

ANNUAL REPORT 2015-16



PR 121

PBW 725



**Punjab Agricultural University
Ludhiana**

2015-16



An illustrious alumni of PAU, Professor Manjeet Singh Chinnan presenting a cheque to Vice Chancellor of PAU, Dr Baldev Singh Dhillon to promote academics and sports in the University. He along with his wife has agreed to donate US\$ 1 lakh to PAU over a period of 10 years.



Dr G.S. Kalkat, Chairman, Punjab State Farmers' Commission, presiding over the Golden Jubilee celebrations of Green Revolution at PAU. He is flanked by Dr S.S. Johl, Chancellor, Central University of Punjab, Bathinda and Dr A.S. Khera, former Vice Chancellor, PAU.



Dr G.S. Kalkat, Chairman, Punjab State Farmers' Commission, inaugurating Dr Gurcharan Singh Kalkat Laboratories at PAU.

ANNUAL REPORT 2015-16



**Punjab Agricultural University
LUDHIANA**



This Annual Report covers the period from
July 1, 2015 to June 30, 2016

Editor
Sheetal Chawla


Photographs
Manjit Singh


Printed and Published by Additional Director of Communication,
for Punjab Agricultural University, Ludhiana in December 2016.


E-mail: adcomm@pau.edu

Website: www.pau.edu

We are also available at:

 Facebook: <https://www.facebook.com/pauldhpunjab/>

 Twitter: https://twitter.com/PAU_LDH

 Youtube: <https://www.youtube.com/channel/UCa3bxtjJAu3jUnUvV1BxhXQ>

CONTENTS

CRITICAL SUMMARY AND HIGHLIGHTS OF ANNUAL REPORT	5-9
RESEARCH	10-21
Crop Improvement	10
Biotechnology	13
Seed Technology	15
Crop Production Technologies	16
Crop Protection Technologies	17
Food Science and Technology	18
Post-Harvest Technologies	19
Subsidiary Occupations	19
Farm Mechanization	20
Agricultural Marketing	20
Home Science	20
Commercialisation of Technologies	21
EDUCATION	22-31
Admissions	22
Examination Cell	23
New Courses	24
Students' Academic Accomplishments	24
Scholarships and Financial Assistance	25
Convocation	26
Students' Welfare Activities	27
EXTENSION	32-37
Kisan Melas	32
Field Days	34
Adaptive Research Trials	34
On Farm Trials	34
Demonstrations	35
Trainings/Exhibitions	35
Skill Development Courses	36
Workshops	36
Farmers' Organizations	37



Plant Clinic/Technical Guidance	37
PAU Doots	37
COMMUNICATION AND MEDIA	38
Communication through Mass Media	38
Farm Publications	38
HUMAN RESOURCE, FINANCE AND INFRASTRUCTURE DEVELOPMENT	39-54
New Appointments, Promotions and Retirements	39
Awards, Distinctions and Recognitions	40
National and International Linkages	41
Important Events Organized at PAU	47
Finances	51
Estate Organization	52
Faculty Participation in National and International Events	52
New Equipments Acquired	53
New Laboratories and Infrastructure Created and Updated	53
M.S. RANDHAWA LIBRARY	55
IMPACT	56-58
ADMINISTRATION	59-63
Board of Management	59
Academic Council	61
Officers of the University	61
Important Decisions of Board of Management	62
Important Decisions of Academic Council	63
Publications	63
ANNEXURE – I (Estate Organization)	64
ANNEXURE – II (Publications)	65-87



CRITICAL SUMMARY AND HIGHLIGHTS OF ANNUAL REPORT OF PUNJAB AGRICULTURAL UNIVERSITY (July 2015 – June 2016)

The Punjab Agricultural University (PAU) is involved in research, teaching and extension activities in agriculture, agricultural engineering, basic sciences, home science and allied disciplines. During the period July 2015 to June 2016, the University made remarkable contributions.

RESEARCH

With research being the major mandate of the University, its main focus is on developing new crop varieties and their production, protection and processing technologies for enhancing productivity and profitability. A greater thrust is also on developing technologies to mitigate the effect of climate change, conserve natural resources and enhance input use efficiency. The salient achievements during the period under report are as under:

Crop Improvement

The University developed/recommended 26 varieties (9 of field crops, 10 of vegetable crops and 7 of flower crops) of different crops at the state level.

Wheat	PBW 677, PBW 725 and HD 3086
Rice	PR 126
Desi cotton	LD 949
Kharif moong	ML 2056
Raya	RLC 3
Sunflower	PSH 1962
Napier Bajra	PBN 346
Tomato	Punjab Gaurav, Punjab Sartaj and Punjab Red Cherry
Pea	AP-3
Pumpkin	PPH-1 and PPH-2
Brinjal	PBHR-41, PBHR-42 and PBHL-4
Garlic	PG-18
Chrysanthemum	Punjab Shyamli
Gladiolus	Punjab Glad-2
Sweet pea	Punjab Sweet Pea-1, Punjab Sweet Pea-2, Punjab Sweet Pea-3, Punjab Sweet Pea-4 and Punjab Sweet Pea-5



Varieties identified at national level

Four crop varieties, developed by PAU, have also been recommended at national level.

Soybean	SL 955
Summer moong	SML 1115
Cotton	LH 2256
Sugarcane	CoPb 92

- The University produced around 72,000 q raw seed (breeder, foundation and certified/TL) of different field crops, out of which, 3,595 q seed was produced through public-private partnership.
- Wild wheat and wild rice germplasm, consisting of 1400 and 1200 accessions, respectively, were screened for major wheat and rice diseases. Accessions with high level of resistance to yellow rust in wheat and sheath blight in rice were crossed with elite cultivars for transferring these genes to cultivated background. Heat tolerance QTL (quantitative trait loci) mapped in *T.durum* – *Ae. speltoides* introgression lines are being transferred to stripe rust resistant elite bread wheat lines using marker assisted selection (MAS).
- In rice, a novel brown plant hopper resistance gene from *Oryza nivara* has been mapped on chromosome 4 and MAS ready markers have been developed.
- Sugarcane transgenics for glucanase gene were evaluated for red rot resistance against isolate CF-08 and two plants were found to be resistant. Micropropagation was optimized in three peppermint collections and new sugarcane variety CoPb 92.

Crop Production Technologies

- The crop production technologies recommended include need-based N scheduling using leaf color chart (LCC) for basmati rice; and sowing of moongbean and arhar (in medium to heavy textured soils) on beds spaced at 67.5 cm (37.5 cm bed top and 30 cm furrow).
- Application of two sprays of salicylic acid @ 7.5 g/acre in 100 litres of water or KNO₃

(Potassium nitrate) enhanced the seed yield of berseem.

- In fruits, bud forcing technique for early nursery production of kinnow and a new propagation 'wedge grafting' technique in mango were developed.
- In vegetables, application of paddy straw mulch @ 25 q/acre in potato fields improved tuber yield and maintained soil health. Besides, application of biofertilizer + FYM (50% N) was found to be the best organic fertilizer, as it resulted in significantly higher microbial population and soil enzymatic activities, which consequently increased the NPK content of the soil and yield attributes of the potato crop.
- The use of *Consortium* biofertilizer @ 500 g/acre through seed treatment in maize obtained higher grain yield as well as better soil health.
- *Azorhizobium* based biofertilizer was recommended for the rice crop.
- In agro-forestry, wheat variety WH 1105 was identified for sowing in poplar plantations.

Crop Protection Technologies

- Green manuring with 60 day old crop of marigold was recommended for the management of root knot nematode in net houses.
- Based on weather prediction, a forewarning model for yellow rust of wheat was developed for timely management of the disease.
- In fruits, fixing PAU fruit fly traps @ 16 traps/acre in second and third week of May provided eco-friendly management of fruit flies in mango and plum orchards.
- Recommendations also include application of Amistar Top 325SC (azoxystrobin 18.2% + difenoconazole 11.4% SC for management of sheath blight and blast of rice; treating wheat seed with Raxil Easy (tebuconazole 6%) @ 13 ml/40kg seed or with Seedex 2DS @ 40 g per 40 kg seed for management of loose smut and flag smut; application of Mifpro-G and Mahaveer-GR (fipronil) @ 6 kg/acre and Mifap 4% GR (cartap hydrochloride) @ 10 kg/acre for

management of rice stem borer and leaf folder in *basmati* rice; application of Quinalmass 25EC (quinalphos) @ 800 ml/acre for management of rice planthoppers; application of Goldban 20EC (chlorpyrifos) @ 350 ml/acre for management of black bug in sugarcane; application of Thompson 25WG (thiamethoxam) @ 40 g/acre in 150 litres of water for management of cotton jassid; and application of Ulala 50WG (flonicamid) @ 80 g/acre, Lano 10EC (pyriproxyfen) @ 500 ml/acre and Craze 50WP (diafenthiuron) @ 200 g/acre in 150 litres of water for management of cotton whitefly.

- In vegetables, paddy straw mulch @ 100 q/ha immediately after planting of turmeric (organic) followed by one hand/spot weeding three months after planting (if needed) provided effective control of weeds.

Farm Machinery

During this period, farm engineers modified and developed several machines.

- The Happy Seeder machine was modified by attaching press-wheels for better crop performance.
- Lucky Seed Drill was developed for simultaneous application of pre-emergence herbicide along with sowing of wheat.
- A tractor PTO operated trail type Loose Straw Chopper was developed and is under final stage of evaluation.
- A prototype of tractor operated finger type Cotton Stripper was developed and evaluated on local cotton variety sown with high density planting system.

Post-Harvest Technologies

- Method for obtaining flour from sweet potato (PSP-21) was standardized, and used for preparation of nutritious convenience foods like cookies and extruded snacks, using cereal grains such as sorghum and maize.
- Technologies for preparation of sugarcane juice beverage using blend of different fruit juices; and for preparation of naturally fermented baby corn pickle preserved with spices and mustard

oil, were developed.

- Packaging of brinjal fruits in paper moulded trays followed by wrapping with shrink and cling film improved their shelf life for one week. Packaging of tomatoes in paper moulded trays followed by wrapping with shrink and cling film extended their marketing period for six days. Packaging of cabbage with shrinks and cling film extended its retail marketing period with acceptable quality for 15 days.
- Bacteriological Food Testing Kit, developed to detect nine pathogens in one go, was validated.
- Sugarcane vinegar production by semi-continuous fermentation was standardized at a commercial scale (500 L) in collaboration with the industry.
- Experiments were conducted to develop and evaluate iron rich maize based snacks, gluten free cookies and extruded snacks.

Other Technologies

- A low-cost hive for stingless bee (*Tetragonula iridipennis*), using a plastic pipe of 10 cm diameter and 45 cm length, was developed.
- Pollinators' visitations on sunflower blooms increased seed yield by 7-18 percent.
- *Pleurotus eryngii*, the king oyster mushroom, was cultivated successfully in Punjab.
- Alternative formulation for long method compost using diammonium phosphate (DAP), and coir pith based casing soil formulation with FYM (1:1, v/v) were recommended for button mushroom cultivation. Utilization of paddy straw for cultivation of button mushroom, paddy straw mushroom and 'dhingri' was also recommended.
- Multilayered winter clothing was developed for the elderly after studying their clothing needs and practices. Experiments were also carried out on the use of Arjun (*Terminalia arjuna*) dye, and replacement of guar gum (*Cyamopsis tetragonolobus*) by Cassia gum (*Cassia obtusifolia*) as natural thickening agent for printing on both cotton and silk fabrics with block and screen printing techniques.



EDUCATION

- During 2015-16, the University offered 10 Undergraduate programmes, 44 Master's programmes, 29 Doctorate programmes and one Diploma programme. A total of 3,882 students were enrolled during the academic year 2015-16. As many as 26 foreign students from countries like Afghanistan, Bhutan, Egypt, Maldives, Nepal, Nigeria, Tanzania and Uganda were admitted in different academic programmes of the University. Admissions to various undergraduate and postgraduate programmes were made through entrance tests.
- As many as 721 students in various programmes were awarded scholarships and financial assistance.
- At the Annual Convocation of Punjab Agricultural University on October 16, 2015, a total of 393 Ph.D. M.Sc., M.Tech., MCA, MBA, MBA (Agri-business) and MJMC (Journalism and Mass Communication) students received degrees. Seventeen students were awarded Medals and Gold Medals, and several others received Merit Certificates. Six members of PAU's faculty were conferred with plaque and cash prizes.
- Apart from this, two students bagged Jawaharlal Nehru Award (ICAR), two Prime Minister's Fellowship (Confederation of Indian Industry) and two International Travel Grants (Department of Science and Technology). One student each was awarded Monsanto Beachell Borlaug International Scholarship, Jeanie Borlaug Laube Women in Triticum (WIT) Early Career Award, and International Young Scientist Award (International Science Community Association, Union Ministry of Corporate Affairs, India).
- In sports and cultural activities, PAU teams won Gold and Silver Medals in different games during the XVI All India Inter-Agricultural Universities Sports and Games Meet, held at Tamil Nadu Agricultural University, Coimbatore on February 22-26, 2016. In addition, PAU awarded 57 Merit Certificates, 9 University Colour and 7Roll of Honour to the outstanding

sportspersons/artists of the University for their proficiency in sports, games, cultural and literary events.

