total cholesterol	111
2	HDL cholesterol	111
3	LDL cholesterol	111
4	VLDL cholesterol	111
5	Tryglycerides	111
6	Total lipid	111
Renal profile		
1	Total protein	64
2	Albumin	64
3	Creatinine	80
4	Blood urea	80
5	Uric acid	314
Lever profile		
1	Alkaline phosphatase	108
2	Bilirubin	258
3	ALT (SGPT)	113
4	AST (SGOT)	114
Metabolic profile		
1	Glucose (Blood sugar)	763
Electrolite profile		
1	Calcium	210
2	Sodium potassium	62
Total		58808





UNIVERSITY AUTHORITIES (01.04.2016-31.03.2017)

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

SENATE

1.	Acharya Devvrat	Chancellor – Chairman
2.	Dr Vijay Singh Thakur	Vice Chancellor, UHF, Nauni (Solan) upto 25/07/2016
3.	Dr JC Sharma	Vice Chancellor, UHF, Nauni (Solan) w.e.f. 26/07/2016 to 10/08/2016
4.	Dr Hari C Sharma	Vice Chancellor, UHF, Nauni (Solan) w.e.f. 11/08/2016
5.	Sh JC Sharma	Principal Secretary (Horticulture) to the Government of Himachal Pradesh
6.	Sh Deepak Sanan	Additional Chief Secretary (Forests) to the Government of Himachal Pradesh upto 21/08/2016
7.	Sh Tarun Kapoor	Principal Secretary (Forests) to the Government of Himachal Pradesh w.e.f. 22/08/2016
8.	Sh Som Raj Kalia	Director of Agriculture, Himachal Pradesh upto 30/09/2016
9.	Sh Ramesh Chand	Director of Agriculture, Himachal Pradesh w.e.f. 01/10/2016
10.	Sh DP Bhanglelaia	Director of Horticulture, Himachal Pradesh upto 30/09/2016
11.	Sh HS Baweja	Director of Horticulture, Himachal Pradesh w.e.f. 01/10/2016
12.	Sh SP Vasudeva	Principal Chief Conservator of Forests, Himachal Pradesh upto 30/09/2016
13.	Sh SS Negi	Principal Chief Conservator of Forests, Himachal Pradesh w.e.f. 01/10/2016
14.	Dr J N Sharma	Dean, College of Horticulture
15.	Dr P K Mahajan	Dean, College of Forestry
16.	Dr P D Thakur	Dean, College of Horticulture and Forestry, Neri, Hamirpur upto 31/10/2016
17.	Dr PC Sharma	Dean, College of Horticulture and Forestry, Neri, Hamirpur w.e.f. 01/11/2016
18.	Dr Vijay Singh Thakur	Director of Research (additional charge as Vice Chancellor upto 25.07.2016.
19.	Dr Vijay Singh Thakur	Director of Research w.e.f. 26.07.2016 to 26.12.2016
20.	Dr K S Verma	Director of Research w.e.f. 27.12.2016
21.	Dr K S Verma	Director of Extension Education upto 27.12.2016
22.	Dr Vijay Singh Thakur	Director of Extension Education w.e.f. 27.12.2016
23.	Sh K T Bodh	Comptroller
24.	Er Sonam Paljore Negi	Estate Officer
25.	Sh Sudesh Kumar Sood	Librarian upto 19/01/2017 (AN)
26.	Dr Narender Sharma	Librarian w.e.f. 19.01.2017 (AN)
27.	Dr Rakesh Gupta	Students' Welfare Officer
28.	Shri Ajay Mahajan	MLA, HP Vidhan Sabha, Shimla
29.	Shri Mohan Lal Brakta	MLA, HP Vidhan Sabha, Shimla
30.	Dr (Mrs) Tara Gupta	Principal Scientist (Forestry), Department of Tree Improvement & Genetic Resources, UHF, Nauni (Solan) upto 26/01/2017
31.	Dr RS Chandel	Joint Director Research, O/o the Directorate of Research, UHF, Nauni (Solan) w.e.f. 27/01/2017
32.	Dr. Rohit Bishist	Assistant Professor, Department of Silviculture and Agroforestry, UHF, Nauni (Solan) w.e.f 27/01/2017
33.	Sh OP Thakur	Superintendent (EC), O/o the Dean, College of Forestry, UHF, UHF, Nauni (Solan).
34.	Sh Suresh Kumar Bhardwaj, HPAS	Registrar, UHF, Nauni (Solan) – Member Secretary upto 12/09/2016
35.	Sh Yash Paul Sharma, HPAS	Registrar, UHF, Nauni (Solan) – Member Secretary w.e.f. 12/09/2016 (AN)