- In cultural activities, students won Gold Medal in group song (Indian), Silver Medal in patriotic group song, and Bronze Medals in poster making and quiz events during the 16th All India Inter Agricultural Universities Youth Festival, organized by ICAR, New Delhi at Orissa University of Agriculture and Technology, Bhubaneswar (Odisha) from February 1- 4, 2016. The students also won Silver Medal in the installation event and Bronze Medals in debate, cartooning, rangoli and clay modeling events during the 31st Inter-University North Zone Youth Festival 2015-16, held at PAU from January 14-18, 2016.

EXTENSION

The University transfers new technologies to the farmers through various extension activities. During the period under report:

- It organized 14 *Kisan Melas* during September 2015 and March 2016. A large number of farmers from Punjab and adjoining states of Haryana, Himachal Pradesh, Jammu and Kashmir, and Rajasthan participated in these *melas*, discussed their farm problems with experts, purchased seeds and farm literature, and participated in produce competitions. Ten progressive farmers were honoured during PAU *Kisan Melas* at Ludhiana for their outstanding contributions to agriculture, horticulture and allied occupations.
- A total of 237 adaptive research trials were conducted at different locations to evaluate new crop varieties as well as production and protection technologies.
- As many as 2,356 front line demonstrations (FLDs) were conducted by all KVKs on improved varieties of oilseed crops (groundnut, sesame, *gobhi sarson*, *toria*, raya and sunflower), pulses (summer *moong*, *khair moong*, mash, soybean, gram and lentil), rice, *basmati*, cotton (American, *desi*, Bt and non Bt varieties), maize and maize fodder.
- Besides, 144 on-farm trials and 1,511 training

programmes were conducted.

- A Skill Development Centre in Agriculture at PAU, Ludhiana and a Food Industry Training-cum-Business Incubation Centre at Regional Research Station, Bathinda were established wherein several farmers and farm women were imparted trainings in food processing and other allied fields for skill development.
- Four Research and Extension Specialists' Workshops and one State Level Training and Planning Workshop were also organized.
- In addition, 232 field days were organized in different villages to promote new crop varieties, IPM in paddy, mechanical transplantation of paddy, use of Happy Seeder, nutrition garden, mushroom cultivation, etc.
- Technical guidance was also provided to 45,602 farmers in the office, field and through telephone helplines.
- The University enrolled 319 PAU *doots* in different villages of Punjab and about 98 advisory messages on various aspects of crop production and protection were sent to them. Till date, 5,109 farmers have been enrolled as PAU *doots*.

COMMUNICATION AND MEDIA

- The University coordinated with Doordarshan Kendra, Jalandhar for 557 TV talks and AIR, Jalandhar for 366 radio talks of PAU scientists.
- About 940 press releases (522 in English and 418 in Punjabi) were issued to various newspapers. About 165 articles (15 in English and 150 in Punjabi), authored by PAU scientists, were sent for publication in vernacular newspapers and magazines.
- The University published two monthly farm magazines namely *Changi Kheti* (in Punjabi) and *Progressive Farming* (in English). The combined circulation of these magazines has increased from 1,89,075 in 2014-15 to 2,17,985 copies (annually) in 2015-16.
- The Package of Practices for Crops of Punjab, twice a year, both in English and Punjabi were published. In addition, 16 farm publications in English and 9 in Punjabi were also brought out.

MEMORANDA OF UNDERSTANDING (MOUs)

To strengthen linkages with the national and international institutions/organizations, PAU signed six memoranda of understanding in 2015-16:

- Maharashtra State Seeds Corporation Limited, Akola, Maharashtra.
- International Crops Research Institute for the Semi-arid Tropics (ICRISAT), Patancheru, Telengana.
- Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur.
- Aston University, United Kingdom.
- M/s Nutech Dairy Engineers Pvt. Ltd., Ambala
- Agriculture Skill Council of India, Gurugram.

AWARDS AND HONOURS

- The Punjab Agricultural University was conferred with the coveted "Agricultural Leadership Award 2015." The Union Home Minister, Sh Rajnath Singh presented the award to Dr Baldev Singh Dhillon, Vice Chancellor, PAU, in a glittering ceremony, held in New Delhi on September 18, 2015.
- Dr Baldev Singh Dhillon, Vice Chancellor, PAU, was conferred with "Lifetime Achievement Award" by Punjab Academy of Sciences during the 19th Punjab Science Congress, held at SUS Institute of Engineering and Technology, Tangori, Mohali on February 7, 2016.
- Dr M.S. Bhullar (Agronomy) and AICRP-Weed Management (WM) team members bagged "Best AICRP-Weed Management Centre Award 2015-16" during 23rd Annual Review Meeting of AICRP-WM, held at Jalgaon, Maharashtra from April 28-30, 2016.
- The *Krishi Vigyan Kendra*, Bathinda won the "Best KVK Award 2015" from ICAR for accomplishing the mandated activities of KVK successfully.
- Many other faculty members brought laurels to PAU by bagging awards and honours at the national level.



RESEARCH

The Punjab Agricultural University (PAU) has been making consistent efforts and reorienting its research agenda in the field of agriculture and allied sciences to provide viable solutions to the emerging farm challenges. Recently, greater thrust has been laid on developing technologies to mitigate the effect of climate change, conserve natural resources and enhance input use efficiency for increasing agricultural productivity. To keep pace with the private sector, biotechnological tools such as marker assisted selection (MAS), transgenics, etc. have been integrated into crop improvement programme for precision breeding. Further, doubled haploid technology is being applied in wheat, maize and rice to accelerate varietal development process. The facilities at Keylong (Himachal Pradesh), Cuttack (Odisha) and Hyderabad (Telangana) are also being used to advance generation during off season. Seed production of *moongbean* and maize hybrids has been enhanced through public-private partnership. Apart from developing new crop varieties and their production-protection technologies, focus is also being laid on post-harvest handling and processing to reduce post-harvest losses in vegetables and fruits.

The salient research achievements during the period under report are:



PBW 677

CROP IMPROVEMENT

Keeping in view the current agricultural challenges, crop improvement research has been reprioritized. More emphasis is being laid on breeding for abiotic and biotic stress tolerance as well as improving quality of the produce.

Varieties recommended at state level

During the period under report, PAU developed/recommended 26 varieties (9 of field crops, 10 of vegetable crops and 7 of flower crops) of different crops for cultivation in Punjab.

Field Crops

- **PBW 677 (Wheat):** It is a double dwarf variety recommended for cultivation under irrigated and timely sown conditions. It is resistant to yellow and brown rusts. Its average grain yield is 22.4 q/acre.
- **PBW 725 (Wheat):** It is a double dwarf variety released for cultivation under irrigated and timely sown conditions. It is resistant to yellow and brown rusts. Its average grain yield is 22.9 q/acre.
- **HD 3086 (Wheat):** It has been recommended for cultivation under irrigated and timely sown



PBW 725

conditions. It is a double dwarf variety that is resistant to yellow and brown rusts. Its average grain yield is 23 q/acre.

- **PR 126 (Rice) (Adhoc release):** It matures in about 123 days after seeding. It is resistant to 7 of the 10 presently prevalent pathotypes of bacterial blight pathogen in Punjab. The average paddy yield is 30 q/acre.
- **LD 949 (Desi cotton):** It produces an average seed cotton yield of 10 q/acre. It is tolerant to *Fusarium* wilt, whitefly, jassid, and bacterial blight. Its lint is suitable as absorbent cotton. It possesses ginning out turn of 40.1 per cent.
- **ML 2056 (Kharif moong):** It is resistant to yellow mosaic virus and gives grain yield of 4.6 q/acre. It has medium bold shining grains with good cooking quality.
- **RLC 3 (Raya):** It is a first canola quality raya variety with grain yield of 7.3 q/acre with 41.5 per cent oil content. It is tolerant to white rust.
- **PSH 1962 (Sunflower):** It is a hybrid that matures in 99 days and has an average seed yield of 8.2 q/acre. The oil content of this hybrid is 41.9 per cent.
- **PBN 346 (Napier Bajra):** It is a multi-cut, leafy variety with long, smooth, non-hairy and broad leaves. The fodder yield and silage quality of this variety is better than PBN 233. It yields 714 q/acre of green fodder.

Horticultural Crops

Vegetable Crops

- **Punjab Gaurav (Tomato):** The fruits are borne in clusters of eight to nine with 5.5% TSS and 4.9 mg/100g lycopene. It gives 247 q/acre early
- **Punjab Sartaj (Tomato):** This variety is tolerant to leaf curl virus and is suitable for protected cultivation under poly-net house. The fruits are borne in clusters of five to six with 5.7% TSS and 5.3 mg/100g lycopene. It gives 254 q/acre early (till end of March) and 898 q/acre total yield.
- **Punjab Red Cherry (Tomato):** The fruits are borne in clusters of 18-20 with an average fruit weight of 12 g. It gives 156 q/acre early (till end of March) and 437 q/acre total yield. It is tolerant to leaf curl virus and is suitable for protected cultivation.
- **AP-3 (Pea):** It is an early maturing variety. Each pod contains 7-8 seeds with shelling out turn of 50 per cent. The first picking can be done in



PSH 1962

(till end of March) and 934 q/acre total yield. This variety is suitable for cultivation under poly-net house.



Punjab Gaurav



Punjab Sartaj



Punjab Red Cherry



60-65 days, if sown in the second week of October. Its total yield is 31.5 q/acre.

- **PPH-1 (Pumpkin):** Its fruits are small, round, mottled-green at immature stage and mottled-brown at mature stage. Fruit cavity is small and flesh is golden yellow. It is extra-early in maturity and gives 206 q/acre yield.
- **PPH-2 (Pumpkin):** Its fruits are small, round, light green at immature stage and smooth-brown at mature stage. Fruit cavity is small and flesh is golden yellow. It is extra-early in maturity and gives 222 q/acre yield.
- **PBHR-41 (Brinjal):** The fruits are round, medium-large, shining, deep purple with purple green calyx. Its average yield is 269 q/acre.
- **PBHR-42 (Brinjal):** The fruits are oval-round, medium sized, shining, purple-black with green calyx. Its average yield is 261 q/acre.



PBHR-41



PBHR-42

- **PBHL-4 (Brinjal):** It is an early maturing F₁ hybrid of long group brinjal. The fruits are long, medium sized, shining and purple-black with green calyx. Its average yield is 267 q/acre.
- **PG-18 (Garlic):** Its bulbs are large (4.55 cm diameter), attractive and white with average bulb weight of 28.4 g. It has 38 per cent dry matter and 1.15 per cent allicin content. Its average yield is 51 q/acre.

Flowers and Ornamentals

- **Punjab Shyamli (Chrysanthemum):** It is a mid-season variety that requires 117 days for flowering. Flowers are pompon-type, purple with a deep purple center. The variety produces upto 49 flowers per plant and is suitable for cut flower purpose.
- **Punjab Glad-2 (Gladiolus):** The florets are bright yellow with 16 days vase life. It takes 93



Punjab Shyamli

days to flower and is suitable for cut flower production.

- **Punjab Sweet Pea-1 (Sweet Pea):** Its plants are tall and climbing. It has light green leaves and magenta flowers. It flowers in 102 days and duration of flowering is 42 days.
- **Punjab Sweet Pea-2 (Sweet Pea):** Its plants are tall and climbing. It has light green leaves and pink flowers. It flowers in 105 days and duration of flowering is 45 days.
- **Punjab Sweet Pea-3 (Sweet Pea):** Its plants are tall and climbing. It has dark green leaves

and maroon flowers. It flowers in 106 days and duration of flowering is 47 days.

- **Punjab Sweet Pea-4 (Sweet Pea):** Its plants are tall and climbing. It has dark green leaves and purple flowers. It flowers in 105 days and duration of flowering is 47 days.
- **Punjab Sweet Pea-5 (Sweet Pea):** Its plants are tall and climbing. It has light green leaves and cream flowers. It flowers in 106 days and duration of flowering is 48 days.

Varieties identified at national level

- **SL 955 (Soybean):** This variety has been identified for Northern Plain Zone (Punjab, Haryana, Delhi, Uttar Pradesh, Uttarakhand and Bihar). It is resistant to yellow mosaic virus (YMV) and soybean mosaic virus (SMV). Seeds contain 19 per cent oil and 39.0 per cent protein.
- **SML 1115 (Summer moong):** It has been identified for North Eastern Hill Zone (Manipur, Mizoram and Tripura) in 2015. It has medium size seeds with shining green colour and good cooking quality. It is resistant to mungbean yellow mosaic virus (MYMV), moderately tolerant to Web blight and Cercospora leaf spot.
- **LH 2256 (Cotton):** It has been identified for North Zone comprising states of Punjab, Haryana and Rajasthan. It has seed cotton yield of 2165 kg/ha. It has higher boll size (4.0 g), ginning out turn (34.9%) and 2.5% span length

(28.1 mm).

- **CoPb 92 (Sugarcane):** It is an early maturing variety recommended for cultivation in North West Zone (Uttar Pradesh, Uttaranchal, Haryana, Punjab and parts of Rajasthan). It is a good ratooner having 8.8 per cent higher cane yield than CoJ 64. It has higher level of resistance to red rot and lesser susceptibility to borer complex than the check varieties.

Germplasm strengthening

A large number of germplasm accessions in different crops have been procured from different parts of the country and abroad to strengthen the ongoing crop breeding programme. These include wheat (330), rice (532), maize (531), sesamum (100), groundnut (68), chickpea (1000), lentil (50), soybean (50), quinoa (25), fababean (50), pigeon pea (20), peach and nectarines (5), apple (5), walnut (2), persimmon (1), apricot (1), *jamun* (2), chilli (13), tomato (16), potato (10), cauliflower (2), brinjal (12), pea (2), cucumber (2), garlic (5), muskmelon (11), watermelon (5), pumpkin (5), bitter melon (3), onion (8), chrysanthemum (2), gladiolus (5), tuberose (2), marigold (2), rose (3) and gerbera (2).

Biotechnology

Field Crops

Wide hybridization, molecular breeding and genomics



CoPb 92



- Wild wheat and wild rice germplasm, consisting of 1400 and 1200 accessions, respectively, were screened for major wheat and rice diseases. Accessions with high level of resistance to yellow rust in wheat and sheath blight in rice were crossed with elite cultivars for transferring these genes to cultivated background.
- A leaf rust resistance gene, transferred from wild wheat *Aegilops peregrina*, has been fine mapped using a new technology known as RenSeq. The leaf rust and stripe rust resistance genes *Lr76* and *Yr70*, introgressed from *Ae.umbellulata*, have been fine mapped using the genome sequence information of wheat chromosome 5D and alien chromosome 5U.
- Heat tolerance QTL (quantitative trait loci) mapped in *T.durum* – *Ae.speltooides* introgression lines are being transferred to stripe rust resistant elite bread wheat lines using marker assisted selection.
- High grain weight has been transferred from different accessions of *Ae.tauschii* to wheat cultivars PBW 621 and PBW 550. The BC₃F₁ introgression lines with high grain weight were evaluated for yield component traits in replicated trials. The SNP markers associated with high grain weight have been identified in *Ae.tauschii* using genome wide association mapping (GWAS). These linked SNP markers are being validated in these introgression lines for further use in MAS.
- In rice, a novel brown plant hopper resistance gene from *Oryza nivara* has been mapped on chromosome 4 and MAS ready markers have been developed.
- A grain number QTL from *O. longistaminata* has been fine mapped on chromosome 2. The candidate gene sequence has been submitted at the National Center for Biotechnology Information (NCBI), a public repository of genome sequence information. This QTL is being mobilized to Punjab Basmati 3 through MAS for yield improvement.
- An improved version of PAU 201 (RYT 3388)

has been nominated for national trials.

- Novel alleles of a rice phosphorus use efficiency gene PSTOL, identified from *Oryza rufipogon*, are being transferred to PR 121.
- In maize, RIL population of I172 x I110 was phenotyped for waterlogging stress and data on morpho-physiological traits and yield contributing traits were recorded. The QTL identified for water logging are being fine mapped using maize genome sequence information. Major QTL for maydis leaf blight (MLB) have been mapped on chromosome 3, 8 and 9.

Transgenics and tissue culture

- Pigeon pea transgenics for *Cry1Ac* gene for pod borer resistance have been developed using *in planta* method in cv. PAU 881. *In vitro* insect bioassay for *Helicoverpa armigera* was carried out on six RT-PCR positive plants. In two T₂ transgenic plants, PAU 881-13 and PAU 881-21, 97.8 per cent larval mortality was observed on the pods and 100 per cent on leaves. The T₃ generation of these plants is being analysed for the presence of the gene and will also be evaluated for pod borer resistance.
- Sugarcane transgenics for glucanase gene were evaluated for red rot resistance against isolate CF-08 and two plants were found to be resistant. Bioassay for another isolate CF-09 is in progress.
- Micropropagation was optimized in three peppermint collections and new sugarcane variety CoPb 92.

Fruits

- Seven rough lemon transgenic plants with glucanase gene were screened for phytophthora resistance. Two plants have been found to be resistant which are being multiplied through micropropagation for replicated bioassays.
- Total transcriptomes from different tissues of six guava genotypes have been sequenced and data are being analyzed for identification of gene based markers, which will be used for mapping important quality traits in guava.

- Delayed bitterness gene encoding limonoid glucosyl transferase (LGT) from *kinnow* mandarin has been cloned and gene sequence of LGT has been submitted at NCBI. Expression studies of LGT are in progress.
- Direct organogenesis and plant regeneration have been optimized in W. Murcott and Daisy mandarins.

Seed Technology

- Seed production by PAU is undertaken at University Seed Farms located at Faridkot, Ludhiana, Nabha, Naraingarh and at various *Krishi Vigyan Kendras*. During the period under report, the University produced around 72,000 q raw seed (breeder, foundation and certified/TL) of different field crops, out of which, 3,595 q seed was produced through public-private partnership. The details are given in Table 1.
- Effect of pulsed electro-magnetic field (EMF) on seed quality enhancement in green gram (SML 668) was studied. Treatment with EMF of 50 Hz and 100 Hz enhanced seed quality in terms of seed germination (84 and 83.8%), seed vigor (2346.4 and 2385.6) and chlorophyll content (6.888 and 6.894 mg/g) over that in control (78%, 2014.5 and 4.363 mg/g), respectively. Seed storability was better as indicated by absence of insects in treated seeds as compared to 1.25 per cent in control, after eight months of storage.
- Studies were conducted to develop a simple, cost-effective and practical seed drying and storage technique using water absorbing desiccants and to determine its effect on seed quality during storage. Germination of seeds stored with the desiccant beads was 88 per cent

whereas it was 80 per cent in control. It was observed that seed storability was maintained after drying seeds with drying beads (which are made up of micro-porous material that is selective for water).

- A total 674 samples of various field and vegetable crops from University Seed Farms, Research Stations and other departments of the University were lab tested for physical purity and germination.
- For testing the genetic purity of nucleus and breeder seed of various field crops, field grow out test was conducted on 161 samples (76 during *Kharif* 2015 and 85 during *Rabi* 2015-16).
- Out of 700 samples of farmers' own saved wheat seeds, 63 (9%) samples had germination below Indian Minimum Seed Certification Standards. Karnal bunt infection ranging from 0.05-8.5 per cent was found in 486 samples and 191 (27.3%) samples failed Indian Minimum Seed Certification Standards due to >0.25% incidence.
- Three formulations of *Trichoderma harzianum* obtained from Anand Agricultural University, Anand; Govind Ballabh Pant University of Agriculture and Technology, Pantnagar; and Punjab Agricultural University, Ludhiana were tested (under ICAR National Seed Project) as seed bio-priming and soil application by mixing it with farm yard manure. The results of first year revealed that bio-priming of seed with PAU formulation of *Trichoderma harzianum* followed by soil application of *T. harzianum* amended farm yard manure, was the best treatment for reducing wilt and root rot. It reduced the wilt incidence by 75 per cent and root rot incidence by 60 per cent as compared to control.

Seed Production (Table 1)

Crops	Breeder seed (q)	Foundation seed (q)	Certified seed (q)	Truthfully labelled seed (q)	Total (q)
Field Crops	6,470	13,838	7,552	43,897	71,757
Vegetable Crops	228	1,871	6,167	654	8,920
Total	6,698	15,709	13,719	44,551	80,677

About 7,244 q seed of potato and 255 q seed of turmeric were produced by the University during 2015-16.



Crop Production Technologies

Field Crops

- Need-based N scheduling using leaf color chart (LCC) is recommended for *basmati* rice.
- In maize-wheat system, it is recommended not to apply P to both the crops for soil test- P status more than 16 kg/acre.
- In medium to heavy textured soils, sowing of *moongbean* is recommended on beds spaced at 67.5 cm (37.5 cm bed top and 30 cm furrow). Two rows should be sown on each bed at a spacing of 20 cm using the same quantity of seed, fertilizers and other cultivation practices as in flat sowing. Similarly, sowing of *arhar* in medium to heavy textured soils is recommended on beds spaced at 67.5 cm (37.5 cm bed top and 30 cm furrow). One row can be sown on each bed using the same quantity of seed, fertilizers and other cultivation practices as in flat sowing. Raised bed sowing not only saves irrigation water but also saves the crop from adverse effects of heavy rainfall.
- To enhance the seed yield of berseem, application of two sprays of salicylic acid or KNO_3 (Potassium nitrate) @ 7.5 g/acre in 100 litres of water at flower initiation and one week after the first spray is recommended.
- There is no need to apply urea to *basmati* rice, if the field has been green manured with 45-55 days old sunhemp/*dhaincha* or incorporated with summer *moongbean* straw (after picking of pods).
- In maize, the use of *Consortium* biofertilizer @ 500 g/acre through seed treatment is recommended for higher grain yield as well as better soil health.
- *Azorhizobium* based biofertilizer has been recommended for the rice crop.
- *In situ* paddy straw degradation was observed from the application of bacterial isolate *Delftia* spp after 120 days with increased yield of wheat crop.
- Bacteriocin producing *Rhizobium* spp in *moongbean* (*Vigna radiata*) was dual inoculated

with indicator strain (indicator +N8) to show a significant increase in number of nodules (24.3) over bacteriocinogenic isolates alone, indicator strain alone and uninoculated control.

- The cross sub-soiling before cotton sowing at 1m x 1m spacing gave significantly higher yield than no sub-soiling. It also had positive effects on root growth and root biomass production.

Fruit Crops

- Early nursery production of *kinnow* using bud forcing technique has been developed. It induces early scion bud break and faster growth of nursery of *Kinnow* and *Kagzi* lime, and also provides early saleable nursery plants.
- A new propagation technique 'wedge grafting' has been developed in mango. Mango can be propagated through wedge grafting from the end of July to the end of August on rootstock of same or higher diameter than the bud stick under open field or protected conditions.
- The field experiment on the management of fruit drop in *Kinnow* mandarin with foliar application of nutrients and plant growth regulators indicated a significant reduction in fruit crop (18.25% decrease over control) and increase in yield with three (mid-April, mid-June and mid-September) foliar applications of salicylic acid (10 µg/ml).

Agro-forestry

- Wheat variety WH 1105 has been identified for sowing in poplar plantations. This variety should be sown in the first fortnight of November for getting higher productivity.
- The fertilizer dose, timing and its method of application for clonal eucalyptus plantations, during different growth years, has been standardized for obtaining higher productivity.

Vegetable Crops

- Drip irrigation and fertigation schedules in pea saved 30 per cent of water, 20 per cent of NPK fertilizers and resulted in 30 per cent higher yield than the conventional method.
- Drip irrigation and fertigation schedules in turmeric saved 33 per cent of water, 20 per cent

of NPK fertilizers and increased yield by 25 per cent as compared to the conventional practice.

- Drip irrigation along with plastic mulch resulted in 70–106 per cent yield increase in brinjal, with approximately 50 per cent of water saving as compared to the conventional practice.
- Poor quality tubewell water can be used for irrigation in cyclic mode with canal water for obtaining optimum tuber yield of potato in light textured soils. Application of paddy straw mulch @ 25 q/acre in potato fields improved tuber yield and maintained soil health.
- Application of biofertilizer + FYM (50% N) was found to be the best organic fertilizer, as it resulted in significantly higher microbial population and soil enzymatic activities, which consequently increased the NPK content of the soil and yield attributes of the potato crop.

Crop Protection Technologies

Field Crops

- Green manuring with 60 day old crop of marigold is effective for the management of root knot nematode in net houses.
- Application of Amistar Top 325SC (azoxystrobin 18.2% + difenoconazole 11.4% SC) is recommended for the management of sheath blight and blast of rice.
- Based on weather prediction, a forewarning model for yellow rust of wheat has been developed using fundamental approach. This will help in timely management of disease in Punjab.
- The continuous monitoring of yellow rust during July to October in lower and upper hills/valleys of the neighbouring state (Himachal Pradesh) indicated that the disease started early in December 2015 and was managed by timely application of fungicides. Dryness and low rainfall in February also checked the disease to some extent. Maximum disease severity was reported at Ropar and Shaheed Bhagat Singh Nagar (40%) followed by that at Jalandhar, Pathankot and Kapurthala (30%); and Amritsar, Mohali, Ludhiana and Fazilka (10%) districts.