BOARD OF MANAGEMENT

1.	Dr Vijay Singh Thakur	Vice Chancellor - Chairman upto 25.07.2016
2.	Dr J C Sharma	Vice Chancellor - Chairman w.e.f. 26.07.2016 to 10.08.2016
3.	Dr Hari C. Sharma	Vice Chancellor - Chairman w.e.f. 11.08.2016
4.	Dr Krishan Kumar Katoch	Vice Chancellor, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur upto 31/07/2016
5.	Smt Anuradha Thakur	Vice Chancellor, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur w.e.f. 01/08/2016 to 11/08/2016
6.	Prof Ashok Kumar Sarial	Vice Chancellor, CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur w.e.f. 11/08/2016
7.	Sh JC Sharma	Principal Secretary (Horticulture) to the Government of Himachal Pradesh
8.	Dr Shrikant Baldi	Additional Chief Secretary (Finance) to the Government of Himachal Pradesh
9.	Sh Deepak Sanan	Additional Chief Secretary (Forests) to the Government of Himachal Pradesh upto 21/08/2016
10.	Sh Tarun Kapoor	Principal Secretary (Forests) to the Government of Himachal Pradesh w.e.f. 22/08/2016
11.	Sh DP Bhanglaia	Director of Horticulture, Himachal Pradesh upto 30/09/2016
12.	Sh HS Baweja	Director of Horticulture, Himachal Pradesh w.e.f. 01/10/2016
13.	Sh SP Vasudeva	Principal Chief Conservator of Forests, Himachal Pradesh upto 30/09/2016
14.	Sh SS Negi	Principal Chief Conservator of Forests, Himachal Pradesh w.e.f. 01/10/2016
15.	Sh Som Raj Kalia	Director of Agriculture, Himachal Pradesh upto 30/09/2016
16.	Sh Ramesh Chand	Director of Agriculture, Himachal Pradesh w.e.f. 01/10/2016
17.	Dr KS Verma	Director of Extension Education, UHF, Nauni (Solun) w.e.f. 19/05/2016 to 11/06/2016 and w.e.f. 05/12/2016
18.	Dr KL Chadha	House No. 7281, Block-B, Pocket 10, Vasant Kunj, New Delhi – 110070 upto 11/06/2016
19.	Dr Sanjeev K Chauhan	Head, ICAR-CAZRI, RRS, Leh (J&K) w.e.f. 05/12/2016
20.	Dr RA Singh	Pr. Chief Conservator of Forests (Retd.), Village Mansar, Tehsil and District Solan upto 11/06/2016
21.	Prof MS Dahiya	Registrar, HAU, Hissar (Haryana) w.e.f. 05/12/2016
22.	Shri Prakash Tajta	Village Pandli, PO Kotkhai, District Shimla upto 11/06/2016
23.	Sh Arun Verma	Village Bhanat, Tehsil Rajgarh, District Sirmour w.e.f. 05/12/2016
24.	Shri Jitender Sirkek	Village Shathla, PO Virgarh, Tehsil Kumarsain, District Shimla upto 11/06/2016
25.	Sh Gopal Mehta	Village Halyana, PO Shamabhalla, Distt. Shimla (HP)-172030 w.e.f. 05.12.2016.
26.	Shri Umesh Negi	VPO Sangla, District Kinnaur upto 11/06/2016
27.	Shri Dinesh Negi	VPO Yulla, Tehsil Nichar, Distt. Kinnaur (HP)-172104 w.e.f. 05.12.2016
28.	Mrs Kunjana Singh	Ranzor Palace, Nahan, District Sirmour upto 11/06/2016
29.	Smt Kiran Kaundal	Jagruti Mahilla Kisan Simniti, Village Paplota, PO Domehar, Tehsil Arki, Distt. Solan(HP)-173221 w.e.f. 05.12.2016
30.	Dr RL Chauhan	Ex-Chairman, NIT, Hamirpur, Kahan Niwas, Kelston, Shimla upto 11/06/2016
31.	Er Balwant Singh Thakur	Chief Engineer (Retd), House No. 91, Himuda Colony, Opposite DAV School, PO Jhaniyara, Tehsil & District Hamirpur (HP)-177 601 w.e.f. 05.12.2016.
32.	Dr BP Singh	Director, CPRI, Shimla (nominee of ICAR) upto 11/04/2016
33.	Dr G Venkateshwarlu	Additional Director General (EQA&R), ICAR, KAB-II, New Delhi (nominee of ICAR) w.e.f. 12/04/2016
34.	Dr VP Tewari	Director, HFRI, Shimla (Nominee of ICFRE)
35.	Sh Suresh Kumar Bhardwaj, HPAS	Registrar, UHF, Nauni (Solan) – Member Secretary upto 12/09/2016
36.	Sh Yash Paul Sharma, HPAS	Registrar, UHF, Nauni (Solan) – Member Secretary w.e.f. 12/09/2016 (AN)