Traces of disease were also observed at Ferozepur, Mansa and Muktsar Sahib districts. Average disease severity in Punjab was recorded as 15.2 per cent.

- Treating wheat seed with Raxil Easy (tebuconazole 6%) @ 13 ml/40kg seed or with Seedex 2DS @ 40 g per 40 kg seed is effective for the management of loose smut and flag smut.
- Two sprays (first at boot stage and second after 15 days interval) with Nativo 75WG (tebuconazole + trifloxystrobin) @ 80 g in 200 litres of water per acre are recommended for the management of sheath blight and brown spot of rice.
- Endophytic actinomycete isolates, J-3-S1 and C-51-B exhibited the plant growth promoting (PGP) traits along with antifungal activity against *Rhizoctonia solani*, *Fusarium oxysporum*, *F. moniliforme* and *Sclerotium* sp.
- Application of Coragen 18.5SC (chlorantriliprole) @ 150 ml/acre is recommended for the management of early shoot borer in sugarcane.
- Application of Coragen 18.5SC (chlorantriliprole) @ 30 ml/acre at 10-15 days after germination is recommended for the management of maize stem borer.
- Application of Ulala 50WG (flonicamid) @ 80 g/acre, Lano 10EC (pyriproxyfen) @ 500 ml/acre and Craze 50WP (diafenthiuron) @ 200 g/acre in 150 litres of water is recommended for the management of cotton whitefly.
- Application of Thompson 25WG (thiamethoxam) @ 40 g/acre in 150 litres of water is recommended for the management of cotton jassid.
- Application of Mifpro-G and Mahaveer-GR (fipronil) @ 6 kg/acre and Miftap 4% GR (cartap hydrochloride) @ 10 kg/acre is recommended for the management of rice stem borer and leaf folder in *basmati* rice.
- Application of Quinalmass 25EC (quinalphos) @ 800 ml/acre is recommended for the management of rice planthoppers.



- Application of Goldban 20EC (chlorpyrifos) @ 350 ml/acre is recommended for the management of black bug in sugarcane.
- Application of Rippen 0.3GR (fipronil) @ 10 kg/acre at 45 days after planting is recommended for the management of early shoot borer in sugarcane.
- Application of post-emergence herbicide, Rice star 6.7EC (fenoxaprop) @ 400 ml/acre at 20 days after sowing is effective in controlling aerobic grasses in direct seeded rice.
- Post-emergence (10-12 days after transplanting) spray of Penoxsulam (Granite 240 SC) at 100 ml/ha is effective in controlling annual grasses, broadleaf weeds and sedges (mixed weed flora) in transplanted rice.
- Post-emergence application of Rice star 6.7EC (fenoxaprop) @ 400 ml/acre at 20 days after transplanting is effective in controlling grass weeds in puddle transplanted rice.
- Post-emergence application of Sulfosulfuron @ 13 g/acre, Metsulfuron @ 10 g/acre Sulfosulfuron + Metsulfuron @ 16 g/acre, Pinoxaden @ 400 ml/acre, Mesosulfuron + Iodosulfuron @ 160 g/acre and Carfentrazone-ethyl @ 20 g/acre 30-35 days after intercropping wheat in autumn sugarcane is effective in controlling annual weed flora.
- Application of Nominee Gold 10SC (bispyribac-sodium) @ 100 ml/acre 15-20 days after nursery (rice) sowing is effective in controlling mixed weed flora.
- Application of Almix 20WP (pre-mix of metsulfuron methyl 10% + chlorimuron ethyl 10%) @ 8 g/acre 20 days after transplanting is effective against sedges and broadleaf weeds in transplanted rice.

Fruit Crops

- Fixing PAU fruit fly traps @ 16 traps/acre in second and third week of May provides eco-friendly management of fruit flies in mango and plum orchards.
- Fruit flies, *Bactrocera dorsalis* and *Bactrocera zonata*, are recorded as new insect pests in mango and plum, respectively.
- Spray of 6.25 l MAK Horticulture Mineral Oil in 500 litres of water for one acre is recommended for the control of citrus psylla and citrus aphid.
- Spray of 160 g Dotara 25WG (Thiamethoxam) in 500 litres of water for one acre is recommended for the control of citrus psylla and citrus aphid.

Vegetable Crops

- Soil sterilization of nursery beds of tomato with Basamid @ 40g/m² is effective for the management of root knot nematode.
- Green manuring with 7-8 week old sunhemp or summer moongbean is effective for the management of potato scab.
- Paddy straw mulch @ 100 q/ha immediately after planting of turmeric (organic) followed by one hand/spot weeding three months after planting (if required) provides effective control of weeds.

Food Science and Technology

- Method for obtaining flour from sweet potato (PSP-21) has been standardized, and used for preparation of nutritious convenience foods like cookies and extruded snacks, using cereal grains such as sorghum and maize. These were found to have higher vitamin C, potassium and beta carotene contents.
- Technology for preparation of sugarcane juice beverage using blend of different fruit juices has been developed. The products have been prepared by using sugarcane juice (80%), kinnow juice (6%) and aonla juice (4%) along with lemon and ginger juice. This technology is ready for commercialization.
- Technologies for production of debittered beverage (using innovative naringinase) from citrus fruits (kinnow, grapefruit, kinnow-lemon and W. Murcott) and low alcoholic naturally carbonated beverage from Perlette grapes were developed.
- Technology for retention of colour and flavor, during the manufacturing of strawberry jam, has been standardized in collaboration with an industry, M/s Kulwant Nutritions, Batala

(Punjab).

- Technology for preparation of naturally fermented baby corn pickle, preserved with spices and mustard oil, has been developed in collaboration with M/s Field Fresh Pvt. Ltd., Ludhawal, Ludhiana (Punjab).
- Bacteriological Food Testing Kit, developed to detect nine pathogens in one go, was validated for one hundred food samples.
- Sugarcane vinegar production by semi-continuous fermentation was standardized at a commercial scale (500 L) in collaboration with the industry.
- Production of natural vinegar from Perlette grapes and red wine from Punjab MACS purple grapes was scaled upto 50 L.

Post-Harvest Technologies

- Packaging of brinjal fruits in paper moulded trays followed by wrapping with shrink and cling film improved their shelf life for one week.
- Packaging of tomatoes in paper moulded trays followed by wrapping with shrink and cling film extended their marketing period for six days.
- Packaging of cabbage with shrink and cling film extended its retail marketing period with acceptable quality for 15 days.
- Fully mature, light green and smooth skinned fruits of lemon cv. PAU Baramasi Lemon-1, harvested during first week of June, can be de-greened in 6-7 days at room temperature by dipping in 1250 ppm (31.25 ml/10 litres of water) ethephon solution for five minutes, followed by packing in corrugated fibre board (CFB) boxes with paper lining for advance marketing of summer crop.
- The physiologically mature fruits of mango cv. Dusehri and Langra, packed in CFB boxes with paper lining, can be ripened at 25 °C in 4-5 days after harvesting. The fruits should be washed in chlorinated water @ 0.01% (sodium hypchlorite 4% @ 2.5 ml/litre) and dried under shade before packaging in CFB boxes.
- The physiologically mature fruits of pear cv.

Punjab Soft, dipped in calcium chloride (2%) for five minutes, can be stored for 60 days at 0-1°C and 90-95% RH after packing in CFB boxes with paper lining.

- Daisy fruits, harvested at colour break stage, develop an orange colour in 3-4 days after dipping in ethephon @1000 ppm for five minutes.

Subsidiary Occupations

Beekeeping

- Rescreening of selected *A. mellifera* colonies revealed that hygienic and non-hygienic colonies removed 88.3 and 49.4 per cent pin pricked dead brood, respectively, in 24 hours. Validation of these selected colonies, done by inoculating the brood with *Varroa* mites, revealed that hygienic and non-hygienic colonies took 33.4 and 51.8 hours, respectively, to achieve 100 per cent uncapping and cleaning of inoculated cells.
- A low-cost hive for stingless bee (*Tetragonula iridipennis*) using a plastic pipe of 10 cm diameter and 45 cm length was developed.
- Pollinators' visitations on sunflower blooms of various genotypes (DK 3849, SH 3322, PSH 569, PSH 1962 and PSH 996) increased seed yield/plant by 7-18 per cent.
- To minimize the pesticide toxicity to pollinators, the pesticide application should be done after 1 pm in bitter gourd, 3 pm in muskmelon and 5 pm in sponge gourd.

Mushrooms

- *Pleurotus eryngii*, the king oyster mushroom, has been successfully cultivated in Punjab.
- Alternative formulation for long method compost using diammonium phosphate (DAP) has been recommended for button mushroom cultivation under Punjab conditions.
- Coir pith based casing soil formulation with FYM (1:1, v/v) has been recommended for button mushroom cultivation under Punjab conditions.
- Strain evaluation of different mushroom varieties is a continuous process.



- Utilization of paddy straw for cultivation of button mushroom, paddy straw mushroom and 'dhingri' has been recommended.

FARM MECHANIZATION

- The Happy Seeder machine has been modified by attaching press-wheels to press the chopped straw, thrown by the flails of Happy Seeder in between the furrows. It forms thick uniform layer of mulch in the inter-row spaces. Before sowing of wheat with this modified machine, one operation of stubble shaver is required for cutting and spreading stubbles and loose straw. With this machine, the furrows remain uncovered from the straw mulch, resulting in better emergence, initial growth and development of the crop. Thick and uniform mulch cover also helps in reducing density and diversity of weed flora.
- Lucky Seed Drill has been developed for simultaneous application of pre-emergence herbicide along with sowing of wheat. Spray begins automatically as the sowing starts, and stops when the sowing gets completed. No planking is required after sowing with Lucky Seed Drill, as each tine of the drill is fitted with a metal chain that puts sufficient soil on the seed before the application of herbicide. Highest efficacy of herbicide (above 90%) was achieved with Lucky Seed Drill.
- A tractor PTO operated trail type Loose Straw Chopper has been developed and is under final stage of evaluation. The machine consists of a comb type pick-up conveyor for picking-up and conveying only the loose paddy straw into straw chopping unit. The straw chopping unit consists of a chopping cylinder, having serrated blades for chopping the loose straw into small pieces and uniformly spreading these in the field. The machine reduces chocking of Happy Seeder and enhances its capacity.
- A prototype of tractor operated finger type Cotton Stripper has been developed and evaluated on local cotton variety sown with high density planting system. Picking efficiency of the developed cotton stripper is about 90 per cent and trash content in the picked cotton in

about 20 per cent.

- Forced circulation solar dryer, installed previously at a farm in the village Kang Khurd, district Kapurthala, has been modified to improve its performance. The dryer now works only on solar energy. The electric energy required for running of 1 hp air blower is now supplied from solar photovoltaic panels. The air blower has also been modified to work on DC electricity.
- Technology of paddy straw bale combustor/ geyser for heating water at farmer's field has been recommended.

AGRICULTURAL MARKETING

- The studies on marketing behaviour and extent of participation of small and marginal farmers in modern milk marketing indicated that 62.3 per cent and 80.3 per cent milk marketed through the modern channel was from small and marginal farms, respectively. The age of dairy farmers, volume of milk produced, level of education of dairy farmers and land holding size greatly influenced the decision making towards participation in modern milk marketing chains. An effective way of involving small holders in modern milk marketing channels is to encourage them to organize themselves into cooperatives and self-help groups to improve their bargaining power and also generate economies of scale in acquisition of inputs, technology, services and information.

HOME SCIENCE

- Experiments were carried out to optimize printing conditions for Arjun (*Terminalia arjuna*) dye. The conventionally used guar gum (*Cyamopsis tetragonolobus*) was replaced by Cassia gum (*Cassia obtusifolia*) as natural thickening agent. These were fairly good for printing on both cotton and silk fabrics with block and screen printing techniques. Products such as cushion covers, coasters, wall hangings and trays were printed using optimized conditions. The study is at stage one. The products will be multiplied and sold during exhibitions.