ACADEMIC COUNCIL

1.	Dr Vijay Singh Thakur	Vice Chancellor, UHF, Nauni (Solan) – Chairman upto 25/07/2016
2.	Dr J C Sharma	Vice Chancellor w.e.f. 26.07.2016 to 10.08.2016
3.	Dr Hari C Sharma	Vice Chancellor w.e.f. 11.08.2016 till date
4.	Dr J N Sharma	Dean, College of Horticulture
5.	Dr P K Mahajan	Dean, College of Forestry
6.	Dr P D Thakur	Dean, College of Horticulture and Forestry, Neri, Hamirpur upto 31.10.2016
7.	Dr P C Sharma	Dean, College of Horticulture and Forestry, Neri, Hamirpur w.e.f. 01.11.2016
8.	Dr Vijay Singh Thakur	Director of Research (additional charge as Vice Chancellor upto 25.07.2016.
9.	Dr Vijay Singh Thakur	Director of Research w.e.f. 26.07.2016 to 26.12.2016
10.	Dr K S Verma	Director of Research w.e.f. 27.12.2016 till date
11.	Dr K S Verma	Director of Extension Education upto 27.12.2016
12.	Dr Vijay Singh Thakur	Director of Extension Education w.e.f. 27.12.2016
13.	Director, Forestry Education	Forest Research Institute, Dehradun
14.	Sh Sudesh Kumar Sood	Librarian up to 19.01.2017 (AN)
15.	Dr Narender Sharma	Librarian w.e.f. 19.01.2017 (AN)
16.	Dr Rakesh Gupta	Students' Welfare Officer
17.	Dr Narender Sharma	Professor and Head, Department of Fruit Science, UHF, Nauni (Solan) w.e.f. 08/07/2016
18.	Dr Bhau Singh Thakur	Professor and Head, Department of Seed Science & Technology, UHF, Nauni (Solan).
19.	Dr KS Verma	Director of Extension Education, UHF, Nauni (Solan) upto 07/07/2016
20.	Dr GP Upadhyay	Professor and Head, Department of Soil Science & Water Management, UHF, Nauni (Solan) w.e.f. 08/07/2016 to 30/09/2016.
21.	Dr Kulwant Rai	Professor and Head, Department of Forest Products, UHF, Nauni (Solan) w.e.f. 15/10/2016
22.	Dr AK Randev	Professor and Head, Department of Social Science, UHF, Nauni (Solan) w.e.f. 08/07/2016
23.	Dr VK Chaudhary	Principal Scientist (Stat.), College of Horticulture & Forestry, Neri (Hamirpur)
24.	Dr KD Sharma	Principal Horticulturist Technologist, College of Horticulture and Forestry, Neri (Hamirpur)
25.	Dr TR Sharma	Principal Scientist, National Biotechnology Centre, LB 5 Building, IARI, New Delhi – 110012 upto 07/07/2016
26.	Dr PS Chauhan	Ex-Dean, College of Horticulture, Gulab Cottage, Shankli, Shimla w.e.f. 08/07/2016
27.	Dr Pawan Mehta	Professor (Entomology), CSK HPKV, Palampur, District Kangra – 176062 upto 07/07/2016
28.	Dr KS Kapoor	Scientist-G, HFRI, Shimla w.e.f. 08/07/2016
29.	Sh Suresh Kumar Bhardwaj, HPAS	Registrar, UHF, Nauni (Solan) – Member Secretary upto 12/09/2016
30.	Sh Yash Paul Sharma, HPAS	Registrar, UHF, Nauni (Solan) – Member Secretary w.e.f. 12/09/2016 (AN)

EXTENSION COUNCIL

1.	Dr Vijay Singh Thakur	Vice Chancellor, UHF, Nauni (Solan) - Chairman upto 25/07/2016
2.	Dr JC Sharma	Vice Chancellor, UHF, Nauni (Solan) - Chairman w.e.f. 26/07/2016 to 10/08/2016
3.	Dr Hari C Sharma	Vice Chancellor, UHF, Nauni (Solan) - Chairman w.e.f. 11/08/2016
4.	Sh DP Bhangalia	Director of Horticulture, Himachal Pradesh upto 30/09/2016
5.	Sh HS Baweja	Director of Horticulture, Himachal Pradesh w.e.f. 01/10/2016
6.	Sh Som Raj Kalia	Director of Agriculture, Himachal Pradesh upto 30/09/2016
7.	Sh Ramesh Chand	Director of Agriculture, Himachal Pradesh w.e.f. 01/10/2016
8.	Sh SP Vasudeva	Principal Chief Conservator of Forests, Himachal Pradesh upto 30/09/2016
9.	Sh SS Negi	Principal Chief Conservator of Forests, Himachal Pradesh w.e.f. 01/10/2016
10.	Dr J N Sharma	Dean, College of Horticulture
11.	Dr P K Mahajan	Dean, College of Forestry
12.	Dr P D Thakur	Dean, College of Horticulture and Forestry, Neri, Hamirpur upto 31.10.2016
13.	Dr P C Sharma	Dean, College of Horticulture and Forestry, Neri, Hamirpur w.e.f. 01.11.2016 till date
14.	Dr Vijay Singh Thakur	Director of Research (additional charge as Vice Chancellor upto 25.07.2016.
15.	Dr Vijay Singh Thakur	Director of Research w.e.f. 26.07.2016 to 26.12.2016
16.	Dr K S Verma	Director of Research w.e.f. 27.12.2016 till date
17.	All the Heads of Departments	UHF, Nauni (Solan)
18.	All the Associate Directors (R&E)	UHF
19.	Director of Extension Education	CSK HPKV, Palampur, District Kangra
20.	Joint Director (Training)	Directorate of Extension Education, UHF, Nauni (Solan)
21.	Joint Director (Communication)	Directorate of Extension Education, UHF, Nauni (Solan)
22.	Extension Coordinator	Directorate of Extension Education, UHF, Nauni (Solan)
23.	Deputy Commissioner	Solan
24.	Shri Mushtaq Mohammad	VPO Dalyana, Tehsil Ghumarwin, District Bilaspur upto 26/07/2016
25.	Sh Bihari Lal Sharma	Executive Director, Youth for Sustainable Development, B-2, MC Car Parking, Near HP High Court, Shimla w.e.f. 10/01/2017
26.	Shri Shyam Singh Mehta	Baghi Panot (Shilliser), Tehsil Rajgarh, District Sirmaur upto 26/07/2016
27.	Smt Bishma Devi	Village Telangi, PO Reckongpeo, District Kinnaur w.e.f. 10/01/2017
28.	Smt Kanta Daishta	Village Samala, Tehsil Rohru, District Shimla upto 26/07/2016
29.	Sh Sudarshan Kumar	Village Ban Kardian, PO Khel, Tehsil Nurpur District Kangra w.e.f. 10/01/2017
30.	Shri Atam Swaroop	Village Mahlog, PO Chail, Tehsil Kandaghat, District Solan upto 26/07/2016
31.	Sh Ramesh Kumar	Village Bilkar, PO Bhota, Tehsil Badsar, District Hamirpur w.e.f. 10/01/2017
32.	Shri Rashpal Pathania	VPO Basavazira, Tehsil Nurpur, District Kangra upto 26/07/2016
33.	Shri Amar Nath Sharma	Village Baharer, PO Jansooh (Dhaneta), Tehsil Nadaun, District Hamirpur w.e.f. 10/01/2017
34.	Sh Suresh Kumar Bhardwaj, HPAS	Registrar, UHF, Nauni (Solan) upto 12.09.2016
35.	Shri Yash Paul Sharma, HPAS	Registrar, UHF, Nauni (Solan) w.e.f. 12.09.2016 (AN)
36.	Sh K T Both	Comptroller, UHF, Nauni (Solan)
37.	Dr K S Verma	Director of Extension Education – Member Secretary upto 27.12.2016
38.	Dr Vijay Singh Thakur	Director of Extension Education – Member Secretary w.e.f. 27.12.2016