- Cotton fabric was finished with microcapsules, developed using optimized concentration of essential oils namely Citronella, Eucalyptus and Rosemary, having mosquito repellent properties. The effectiveness of application of essential oils was best achieved at 10 per cent concentration. The microencapsulation method showed good mosquito repellent activity upto 30 washes. This work is at stage one. The mosquito repellent tests will be carried out on a larger group, and products will be sold at *Kisan Melas* and exhibitions.
- Multilayered winter clothing was developed for the elderly after studying the clothing needs and practices of 10 respondents (five males and five females) between the age of 65-70 years. Ten layers from different fabrics were prepared. Most preferred fabrics were the woven cotton wool blended fabrics and knitted cotton for layering. This study is at stage one. The multilayered winter clothing will be stitched and sold.
- The prevalence of depression and adjustment problems among the elderly revealed that elderly female experienced more physical problems whereas elderly male experienced more psychological problems. Elderly belonging to low socio-economic strata experienced more physical and psychological abuse and neglect as compared to elderly from

middle and high socio-economic strata whereas higher percentage of respondents from middle socio-economic strata experienced financial abuse. Prevalence of depression was found to be higher among elderly females belonging to low socio-economic strata.

COMMERCIALIZATION OF TECHNOLOGIES

- **Vegetable Varieties (2015):** The PAU has offered non-exclusive rights to M/s Kalash Seeds Private Limited, Jalna for producing and selling the seeds of chilli hybrid CH-27, brinjal hybrids PBH-3 and PBH-4, muskmelon hybrid MH-27 and onion variety PRO-6.
- **Multi Grain Flour (2015):** The PAU has licensed the formulation of multi grain flour to M/s Good Brands for a Healthy Life Private Limited, Pune on non-exclusive basis.
- **Multi Grain Instant Porridge (2015):** The PAU has granted rights on non-exclusive basis to M/s Harsh International Foods, Ludhiana for manufacturing and marketing of multi grain instant porridge.
- **Forced Circulation Solar Dryer (2015):** The PAU has offered non-exclusive rights to M/s Vishvkarma Solar Energy Corporation, Phillaur for manufacturing and selling of forced circulation solar dryer.

Patents Filed

Sr. No.	Year	Invention	Department	Application No.
1	2016	Modified PAU Fruit Fly Trap	Department of Fruit Science and Department of Entomology	Awaited
2	2016	Bacteriological Food Testing Kit (BFTK)	Department of Microbiology	Awaited
3	2016	Improvement and Evaluation of Filter for Canal Water Potability	Department of Soil and Water Engineering	Awaited
4	2016	Microencapsulation of Rosemary Oil on Cotton Fabric for Mosquito Repellency	Department of Apparel and Textile Science	Awaited



EDUCATION

Academic programmes of the University are run through its four constituent colleges at Ludhiana namely College of Agriculture (CoA), College of Agricultural Engineering and Technology (CoAE&T), College of Basic Sciences and Humanities (CoBSc&H), College of Home Science (CoHSc) and two Institutes of Agriculture at

Gurdaspur and Bathinda.

ADMISSIONS

During 2015-16, the University offered 10 Undergraduate programmes, 44 Master's programmes, 29 Doctorate programmes and one Diploma programme as per following details.

Programme	Number of seats		Number of students admitted	Number of students passed out
Class/programme	General & Reserved/ Additional	ICAR		
UNDERGRADUATE				
B.Sc. Agri. (Hons) 4-year	85	15	100	95
B.Sc. Agri (Hons) 6-year*	-	-	-	87
B.Sc. Agri (Hons) 6-year at Gurdaspur**	61	-	61	-
B.Sc. Agri (Hons) 6-year at Bathinda**	67	-	67	-
B.Tech. Agril. Engg. 4-year	78	11	89	44
B.Sc. (Hons) Home Science 4-year	42	8	44	34
B.Sc. (Hons) Home Science 6-year***	-	-	-	28
B.Sc. Nutrition & Dietetics 4-year	61	-	61	11
B.Sc. Biotech. (Hons) 4-year	54	9	63	43
B.Tech Food Tech. 4-year	56	9	65	28
B.Sc. (Hons) Fashion Designing 4-year	60	-	37	1
B.Sc. Interior Design 4-year	60	-	26	-
POSTGRADUATE				
M.Sc. Agriculture	132	33	165	235 in all M.Sc./M.Tech. programmes
M.Sc. Home Science	49	10	40	
M.Sc. Basic Sciences	107	23	100	
5-year Integrated M.Sc. (Hons)	90	-	90	
M.Tech	51	6	22	
Remote Sensing & Geographic Information System (GIS)****	15	-	-	
MBA	50	-	43	31
MBA Agribusiness	30	7	11	5
MCA	61	-	20	47
Ph.D.	137	12	111	73
Diploma course in Hybrid Seed	40	-	20	11

* Programme discontinued at PAU campus from 2014-15

** The students will study for first two years at outstations and then will be shifted to PAU, Ludhiana.

*** Programme discontinued from 2010-11

**** Programme suspended for 2015-16

EXAMINATION CELL

The Examination Cell under Controller of Examinations conducted entrance tests for admitting meritorious students to various academic programmes of PAU. Details are given below:

- Conducted Common Entrance Test (CET) for admission to B.Sc. Agri. (Hons) 4-year, B.Sc. Biotech, (Hons) 4-year, B.Tech Food Tech. 4-year, B.Sc. Agri. (Hons) 6-year, B.Sc. (Hons) Home Science 4-year, B.Sc. (Hons) Nutrition & Dietetics 4-year, B.Sc. (Hons) Fashion Designing 4-year, B.Sc. (Hons) Interior Design 4-year and 5-year Integrated M.Sc. (Hons) programmes in June 2016 for which 6,529 candidates applied for admission.
- Conducted 16 Masters' entrance tests for admission to M.Sc./MBA(AB)/MJMC/M.Tech programmes during May-June 2016 for which 1,215 candidates applied for admission.
- Conducted entrance tests for admission to 29 Ph.D. programmes during November 2015.
- Conducted written test for recruitment to the posts of Clerks on compassionate grounds on September 8, 2015 and April 11, 2016. For recruitment to the posts of Assistants at *Krish Vigyan Kendras*, a computer test was conducted on November 5, 2015. Besides, a written test for recruitment to the posts of Programme Assistants (Computer) was conducted on April 11, 2016 for 87 candidates. In addition, shorthand dictation test (Punjabi and English) for recruitment to the posts of Stereo Typists was conducted on May 18-19, 2016 for 211 candidates. The written test for recruitment to the posts of Senior Assistants and Clerks in Punjab Remote Sensing Centre (PRSC) was also conducted on April 11, 2016 for 109 candidates. Apart from this, the capability test (to use MS Excel and typewriting test in Punjabi) of the candidates who qualified in the written test was conducted on May 31, 2016. Also conducted six papers of Higher Standard Departmental Examination for PAU employees during September 2015 and April 2016. It organized a 10-day training programme for the candidates appearing in Higher Standard Departmental Examinations during February-March 2016.
- Helped in the conduct of Civil Services (Preliminary) Examination of Union Public Service Commission on August 23, 2015, by creating one Centre on PAU campus.



Students appearing for Common Entrance Test (CET) at PAU.



NEW COURSES

College of Agriculture

Course title	Course number	Credit hours
Production Technology of Economic Forest Trees	Forst.433	2+1
Principles and Practices of Silviculture and Agro-forestry	Forst.434	2+1
Forest Mensuration and Management	Forst.435	2+1
Fundamentals of Horticulture	Hort.103	1+1
Elementary Fruit Cultivation	Hort.51	2+1
Elements of Vegetable Cultivation	Veg.51	2+1

College of Basic Sciences and Humanities

Course title	Course number	Credit hours
Interactive Language Proficiency	Eng.201	0+1
Basic Plant Physiology	Bot.91	3+1
Plant Reproduction and Biotechnology	Bot.92	3+1
Introductory Biology	Bio.91	3+1
Cell Structure and Function	Bio.92	3+1
Genetics and Evolution/Biology III	Bio.93	3+1
Ecology and Environment	Bio.94	3+1
Introductory Inorganic Chemistry	Chem.91	4+1
Organic Chemistry-I	Chem.92	3+1
Fundamentals of Physical Chemistry	Chem.93	3+1
Organic Chemistry-II	Chem.94	3+1
Mechanics	Phys.91	4+1
Matter and Thermo Dynamics	Phys.92	4+1
Electricity and Magnetism	Phys.93	4+1
Optics, Nuclear and Electronics	Phys.94	4+1
Basics of Animal Physiology	Zoo.91	3+1
Animal Reproduction and Human Welfare	Zoo.92	3+1

STUDENTS' ACADEMIC ACCOMPLISHMENTS

College of Agriculture

- Manpreet Singh (L-2010-A-2-D) received "Jawahar Lal Nehru Award 2015" from the Indian Council of Agricultural Research, New Delhi, for his outstanding doctoral thesis research entitled "Dry seeded rice (*Oryza sativa* L.) productivity

and weed dynamics in relation to copper cropping, tillage and weed control."

- Hament Thakur (L-2014-A-44-D) and Ashok B. Jagtap (L-2014-A-17-D) bagged "Prime Minister's Fellowship 2016" each from the Confederation of Indian Industry (CII), New Delhi, for their doctoral research. Hament is working on "Genetics and molecular mapping of leaf curl virus disease resistance gene (s) in chilli pepper (*Capsicum annuum* L.) while

Ashok is working on the "Identification and characterization of high temperature stress responsive genes in maize (*Zea mays* L.)."

- Karaminderbir Kaur (L-2014-A-16-D) bagged "Monsanto Beachell Borlaug International Scholarship 2016" from the University of California, Davis, USA. She will carry out research on the "Development of an *in vivo* haploid induction system in rice using intergeneric crosses and manipulation of CenH3 gene."
- Mitaly Bansal (L-2011-A-50-D) was awarded "Jeanie Borlaug Laube Women in Triticum (WIT) Early Career Award 2016" for her excellent research achievements.
- Ashwani Kumar (L-2013-A-17-D) received "Dryland Cereals Scholarship 2015," administered by Asia-Pacific Association of Agricultural Research Institutions, Bangkok and funded by Consortium Group of International Agricultural Research. He will carry out research on the "Development of symbiotic drinks from finger millet and oats."
- Shikha (L-2014-A-56-D) and Ifran Khan (L-2013-A-90-M) were awarded International Travel Grants by the Department of Science and Technology (DST), Government of India, for presenting research papers during the XVIII International Plant Protection Congress (IPCC), held at Berlin, Germany from August 24-27, 2015. Shikha presented a research paper entitled "First report of mixed infection of zucchini yellow mosaic virus (ZYMV) and tomato leaf curl New Delhi virus (ToLCNDV) infecting bitter melon in Punjab, India" while Ifran presented a research paper entitled "Virus complex causing degeneration of cultivated allium species in North-Western India."

College of Basic Sciences and Humanities

- Rimaljeet Kaur (L-2010-BS-49-D) was conferred with "Jawaharalal Nehru Award 2015" by the Indian Council of Agricultural Research, New Delhi, for her outstanding doctoral thesis research entitled, "Characterization of

Helicoverpa armigera (Hubner) α -amylase and status of anti-oxidants in Pigeonpea, *Cajanus cajan* (Mills) Paugh).

- Ankita Thakur (L-2013-BS-83-D) participated in a 15-day sponsored training programme "SERB School in Entomology," organized by the Department of Science and Technology, New Delhi in Hyderabad from December 7-21, 2015.
- Amaninder Kaur (L-2012-BS-78-D) won "Best Poster Presentation Award" during the National Conference on "Medical and Life Sciences," held at Baba Farid University of Health Sciences, Faridkot from April 11-12, 2016.
- Ramadeep Kaur (L-2012-BS-79-D) got second best poster award during the National Conference on "Medical and Life Sciences," held at Baba Farid University of Health Sciences, Faridkot from April 11-12, 2016.

College of Home Science

- Vinita Pandey (L-2012-HSc-98-D) bagged "International Young Scientist Award" from International Science Community Association, Ministry of Corporate Affairs, India.
- Monika Choudhary (L-2010-HSc-78-D) received "Nestle Research International Young Scientist Award 2015" from Nestle Foundation, Gurugram, Haryana.

SCHOLARSHIPS AND FINANCIAL ASSISTANCE

College of Agriculture

- Twenty two students got ICAR-National Talent Scholarship, four ICAR-Senior Research Fellowship, 25 ICAR-Junior Research Fellowship, seven ICAR Fellowship (foreign student) and 21 Innovation in Science Pursuit for Inspired Research Fellowship (DST).
- Three students were awarded Monsanto Beachell Borlaug International Scholarship and four Monsanto Merit Fellowship.
- Four students received Rajiv Gandhi National Fellowship (UGC), 55 Post-matric Scholarship



(Welfare Department, Punjab), 30 Dr G.S. Khush Scholarship (PAU) and 188 PAU Merit Scholarship/Fellowship/stipends.