RESEARCH COUNCIL

1.	Dr Vijay Singh Thakur	Vice Chancellor, UHF, Nauni (Solan) - Chairman upto 25/07/2016
2.	Dr JC Sharma	Vice Chancellor, UHF, Nauni (Solan) - Chairman w.e.f. 26/07/2016 to 10/08/2016
3.	Dr Hari C Sharma	Vice Chancellor, UHF, Nauni (Solan) - Chairman w.e.f. 11/08/2016
4.	Sh DP Bhangalia	Director of Horticulture, Himachal Pradesh upto 30/09/2016
5.	Sh HS Baweja	Director of Horticulture, Himachal Pradesh w.e.f. 01/10/2016
6.	Sh Som Raj Kalia	Director of Agriculture, Himachal Pradesh upto 30/09/2016
7.	Sh Ramesh Chand	Director of Agriculture, Himachal Pradesh w.e.f. 01/10/2016
8.	Sh SP Vasudeva	Principal Chief Conservator of Forests, Himachal Pradesh upto 30/09/2016
9.	Sh SS Negi	Principal Chief Conservator of Forests, Himachal Pradesh w.e.f. 01/10/2016
10.	Dr J N Sharma	Dean, College of Horticulture
11.	Dr P K Mahajan	Dean, College of Forestry
12.	Dr P D Thakur	Dean, College of Horticulture and Forestry, Neri, Hamirpur upto 31.10.2016
13.	Dr P C Sharma	Dean, College of Horticulture and Forestry, Neri, Hamirpur w.e.f. 01.11.2016 till date
14.	Dr K S Verma	Director of Extension Education upto 27.12.2016
15.	Dr Vijay Singh Thakur	Director of Extension Education w.e.f. 27.12.2016
16.	All the Heads of Departments	UHF, Nauni (Solan)
17.	All the Associate Directors (R&E)	UHF
18.	Director of Research	CSK HPKV, Palampur, District Kangra
19.	Dr Kumar Singh Sisodia	VPO Tikri, Upper Neuwal, Tehsil Chopal, District Shimla upto 26/07/2016
20.	Shri MK Badyal	HP Farmar, 1 st Floor, Dogra Bazar, Chamba w.e.f. 10/01/2017
21.	Shri Ram Lal Chauhan	Village Dhangvi, PO Gumma, Tehsil Kotkhai, District Shimla upto 26/07/2016
22.	Shri Prem Singh Chauhan	Village Jaltahar, Chalnair (Kotkhai), Distt. Shimla w.e.f. 10.01.2017
23.	Shri Sahib Singh Mehta	Village Gahana, PO Khunni, Sub-Tehsil Nankhari, District Shimla upto 26/07/2016
24.	Shri Hariman Sharma	Village Paniyala, PO Kothi, Tehsil Ghumarwin, Distt. Bilaspur (HP) w.e.f. 10.01.2017.
25.	Shri Sanjeev Sharma	Village Jathai, PO Cheog, Tehsil Theog, District Shimla upto 26/07/2016
26.	Shri Nand Kishore Sharma	Village Shanech, PO & Tehsil Kandaghat, Distt. Solan(HP) w.e.f. 10.01.2017
27.	Shri SS Chauhan	Village Bachhrin, PO Morsingi, Tehsil Ghumarwin, District Bilaspur upto 26/07/2016
28.	Shri Kartar Singh	Village Katoi, PO Chaukath, Tehsil Jawalamukhi, Distt. Kangra (HP) w.e.f. 10.01.2017
29.	Sh Suresh Kumar Bhardwaj, HPAS	Registrar, UHF, Nauni (Solan) upto 12.09.2016
30.	Shri Yash Paul Sharma, HPAS	Registrar, UHF, Nauni (Solan) w.e.f. 12.09.2016 (AN)
31.	Sh K T Both	Comptroller, UHF, Nauni (Solan)
32.	Dr Vijay Singh Thakur	Director of Research (additional charge as Vice Chancellor) – Member Secretary upto 25.07.2016.
33.	Dr Vijay Singh Thakur	Director of Research – Member Secretary w.e.f. 26.07.2016 to 26.12.2016
34.	Dr K S Verma	Director of Research – Member Secretary w.e.f. 27.12.2016 till date

BOARD OF STUDIES

(College of Horticulture)