- Two students qualified UGC-Junior Research Fellowship/National Eligibility Test and two got Nepal Aid Fund (Department of Agricultural Research and Education-DARE).
- One student each was awarded UGC-Senior Research Fellowship, Department of Biotechnology (DBT)-Junior Research Fellowship and National Fellowship for Higher Education (UGC).
- Five students received Bharti Field Fresh Fellowship.

College of Agricultural Engineering and Technology

- Fourteen students were awarded ICAR-National Talent Scholarship, three ICAR-Junior Research Fellowship, two Rajiv Gandhi National Fellowship (UGC) and two Innovation in Science Pursuit for Inspired Research Fellowship (DST).
- One student qualified ICAR-National Eligibility Test and one got ICAR-Senior Research Fellowship.
- Seventeen students received Post-matric Scholarship (Welfare Department, Punjab), six Dr G.S. Khush Scholarship (PAU), 29 PAU Undergraduate Merit Fellowship (for B.Tech.), 15 PAU Merit Fellowship (for M.Tech., Ph.D.) and three got stipends.

College of Basic Sciences and Humanities

- Two students received ICMR Fellowship, eight UGC-Senior Research Fellowship and Junior Research Fellowship, two Council of Scientific and Industrial Research (CSIR)-UGC Junior Research Fellowship, and 10 Innovation in Science Pursuit for Inspired Research Fellowship (DST).
- Ten students were awarded Rajiv Gandhi National Fellowship (UGC), 11 Maulana Azad

National Fellowship (UGC), 17 Post-matric Fellowship (Punjab Government) and five Dr G.S. Khush Scholarship (PAU).

- A total of 91 students received PAU Merit Fellowship and 38 students got student aid fund.
- One student each was awarded ICAR-Senior Research Fellowship, ICAR-Junior Research Fellowship, Indian Council of Social Science Research (ICSSR) Fellowship, PG Indira Gandhi Scholarship (UGC), National Fellowship for OBC (UGC), Women Scientist Scholarship (UGC) and Bihar Samajya Kalyan Vibhagya Fellowship. One student qualified ICAR-National Eligibility Test.

College of Home Science

- Eleven students got Innovation in Science Pursuit for Inspired Research Fellowship (DST), two ICMR-Senior Research Fellowship, seven ICAR-Junior Research Fellowship and eight PAU Merit Fellowship.
- A total of 15 students qualified UGC-Junior Research Fellowship/National Eligibility Test.
- One student each was awarded ICAR-Senior Research Fellowship, Maulana Azad National Fellowship for Minority Students (UGC), National Fellowship for OBC (UGC) and USAID/Tanzania project (Ohio State University, USA).

CONVOCATION

- The Annual Convocation of Punjab Agricultural University was held on October 16, 2015. Prof. Kaptaan Singh Solanki, Former Governor of Punjab and Present Governor of Haryana, presided over the convocation while Dr Ved Prakash, Chairman, University Grants Commission, New Delhi, was the chief guest. During the convocation, a total of 393 Ph.D., M.Sc., M.Tech., MCA, MBA, MBA (Agribusiness) and MJMC (Journalism and Mass Communication) students received degrees. Besides, 17 students were awarded Medals and Gold Medals, and several other received



Professor Ramesh Chand, Member of NITI Aayog, Government of India, awarding a Merit Certificate to the PAU student during the Annual Convocation of the College of Agriculture, PAU.



Professor Kaptan Singh Solanki, Former Governor of Punjab and Present Governor of Haryana, presenting Doctor of Science degree (*honoris causa*) to Dr K.S. Gill, former Vice Chancellor, PAU, during Annual Convocation of Punjab Agricultural University.



Dr Ved Prakash, Chairman, University Grants Commission, New Delhi, delivering his convocation address at PAU.

STUDENTS' WELFARE ACTIVITIES

Important Sports Achievements

Inter-Varsity Tournaments

The PAU teams participated in the North Zone/All India Inter-Varsity tournament in Lawn Tennis (M), Cricket (M), Football (M), Table Tennis (M&W), Basketball (M&W), Swimming (M&W), Kabaddi (M), Cycling (M&W), Handball (M&W), Badminton (M&W), Volleyball (M), Hockey (M), Athletics (M), Shooting (M&W) and Weight Lifting (M).

University Level Tournaments

The teams from constituent colleges of PAU participated in Inter-College Tournaments for Volleyball (M), Basketball (M&W), Football (M), Swimming (M&W), Lawn Tennis (M), Handball (M&W), Hockey (M), Badminton (M&W), Weight Lifting (M), Cricket (M), Table Tennis (M&W) and Cycling (M&W). Karan Gakhar (CoA) was declared as Best Cyclist, Manjinder Singh (CoA) as Best Hockey Player, and Amritpal Singh (CoA) and Khushmanpreet Hanjhra (CoA) as Best Swimmers in men and women category, respectively.

Annual Athletic Meet

The 50th Annual Athletic Meet of PAU for the session 2015-16 was held at PAU Athletic Track on March 9-10, 2016. Japjit Singh (CoAE&T) and Pratishtha Verma (CoA) were declared Best Athletes in men and women category, respectively.

Merit Certificates. Six members of PAU's faculty were conferred with plaque and cash prizes. On the occasion, the Doctor of Science degree (*honoris causa*) was bestowed on Dr K.S. Gill, former Vice Chancellor, PAU.

- The Annual Convocation of the College of Agriculture, PAU was held on January 25, 2016. Professor Ramesh Chand, Member of NITI Aayog, Government of India, was the chief guest. A total of 421 students of B.Sc. Agri. (Hons), B.Sc. Biotechnology (Hons) and B.Tech. Food Technology (Hons) received degrees. Three students won University Gold Medals and seven students other medals. Three students won the Academic Roll of Honour while 79 students were awarded Merit Certificates. Twenty nine students of B.Sc. Agri. (Hons) 4- and 6-year programmes won prizes for having achieved academic distinctions during their degree programmes.



Students from constituent colleges of PAU participating in Annual Athletic Meet.

University Colour/Merit Certificates

The PAU Sports and Youth Activities Council in its 52nd meeting held on December 9, 2015 awarded 57 Merit Certificates, 9 University Colour and 7 Roll of Honour to the outstanding sportspersons/artists of PAU for their proficiency in sports, games, cultural and literary events for the session 2014-15. The students were awarded these honours during the 50th Annual Athletic Meet of the University.

Sports Coaching Camps

The Annual National Sports Organization (NSO) coaching camp was organized at PAU for the session 2015-16. As many as 179 trainees enrolled under NSO programme including officials attended the camp. Before participation of PAU teams in All India Inter Varsity/Inter Agricultural University Tournaments, a coaching camp of 15-20 days duration in respective games was also held in the University.

Sports Scholarships

The Sports Scholarship Committee in its meeting held on June 6, 2016 approved 10 sports scholarships of the value of Rs 350/- per month in four major and six minor games for the academic session 2015-16 to outstanding sportspersons for their proficiency in sports and games.

Outstanding Players

- The PAU teams won Gold and Silver Medals in different games during XVI All India Inter-Agricultural Universities Sports and Games Meet, held at Tamil Nadu Agricultural University, Coimbatore from February 22-26, 2016.
 - The Basketball (M) team won Gold Medal.

The team comprised students: Aalamdeep Singh (CoA), Harsimar Singh (CoAE&T), Gurjeet Singh (CoA), Harpreet Singh (CoA), Pukhraj Singh Brar (CoA), Karan Brar (CoA), Karan Bawa (CoA), Simarjeet Singh (CoA), Sawtanterpreet Singh (CoAE&T) and Hardeep Singh (CoA).

- The Badminton (M) team won Gold Medal. The team comprised students Guranjan Singh Matharoo (CoAE&T), Puneetinder Singh (CoA), Chanpreet Singh (CoA) and Amit Bhasin (CoA).
- The Volleyball (M) team won Gold Medal. The team comprised students Kamaljit Singh (CoA), Simarjeet Singh (CoA), Amanpreet Singh (CoA), Milapdeep Singh (CoA), Vikramjeet Singh Brar (CoA), Shehbaz Singh (CoA), Lovejeet Singh (CoA), Yograjdeep Singh (CoA) and Jatinder Singh (CoAE&T).
- The Badminton (W) team won Silver Medal. The team comprised students Harveen Kaur (CoHSc), Navdeep (CoA), and Gagandeep Kaur (CoBSc&H).
- Tejinder Pal Singh (CoA) won first position in shot put and third position in discus throw.
- Mehakpreet Kaur Randhawa (CoA) got first position in 1500M, second in 800M and third in 400M.
- Pratishtha Verma (CoA) bagged second position in 100M in athletics.
- Amanpreet Singh (CoA) got third position in Youth National Volleyball Championship, held at Nagpur from January 30 to February 5, 2016.

- Puneetinder Singh Grewal (CoA) and Harveen Kaur (CoHSc) won third position in North Zone Inter-State Senior Badminton Championship 2015-16 for Men and Women, held at New Delhi from October 27-30, 2015. Both the students represented the teams of Punjab.
- Amandeep Singh (CoA) bagged first position in Senior Punjab State Handball Men and Women Tournament, held at Sangrur from September 16-18, 2015.
- Arjun Singh (CoA) won first position in Senior State Hockey Championship, held at Kapurthala from October 30 to November 1, 2015.
- Parasdeep Singh (CoA) got second position in Senior Punjab State Handball Men and Women Tournament, held at Sangrur from September 16-18, 2015.
- Jagpal Singh (CoA), Barinderpal Singh (CoA) and Manveer Singh (CoA) bagged second position in Senior State Hockey Championship, held at Sangrur from October 30 to November 1, 2015.
- Aditi Sewak (CoHSc) got third position in 50th Punjab State Shooting Championship, held at PAP, Jalandhar from August 26-30, 2015.
- Puneetinder Singh Grewal (CoA), Chanpreet Singh (CoA), Guranjan Singh (CoAE&T) and Harveen Kaur (CoHSc) won second position in Inter District Team Championship in Men and Women Sections during Senior Open Punjab State and Inter District Badminton Championship, held at Patiala from November 3-6, 2015. The students represented Ludhiana district.
- The academic session 2015-16 witnessed transformation in NSS activities and structure. For proper coordination and developing leadership quality among students, a Students' Coordination Committee (SCC) was formed in the University. Under this, many volunteers extended their services to NSS after completion of two years of compulsory NSS course. Inspired by the programme, about 50 NSS volunteers participated in the North Zone Youth Festival (Goonj) from January 14-18, 2016 to maintain Help Desk Stall for guiding participating universities.
- A special seven-day camp on 'Campus Beautification' was organized from January 21-27, 2016.
- Seven NSS volunteers of the University participated in the 6th Conclave of *Bharatiya Chhatra Sansad*, held at Maharashtra Academy of Engineering and Educational Research's MIT (Maharashtra Institute of Technology) Campus, Pune from January 27-30, 2016.
- A special blood donation-cum-free blood group check-up camp was jointly organized by the Punjab Agricultural University, Dayanand Medical College and Hospital, Christian Medical College and Hospital, and Raghunath Hospital (CMC&H), Ludhiana on March 18-19, 2016. As many as 305 units of blood were collected and more than 500 farmers came for check-up and to know their blood group. Dr Aikaj Jindal, Blood Transfusion Officer, CMC&H, Ludhiana supervised the whole camp.
- An 'International Biodiversity Day' was jointly celebrated by the NSS Cell, PAU, National Biodiversity Authority and Punjab Biodiversity Board, Chandigarh on May 22, 2016. On this occasion, a technical session and poster making competition were organized.

National Service Scheme Activities

- Three NSS volunteers of PAU were conferred with 'Swami Vivekananda Youth Award' for their contributions to the society.
- Asish Kumar Padhy, an NSS volunteer, received a National Award from Indian Council of Agricultural Research (ICAR) and All India Agricultural Students' Association (AIASA) for his contributions to the agricultural society as a social worker.
- The NSS volunteers also participated in the 'World Environment Day' celebrations, organized by the Indian Society of Geomatics and Indian Ecological Society at Punjab Remote Sensing Centre, Ludhiana on June 5, 2016.
- An 'International Yoga Day' was celebrated by the NSS Unit on June 21, 2016.



- Awareness about HIV/AIDS, drug abuse, environment safety and biodiversity conservation was spread among the masses through banners, posters, distribution of pamphlets and interactions with the rural as well as urban people during *Kisan Melas* and in the form of rallies in the city. Special lectures on social issues like female foeticide, drug abuse, stress management, etc. were also organized.

Cultural Activities

- Independence Day and Republic Day were celebrated on August 15, 2015 and January 26, 2016, respectively. A large number of students, staff and faculty of the University participated in the celebrations.
- The PAU Inter-College Youth Festival was organized from November 27 to December 4,

2015. Nearly 400 students from constituent colleges and outstation institutes of PAU participated in the literary, fine arts, music, theatre and dance events. The overall running trophy was bagged by the College of Agriculture.

- The 31st Inter-University North Zone Youth Festival 2015-16 was jointly organized by the Punjab Agricultural University and Association of Indian Universities (AIU), New Delhi at PAU from January 14-18, 2016. A total of 29 Universities from North India with approximately 1200 students participated in this festival.
- A contingent of 40 PAU students participated in the 31st Inter-University North Zone Youth Festival 2015-16. The students won Silver Medal in the installation event and Bronze Medals in debate, cartooning, rangoli and clay



Republic Day and Independence Day being celebrated at PAU.



Students of PAU performing giddha and bhangra during Inter-College Youth Festival.



Dr Om Gauri Dutt Sharma, Deputy Director General, Doordarshan Kendra, Jalandhar, inaugurating the 31st Inter-University North Zone Youth Festival at PAU. modeling events.

- A PAU contingent participated in the Punjab State Inter-University Youth Festival, organized by Punjab Art Council, Chandigarh at Baba Banda Singh Bahadur Engineering College, Fatehgarh Sahib from January 21-23, 2016. The students won Gold Medal in traditional ladies songs; Silver Medals in slogan writing, cartooning, photography, debate; and Bronze Medals in one-act play, mono acting and *geet* *gazel*.
- A PAU contingent of 27 members participated in the 16th All India Inter Agricultural Universities Youth Festival, organized by Indian Council of Agricultural Research, (ICAR) New Delhi at Orissa University of Agriculture and Technology, Bhubaneswar (Odisha) from February 1- 4, 2016. The students won Gold Medal in group song (Indian), Silver Medal in patriotic group



Students from various Universities participating in group dance and cultural procession during 31st Inter-University North Zone Youth Festival at PAU.

- song, and Bronze Medals in poster making and quiz events.
- The installation team of PAU represented North India at 31st Inter-University National Youth Festival 2015-16, organized by the University of Mysore, Mysore, Karnataka from February 15-19, 2016. The University team won Silver Medal.



EXTENSION

The University undertakes the transfer of improved agricultural technologies to the farmers' fields through 15 Farm Advisory Service Centres (FASCs) and 17 *Krishi Vigyan Kendras* (KVKs) located in different districts and various departments; Agricultural Technology Information Centre (ATIC); and Advanced Centre of Training at *Kairon Kisan Ghar* (KKG) on the main campus. Technologies are transferred through various extension modes like *Kisan Melas*, field days, workshops, adaptive research trials, on farm trials, demonstrations, trainings (short, vocational and in-service), exhibitions, camps, campaigns, technical guidance, TV/radio talks, *Kisan Club/committee* meetings, agricultural publications and sale of farm literature. The University also plays a vital role in capacity building of farmers, farm women and extension functionaries in scientific farm technologies and practices, and subsidiary occupations through various training programmes.

KISAN MELAS

Kisan Melas play a key role in the dissemination

of improved knowledge among the masses. The farmers are acquainted with the new technologies through live demonstrations, exhibitions and technical sessions. The question-answer session during these *melas* addresses the queries of the farmers. A total of 14 *Kisan Melas* were organized during the period under report: seven *Kisan Melas* each were organized during the months of September 2015 and March 2016 at the main campus of PAU, Ludhiana; KVK *Rauni* (Patiala); KVK Nag Kalan (Amritsar); Regional Research Station (RRS) Faridkot; RRS Ballowal Saunkhri, RRS Bathinda and RRS Gurdaspur. A large number of farmers from the Punjab and adjoining states participated in these *melas*. Field demonstrations and elaborate exhibitions on improved varieties, production-protection technologies, mushroom cultivation, beekeeping, nutritional gardening, protected cultivation, etc. were organized for the farmers. The seeds of improved varieties of crops, vegetables and fodders; saplings of fruit plants and farm literature were also sold to the farmers in these *melas*. In addition, exhibitions on other farm inputs including fertilizers, pesticides, implements and farm machinery were also arranged.



Huge gathering of farmers at PAU *Kisan Mela* (Ludhiana) in September 2015.



Dr Baldev Singh Dhillon, PAU VC, apprising Dr Robert Thompson, former Assistant Secretary for Economics, Department of Agriculture, USA, of PAU developed fruit crop varieties (left).
Dr Christopher Gibbins, Counsel General of Canada in Chandigarh, who was the Guest of Honour at PAU Kisan Mela (Ludhiana) in March 2016, seeing experimental areas at PAU (right).



A farmer helping a rickshaw puller in carrying seed bags.

Awards to Progressive Farmers

The progressive farmers were honoured during PAU Kisan Melas for their outstanding contributions to agriculture, horticulture and allied occupations. During PAU Kisan Mela on September 25-26, 2015, four progressive farmers and one farm woman were honoured. S. Gurpreet Singh of village Mehraj (Bathinda) was conferred with Sardar Dalip Singh Dhaliwal Memorial Award; S. Jinder Singh of village Sandhuan (Ropar) with Parwasi Bharti Award; S. Gurdeep Singh of village Mehma Sawai (Bathinda) with Sardar Surjit Singh Dhillon Award; S. Harbans Singh of village Tarpai (Amritsar) with Sardar Ujagar Singh Dhaliwal Memorial Award; and Smt. Shehnaz of Model Town (Bathinda) with Sardarni Jagbir Kaur Grewal Memorial Innovative Woman Farmer



Ten progressive farmers, who were honoured at PAU Kisan Melas in September 2015 and March 2016, posing for group photos.



Award. During PAU *Kisan Mela* on March 18-19, 2016, S. Sohan Singh Bhanga of village Bishanpura (Sangrur) was conferred with "Chief Minister Award" for excellence in agriculture whereas S. Avtar Singh Ratol of village Saroud (Sangrur) was awarded "Chief Minister Award" for excellence in horticulture. Besides, S. Gurmail Singh of village Uchhagoan (Patiala); S. Harjit Singh of village Jhita Kalan, (Amritsar); and Mr Surinderpal Singh of village Dhingwali, Abohar (Fazilka) were honoured with "CRI Pumps Awards" for adopting improved water management techniques, farm mechanization and excellence in organic farming, respectively.

FIELD DAYS

Under the principle of 'seeing and believing,' the University holds field days in order to popularize improved technologies and practices among farmers. A total of 232 field days were organized in different villages to promote new crop varieties, IPM in paddy/*basmati*, mechanical transplantation of paddy, use of happy seeder, nutrition garden, mushroom cultivation, etc.

ADAPTIVE RESEARCH TRIALS

Adaptive Research Trials (ARTs) are conducted at farmers' fields under different agro-climatic conditions to test new technologies generated by the research system. A total of 420 ARTs were conducted at different locations to evaluate new crop varieties, and production and protection technologies. Based on these trials, a total of 93 recommendations were made, out of

which, 40 were of new varieties (12 field crops, 16 vegetables, 4 fruit crops and 8 flowers), 33 of production technologies and 20 of protection technologies.

ON FARM TRIALS (OFTs)

On Farm Trials are conducted to test a new technology/idea under farmer's field conditions alongwith PAU recommended practice and farmer's own practice. A total of 144 OFTs were conducted by the KVK scientists, out of which, some important OFTs are given as under:

Wheat: Comparison of various methods of sowing, evaluation of seed rate of wheat sown with Happy Seeder in heavy textured soils, impact of tank mix application of zincated urea on wheat yield and quality, and effect of phosphorus solubilizing bacteria on wheat productivity.

Paddy: Mechanical transplanter and direct seeded rice, effect of time of urea application on incidence of false smut in rice, testing of newly released insecticide Fame in comparison to Dursban for the control of stem borer and leaf folder, optimization of plant population in paddy/*basmati*, control of foot rot in *basmati*, seed treatment of *basmati* with *Trichoderma*, and effect of potash application in paddy.

Cotton: Evaluation of phosphorus requirement of Bt cotton crop sown after wheat and management of whitefly in cotton by using HMO (Horticulture Mineral Oil).

Maize: Use of tricho-cards for the control of maize borer and effect of biofertilizers on the yield.



Field Days on Non-Burning of Crop Residues and Paddy Straw Management being conducted by PAU's *Krishi Vigyan Kendra*, Mansa and Department of Extension Education, respectively.

Vegetables: Effect of potash and sulphur on yield and quality of onion, need based use of fungicides for management of late blight of potato, different techniques of cultivation of *kharif* onion, seed rate of early sown pea, weed control in pea, use of post-emergence herbicide in cauliflower nursery and plastic mulch effect on muskmelon.

Fruits: Effect of different methods of pruning on yield and quality of guava, effect of potassium application on fruit yield and quality of *kinnow*, control of fruit drop in *kinnow*, integrated management of guava fruit fly, and effect of different mulch materials on yield and weed growth in bearing orchards.

Animal Science: Effect of feeding mineral mixture and de-worming on production and reproduction performance in cross bred cows, prevention of mastitis in dairy animals, assessment of milking management practices of dairy animals and tick control in buffaloes.

DEMONSTRATIONS

For the promotion of crop production, protection and other improved agricultural technologies developed by PAU, demonstrations are conducted at farmers' fields and KVK farms. As many as 2,356 front line demonstrations (FLDs) were conducted by all KVKs on improved varieties of oilseed crops (groundnut, sesame, *gobhi sarson*, toria, raya and sunflower), pulses (summer *moong*, *kharif moong*, mash, soybean, gram and lentil), rice, *basmati*, cotton (American, *desi*, Bt and non Bt varieties),

maize and maize fodder.

The FLDs were also conducted on nitrogen management in paddy using leaf colour chart, control of foot rot in *basmati*, weed control in direct seeded rice, weed control in maize, management of stem borer/leaf folder in paddy and *basmati*, green manuring before paddy and *basmati*, use of paddy transplanter, management of maize borer using *Trichoderma harzianum*, use of fertilizer on soil test basis, mixed cropping of toria and *gobhi sarson*, use of biofertilizers in wheat, and amelioration of manganese deficiency.

Apart from this, demonstrations were carried out on nutritional gardening of summer and winter vegetable crops, turmeric cultivation, low tunnel technology for vegetable crops, orchard protection in summers, bulb set technique in *kharif* onion production, cultivation of rainy season tomato and broccoli, and fungicidal management of foot rot/gummosis in citrus.

In addition, field demonstrations of different straw management machinery namely Happy Seeder, Straw Chopper-cum-Spreader, Loose Straw Chopper, Reversible Mould Board Plough and Spatial No-till Drill were conducted at farmers' fields and farms of PAU/KVKs. Straw management machines were also demonstrated to the farmers at two-day *Kisan Mela*, organized at PAU, Ludhiana in September 2015 and March 2016.

A total of 955 method demonstrations were conducted on the collection of soil and water samples, use of LCC and tensiometer, seed treatment, *Rhizobium* inoculation in berseem/gram/peas/lentil, nursery raising of vegetables, beekeeping, mushroom cultivation, and different aspects of cooking and home management. Demonstrations on animal sciences were also carried out.

TRAININGS AND EXHIBITIONS

Trainings

The KVKs and Advanced Centre of Training at PAU campus organized 1,511 training programmes (1,074 short, 246 vocational, 130 in-service and 61 sponsored) for the farmers, farm women and extension functionaries to enhance their knowledge



Demonstration on direct seeded rice technique being given at PAU.



Farm women selling their food products after acquiring training from PAU.



Rural girls displaying tie and dye dupattas and cloth napkins after receiving training from PAU.

for increasing agricultural productivity and profitability. Vocational trainings were given on hybrid seed production, protected cultivation of vegetables, value addition to agricultural produce, precision farming, mushroom cultivation, apiculture, poultry, dairying, tie and dye, stitching and embroidery, preparation of pickle/*murabba*/ketchup and other kitchen recipes, etc. A total of 19,907 farmers, 8,495 farm women and 1,997 extension personnel participated in these training programmes.

The extension scientists also acted as resource persons in 757 farmers' training camps, organized by different line departments (Agriculture, Horticulture, Soil Conservation, IFFCO, KRIBHCO, etc.).

Exhibitions

Exhibitions are arranged during *Kisan Melas*, district level training camps, field days, scientific advisory committee meetings, technology week

celebrations, special days, etc. to create awareness among farmers about the use and benefits of improved/new technologies and practices. During the period under report, knowledge on newly developed improved varieties/hybrids of different field and horticultural crops, efficient nutrient management practices, integrated pest management practices and other plant protection technologies, improved crop production technologies, etc. was disseminated through models and charts. Besides, models of integrated farming system, drip irrigation, vermi-compost and kitchen gardening were displayed. Agro-processing and value addition in agriculture were also promoted by the sale of such products, prepared by KVK trained farmers/farm women and self-help groups.