1.	Dr J N Sharma	Dean, College of Horticulture
2.	All the Heads of Departments	College of Horticulture, UHF, Nauni (Solan)
3.	Dr PK Mahajan	Professor and Head, Department of Basic Science, UHF, Nauni (Solan)
4.	Dr GP Upadhyay	Professor and Head, Department of EEWM, UHF, Nauni (Solan) upto 30/09/2016
5.	Dr AK Randev	Professor and Head, Department of Social Sciences, UHF, Nauni (Solan)
6.	Dr DK Mehta	Sr. Extension Specialist, Department of Seed Science & Technology, UHF, Nauni (Solan)
7.	Dr Dinesh Singh Thakur	Sr. Extension Specialist, Department of Fruit Science, UHF, Nauni (Solan)
8.	Dr Dharmesh Gupta	Sr. Scientist, Department of Plant Pathology, UHF, Nauni (Solan)
9.	Dr (Mrs) Kiran Rana	Associate Professor, Department of Entomology, UHF, Nauni (Solan)
10.	Dr (Ms) Bharti Kashyap,	Assistant Professor, Department of Floriculture and Landscape Architecture, UHF, Nauni (Solan)
11.	Dr (Ms) Manisha Thakur	Assistant Professor, Department of Biotechnology, UHF, Nauni (Solan)
12.	Dr (Ms) Santosh Kumari	Scientist, Department of Vegetable Science, UHF, Nauni (Solan)
13.	Dr (Ms) Yasmin Janjhua	Assistant Professor, Department of Business Management, UHF, Nauni (Solan)
14.	Dr Krishan Kumar	Professor, Department of Fruit Science, UHF, Nauni (Solan) - Secretary

BOARD OF STUDIES

(College of Forestry)

1.	Dr P K Mahajan	Dean, College of Forestry
2.	All the Heads of Departments, College of Forestry	UHF, Nauni (Solan)
3.	Dr JN Sharma	Professor and Head, Department of Plant Pathology, UHF, Nauni (Solan)
4.	Dr Rakesh Gupta	Professor and Head, Department of Entomology, UHF, Nauni (Solan)
5.	Dr (Mrs.) Tara Gupta	Principal Extension Specialist, Department of Tree Improvement and Genetic Resources, UHF, Nauni (Solan)
6.	Dr Rajesh Kaushal	Senior Scientist, Department of Basic Sciences, UHF, Nauni (Solan)
7.	Dr (Mrs.) Parminder Kaur Baweja	Senior Scientist, Department of Environmental Science, UHF, Nauni (Solan)
8.	Sh Mukesh Prabhakar	Scientist, Department of Silviculture and Agroforestry, UHF, Nauni (Solan)
9.	Sh Yashpal Sharma	Phytochemist, Department of Forest Products, UHF, Nauni (Solan)
10.	Dr Subhash Sharma	Assistant Professor, Department of Social Sciences, UHF, Nauni (Solan)
11.	Er Ghanshyam Aggarwal	Assistant Professor, Department of Soil Science and Water Management, UHF, Nauni (Solan)
12.	Dr Bhupinder Dutt	Associate Professor, Department of Forest Products, UHF, Nauni (Solan) - Secretary



BOARD OF STUDIES

(College of Horticulture and Forestry, Hamirpur at Neri)

1.	Dr. P D Thakur	Dean, College of Horticulture and Forestry, Neri, Hamirpur upto 31/10/2016
2.	Dr. PC Sharma	Dean, College of Horticulture and Forestry, Neri, Hamirpur w.e.f.01/11/2016
3.	Dr. YC Gupta	Professor and Head, Department of Floriculture and Landscape Architecture, UHF, Nauni (Solan)
4.	Dr. RS Prashar	Principal Scientist, Department of Social Sciences, UHF, Nauni (Solan)
5.	Dr. DK Sharma	Principal Scientist (Veg.), Department of Horticulture, COH&F, Hamirpur upto 30/04/2016
6.	Dr. VK Chaudhary	Principal Scientist (Stat.), Department of Social Sciences and Basic Sciences, COH&F, Hamirpur
7.	Dr. KD Sharma	Principal Horticultural Technologist (FST), Department of Food Science and Technology, COH&F, Hamirpur
8.	Dr. Sanjeev Thakur	Professor and Head, Department of Tree Improvement and Genetic Resources, UHF, Nauni (Solan)
9.	Dr. Kamal Sharma	Principal Scientist, Department of Forestry and Environment, COH&F, Hamirpur
10.	Dr. VK Sharma	Scientist (FBGR), Department of Horticulture, COH&F, Hamirpur
11.	Dr. Som Dev Sharma	Principal Extension Specialist (Hort.), COH&F, Hamirpur - Secretary

FINANCE COMMITTEE

1.	Dr. Vijay Singh Thakur	Vice Chancellor, UHF, Nauni (Solan) – Chairman upto 25/07/2016
2.	Dr. JC Sharma	Vice Chancellor, UHF, Nauni (Solan) – Chairman w.e.f. 26/07/2016 to 10/08/2016
3.	Dr. Hari C. Sharma	Vice Chancellor, UHF, Nauni (Solan) – Chairman w.e.f. 11/08/2016
4.	Dr. Shrikant Baldi	Additional Chief Secretary (Finance) to the Government of Himachal Pradesh
5.	Ms. Upma Chawdhry	Additional Chief Secretary (Agriculture) to the Government of Himachal Pradesh upto 30/09/2016
6.	Sh. Arvind Mehta	Additional Chief Secretary (Agriculture) to the Government of Himachal Pradesh w.e.f. 01/10/2016
7.	Sh. JC Sharma	Principal Secretary (Horticulture) to the Government of Himachal Pradesh
8.	Sh. Suresh Kumar Bhardwaj,	Registrar, UHF, Nauni (Solan) upto 12/09/2016
9.	Sh. Yash Paul Sharma	Registrar, UHF, Nauni (Solan) w.e.f. 12/09/2016 (AN)
10.	Sh. Rajesh Sharma	Examiner, Local Audit Department upto 30/09/2016
11.	Sh. Dev Dutt Sharma	Examiner, Local Audit Department w.e.f. 30/09/2016
12.	Sh. DP Bhangalia	Director of Horticulture, Himachal Pradesh upto 30/09/2016
13.	Sh. HS Baweja	Director of Horticulture, Himachal Pradesh w.e.f. 01/10/2017
14.	Sh. SP Vasudeva	Principal Chief Conservator of Forests, Himachal Pradesh upto 30/09/2016
15.	Sh. SS Negi	Principal Chief Conservator of Forests, Himachal Pradesh w.e.f. 01/10/2016
16.	Dr. RL Chauhan	Ex-Chairman NIT, Kahan Niwas, Kelston, Shimla – 171001 upto 24/02/2016
17.	Er. Balwant Singh Thakur	Chief Engineer (Retired), H. No. 91, HIMUDA Colony, Opposite DAV School, PO Jhaniyara, District Hamirpur – 177601 w.e.f. 25/02/2017
18.	Sh. K T Both	Comptroller, UHF, Nauni (Solan) – Member Secretary

OFFICERS OF THE UNIVERSITY

S. No.	Officers	Designation/Status
1.	Acharya Devvrat	Chancellor
2.	Dr Vijay Singh Thakur	Vice Chancellor upto 25.07.2016
3.	Dr J C Sharma	Vice Chancellor w.e.f. 26.07.2016 to 10.08.2016
4.	Dr Hari C Sharma	Vice Chancellor w.e.f. 11.08.2016
5.	Dr J N Sharma	Dean, College of Horticulture
6.	Dr P K Mahajan	Dean, College of Forestry
7.	Dr P D Thakur	Dean, College of Horticulture and Forestry, Neri, Hamirpur upto 31.10.2016
8.	Dr P C Sharma	Dean, College of Horticulture and Forestry, Neri, Hamirpur w.e.f. 01.11.2016
9.	Dr Vijay Singh Thakur	Director of Research (additional charge as Vice Chancellor upto 25.07.2016.
10.	Dr Vijay Singh Thakur	Director of Research w.e.f. 26.07.2016 to 26.12.2016
11.	Dr K S Verma	Director of Research w.e.f. 27.12.2016
12.	Dr K S Verma	Director of Extension Education upto 27.12.2016
13.	Dr Vijay Singh Thakur	Director of Extension Education w.e.f. 27.12.2016
14.	Sh K T Bodh	Comptroller
15.	Er Sonam Paljore Negi	Estate Officer
16.	Sh Sudesh Kumar Sood	Librarian up to 19.01.2017 (AN)
17.	Dr Narender Sharma	Librarian w.e.f. 19.01.2017 (AN)
18.	Dr Rakesh Gupta	Students' Welfare Officer
19.	Sh Suresh Kumar Bhardwaj, HPAS	Registrar upto 12.09.2016
20.	Shri Yash Paul Sharma	Registrar w.e.f. 12.09.2016 (AN) till date
Joint Directors		
21.	Dr S K Gupta	Joint Director (Communication)
22.	Dr I D Sharma	Joint Director (Training)
23.	Dr Satish K Sharma	Deputy Director Research (Horticulture)
24.	Dr Manoj K Vaidya	Joint Director Research (Planning)
25.	Dr Rajeshwar Singh Chandel	Deputy Director Research (Forestry)
Heads of the Departments		
26.	Dr Narender Sharma	Professor and Head, Department of Fruit Science upto 19.01.2017 (AN)
27.	Dr B S Thakur	Professor & Head, Department of Fruit Science w.e.f. 23.01.2017
28.	Dr (Ms) Anju K Dhiman	Professor and Head, Department of Food Science and Technology upto 03.08.2016
29.	Dr P C Sharma	Professor and Head, Department of Food Science and Technology w.e.f. 03.08.2016 (AN) to 05.08.2016
30.	Dr (Ms) Anju K Dhiman	Professor and Head, Department of Food Science and Technology w.e.f. 06.08.2016 to 22.10.2016
31.	Dr P C Sharma	Professor and Head, Department of Food Science and Technology w.e.f. 22.10.2016 (AN) to 31.10.2016
32.	Dr J N Sharma (Dean, COH)	Professor and Head, Department of Food Science and Technology (additional charge w.e.f. 02.11.2016)
33.	Dr I M Sharma	Professor and Head, Department of Plant Pathology upto 31.03.2017



34.	Dr (Mrs) Anju S. Khanna	Professor and Head, Department of Entomology
35.	Dr HS Kanwar	Professor and Head, Department of Vegetable Science
36.	Dr YC Gupta	Professor and Head, Department of Floriculture and Landscape Architecture
37.	Dr (Mrs) A K Nath	Professor and Head, Department of Biotechnology
38.	Dr K K Raina	Professor and Head, Department of Business Management
39.	Dr Bhupender Gupta	Professor and Head, Department of Silviculture and Agroforestry
40.	Dr Sanjeev Thakur	Professor and Head, Department of Tree Improvement and Genetic Resources
41.	Dr Kulwant Rai	Professor and Head, Department of Forest Products
42.	Dr AK Randev	Professor and Head, Department of Social Sciences
43.	Dr GP Upadhyay	Professor and Head, Department of Soil Science and Water Management upto 30.09.2016
44.	Dr J C Sharma	Professor and Head, Department of Soil Science and Water Management w.e.f. 01.10.2016
45.	Dr (Mrs) Veena Sharma	Professor and Head, Department of Basic Sciences upto 31.10.2016
46.	Dr (Ms) Anju S. Thakur	Professor and Head, Department of Basic Sciences w.e.f. 02.11.2016
47.	Dr B S Thakur	Professor and Head, Department of Seed Science and Technology w.e.f. 02.04.2016 to 23.01.2017
48.	Dr Manish Kumar Sharma	Professor and Head, Department of Seed Science and Technology w.e.f. 23.01.2017
49.	Dr Satish Kumar	Professor and Head, Department of Environmental Sciences
Associate Directors		
50.	Dr M S Mankotia	Associate Director (R&E), Regional Horticultural Research and Training Station, Mashobra (Shimla) upto 30.11.2016
51.	Dr (Ms) Sushma Bhardwaj	Associate Director (R&E), Regional Horticultural Research and Training Station, Mashobra (Shimla) w.e.f. 01.12.2016
52.	Dr Jayant Kumar	Associate Director (R&E), Regional Horticultural Research and Training Station, Bajaura (Kullu) upto 31.08.2016
53.	Dr D R Khajuria	Associate Director (R&E), Regional Horticultural Research and Training Station, Bajaura (Kullu) w.e.f. 02.09.2016
54.	Dr ML Bhardwaj	Associate Director (R&E), Regional Horticultural Research and Training Station, Jachh
55.	Dr AK Joshi	Associate Director (R&E), Regional Horticultural Research and Training Station, Dhaulakuan (Sirmaur)
56.	Dr Pankaj Gupta	Associate Director (R&E) and Programme Coordinator, Regional Horticultural Research and Training Station and Krishi Vigyan Kendra, Sharbo (Kinnaur) upto 09.05.2017
57.	Dr DD Sharma	Associate Director (R&E) and Programme Coordinator, Horticultural Research and Training Station and Krishi Vigyan Kendra, Kandaghat (Solan)
58.	Dr Rajeev Raina	Programme Coordinator, Krishi Vigyan Kendra, Chamba
59.	Dr N S Kaith	Programme Coordinator, Krishi Vigyan Kendra, Rohru (Shimla)
60.	Dr Arun Kumar	Scientist-cum-Incharge, Regional Horticultural Research Sub-Station, Tabo (Lahaul & Spiti) upto 22.03.2017
61.	Dr Pankaj Gupta	Scientist-cum-Incharge, Regional Horticultural Research Sub-Station and KVK, Tabo (Lahaul & Spiti) (additional charge w.e.f. 23.03.2017)

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