SKILL DEVELOPMENT COURSES

A Skill Development Centre in Agriculture at PAU, Ludhiana and a Food Industry Training-cum-Business Incubation Centre at Regional Research Station, Bathinda were established. The skill development courses in food processing are being organized regularly at both the centres. The PAU Centre conducted seven training courses for baking technicians, craft bakers and tractor operators in which 144 trainees participated. The Food Industry Training-cum-Incubation Centre at RRS, Bathinda conducted 29 skill development courses in which 686 farmers and farm women participated. Besides, a 'Horticulture Supervisor Training Course' was organized at PAU, Ludhiana and KVKs Bathinda and Gurdaspur in which 52 trainees participated. Similarly, a 'Gardener Training Course' was organized at KVKs Bathinda and Gurdaspur, from which 53 trainees were benefitted. The skill training courses on 'Precision Agriculture' were conducted by the University (for 14 batches of 40 trainees each) with focus on drip fertigation and protected cultivation.

WORKSHOPS

Workshops are organized regularly by PAU in which the University Scientists and Extension Officers of line departments discuss results of latest technologies, developed by the University and finalize the Package of Practices for the farmers.



Dr Baldev Singh Dhillon, PAU VC, seeing fruit crops during "Research and Extension Specialists' Workshop on Vegetables, Floriculture and Sericulture along with Post-harvest Management, Farm Power Machinery, Food Technology and Agricultural Economics" at PAU.

Extension Officers also provide feedback of the farmers to the scientists about the challenges being faced in the field so as to find solutions to these challenges. During the year, five workshops were organized: four Research and Extension Specialists' Workshops on *Rabi* Crops (August 27-28, 2016); Fruits, Mushroom, Agro-forestry, Post-harvest Management, Food Technology and Agricultural Economics (January 20-21, 2016); *Kharif* Crops (February 24-25, 2016); Vegetables, Floriculture and Sericulture along with Post-harvest Management, Farm Power Machinery, Food Technology and Agricultural Economics (May 30-31, 2016); and one State Level Training and Planning Workshop for KVKs (March 3, 2016). A total of 1851 scientists and extension functionaries from the State Departments of Agriculture and Horticulture participated in these workshops.

FARMERS' ORGANIZATIONS

The meetings of various farmers' organizations were organized to share the latest technological

advancements in various disciplines. Ten monthly training camps for the members of PAU *Kisan* Club were organized in which 5,955 farmers and 562 farm women participated. In addition, 10 monthly training camps for the members of Progressive Beekeepers Association were also organized in which 489 farmers participated. Two meetings of the Tree Growers Association were organized in which 70 growers participated. Four training camps were organized for the members of Seed Producers and Nursery Growers Association, benefitting 205 farmers.

PLANT CLINIC AND TECHNICAL GUIDANCE

The PAU provides diagnostic services pertaining to various crop disorders including nutritional deficiencies and weed, pest and disease infestation in the field, vegetable, fruit, forest and ornamental crops, through Plant Clinic at PAU, KVKs and FASCs in different districts of the state. The extension scientists also provided technical guidance on different aspects of crop production and subsidiary occupations to 45,602 farmers in the office, field and through telephone helplines.

PAU DOOTS

The University enrolls farmers, having access to internet, as PAU *doots* for the transfer of technologies in their respective villages through public address system and other modes of communication. These *doots* are being sent 2-3 messages per week on various agricultural practices through e-mail for further spread to the fellow farmers. During the period under report, 319 *doots* were enrolled and 98 messages were sent to them. Till date, 5,109 farmers have been enrolled as PAU *doots*.



COMMUNICATION AND MEDIA

COMMUNICATION THROUGH MASS MEDIA

The Centre for Communication and International Linkages (CCIL) maintains a constant liaison with the print and electronic media including Doordarshan and AIR, Jalandhar to publicize the activities of the University. It issues press releases to different newspapers and news channels on regular basis. During the period under report, the Centre issued 940 press releases (522 in English and 418 in Punjabi). The Centre also sent 165 articles (15 in English and 150 in Punjabi), authored by PAU scientists, for publication in vernacular newspapers and magazines. The Centre provided TV coverage to different events and also produced 14 Kisan Mela reports for telecast from Doordarshan. It coordinated with Doordarshan Kendra, Jalandhar for 557 TV talks and AIR, Jalandhar for 366 radio talks of PAU scientists.

FARM PUBLICATIONS

The CCIL publishes two monthly farm

magazines *Changi Kheti* (in Punjabi) and *Progressive Farming* (in English). Both the farm magazines are printed in four colours on offset machines to maintain top quality. The combined circulation of these magazines has increased from 1,89,075 in 2014-15 to to 2,17,985 copies (annually) in 2015-16. The Centre also publishes *Package of Practices for Crops of Punjab*, twice a year, both in English and Punjabi. Besides, technical farm bulletins are published regularly on various crops and technologies. During the period under report, the Centre brought out 16 farm publications in English and 9 in Punjabi. Revised editions of *Package of Practices for Rabi and Kharif Crops* (in English and Punjabi), *Field Problems of Important Crops of Punjab* (in Punjabi), *Renewable Energy Biogas: An Ideal Source*, etc. were published by the Centre. In addition, new editions of *Agro-Processing, Storage of Food Grains - A Guide for Farmers, Handbook for Wise Purchase of Home Appliances, Nursery Production of Ornamental Plants, Rodent Pests: A Practical Guide for Management, Care and Maintenance of Farm Machinery*, etc. were brought out by the Centre.



Rush of farmers at PAU publications stall during Kisan Mela.



Farmers reading 'Package of Practices for Rabi Crops,' a highly sought after PAU publication.

HUMAN RESOURCE, FINANCE AND INFRASTRUCTURE DEVELOPMENT

NEW APPOINTMENTS, PROMOTIONS AND RETIREMENTS

New appointments

During the period under report, following new appointments were made. Besides, 39 Assistant Professors & equivalent and five Associate Professors & equivalent were directly recruited.

S.No.	Name	Appointed as	Date of appointment
1	Dr Baldev Singh Dhillon	Vice Chancellor	01.07.2015 (second term)
2	Dr Pardeep Kumar Khanna	Registrar	01.03.2016 (re-employed)
3	Dr Major Singh Dhaliwal	Additional Director of Research (Horticulture and Food Science)	09.09.2015 (AN)
4	Dr G.S. Buttar	Additional Director of Extension Education	19.01.2016 (AN)
5	Dr S.S. Kukal	Additional Director of Research (Natural Resources and Plant Health Management)	09.03.2016
6	Dr Swarndeep Singh Hundal	Head, Department of Zoology	20.07.2015 (AN)
7	Dr (Mrs) Tejpreet Kaur Kang	Head, Department of Human Development	11.08.2015
8	Dr (Mrs) Muninder Sidhu	Head, Department of Family Resource Management	01.10.2015
9	Dr Ajmer Singh Dhatt	Head, Department of Vegetable Science	03.11.2015 (AN)
10	Dr Jaswinder Singh Bhalla	Head, Department of Extension Education	18.11.2015
11	Dr Ranjit Singh Gill	Head, Department of Entomology	19.01.2016 (AN)
12	Dr (Mrs) Kiranjot Sidhu	Head, Department of Home Science Extension and Communication Management	21.01.2016
13	Dr (Mrs) Seema Bedi	Head, Department of Botany	03.02.2016
14	Dr Sukhjinder Singh Sidhu	Head, Department of Math. Stat. and Physics	13.02.2016
15	Dr Babu Singh Brar	Head, Department of Soil Science	29.03.2016
16	Dr (Mrs) Pratibha Goyal	Director, School of Business Studies	12.03.2016

Promotions and retirements

During the period under report, 49 Assistant Professor level teachers having grade pay of Rs 6,000 were placed in the grade pay of Rs 7,000/- in the pay scale of Rs 15,600-39,100; 48 Assistant Professor level teachers having grade pay of Rs 7,000 were placed in the grade pay of Rs 8,000/- in the pay scale of Rs 15,600-39,100; 4 Assistant Professors having grade pay of Rs 8,000/- in the

pay scale of Rs 15,600-39,100 were promoted/designated to the post of Associate Professor & equivalent in the grade pay Rs 9,000/- in the pay scale of Rs 37,400-67,000 and 78 Associate Professors having grade pay of Rs 9,000/- were promoted to the post of Professor & equivalent in the grade pay of Rs 10,000/- in the pay scale of Rs 37,400-67,000. A total of 29 teachers retired/resigned from the University service.



Faculty strength

Category	Sanctioned posts	Posts in position
State	1,056	483
ICAR	184	182
KVK	119	108
Others	23	18
Total	1,382	791

AWARDS, DISTINCTIONS AND RECOGNITIONS

- The Punjab Agricultural University was decorated with the coveted "Agricultural Leadership Award 2015." The Union Home Minister, Sh Rajnath Singh presented the award to the PAU Vice Chancellor, Dr Baldev Singh Dhillon in a glittering ceremony, held in New Delhi on September 18, 2015.



Dr Baldev Singh Dhillon, PAU VC, receiving "Agricultural Leadership Award 2015" from Sh Rajnath Singh, Union Home Minister. Also seen in the picture are senior officials of PAU namely Dr P.K. Khanna, Registrar (second from left); Dr Neelam Grewal, Dean, Postgraduate Studies (first from right); and Dr R.K. Gumber, former Director of Research (first from left).

Vice Chancellor

- Dr Baldev Singh Dhillon, Vice Chancellor, PAU was conferred with "Lifetime Achievement Award" by Punjab Academy of Sciences during the 19th Punjab Science Congress, held at SUS Institute of Engineering and Technology, Tangori, Mohali on February 7, 2016.

Dean, Postgraduate Studies

- Dr Neelam Grewal, Dean, Postgraduate Studies, was nominated as Member, Sectoral Committee on Accreditation, Education and Quality Reforms, Education Division, ICAR, New Delhi; Member, Panel of Experts to judge ICAR-NASI Award for Innovation and Research on Farm Implements of ICAR, New Delhi; Jury Member, Mahindra Samridhi Agriculture Awards 2015; and Advisory Member of UGC-DSR for Department of Clothing and Textiles, MS University of Baroda, Vadodara. She was also nominated as Member of the Committee constituted to give recommendations on issues related to competitive examinations conducted by Education Division for admission to Ph.D. programmes and award of ICAR-SRF (AICE-SRF) (PGS), ICAR, New Delhi.

College of Agriculture

- Dr Yadvinder Singh (Soil Science) got "Professor K S Bilgrami Memorial Prize 2015" from Indian National Science Academy, New Delhi.
- Dr H.S. Rattanpal (Fruit Science) was awarded "International Fellowship 2016" under Netherlands Fellowship Programme by Wageningen University, The Netherlands.
- Dr Beant Singh (Plant Breeding and Genetics) received "Rothamsted International Fellowship 2016" from Rothamsted Research, Harpenden, United Kingdom.
- Dr M.S. Bhullar (Agronomy) and AICRP-Weed Management (WM) team members bagged "Best AICRP-Weed Management Centre Award 2015-16" during 23rd Annual Review Meeting of AICRP-WM, held at Jalgaon, Maharashtra from April 28-30, 2016. Besides, with the collaborative efforts of AICRP-WM team and residents of Mansuran village in Ludhiana district, 'Mansuran' has achieved the distinction of being the 'First Parthenium free village of India.'
- Dr A.S. Dhatt (Vegetable Science) was conferred with "Harpal Kaur Memorial Prize 2016" by PAU.

- Dr MIS Gill (Fruit Science) got "Hans Raj Pahwa Award 2016" from PAU.
- Dr Harminder Singh (Fruit Science) was awarded "Sardar G.S. Nihal Singh Wala Award 2016" by PAU.
- Dr Parveen Chhuneja (School of Agricultural Biotechnology) got an "Award of Citation and Plaque 2016" from PAU for being the best researcher.
- Dr O.P. Choudhary (Soil Science) was awarded "Plaque and Merit Certificate 2015" by PAU for outstanding research, teaching and extension.
- Dr M.S. Hadda (Soil Science) bagged "Gold Medal 2016" from Soil Conservation Society of India, New Delhi.
- Dr Navtej Bains (Plant Breeding and Genetics) and Dr Amarjeet Kaur (Food Science and Technology) were conferred with "Manjeet Singh Chhinan Distinguished Professor Chair 2016" by PAU.
- Dr Gurpreet Singh Makkar (Plant Breeding and Genetics) bagged "Achiever Award 2015" from Dr Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan.
- Dr Kamaljit Kaur (Food Science and Technology) received first prize in "Oral Presentation" during International Conference on "Growing Trends in Food Technology and Nutrition for Public Health Care," held at Jawaharlal Nehru University, New Delhi in 2016.
- Drs Gaurav Kumar Taggar, Ravinder Singh and H.K. Cheema (Plant Breeding and Genetics) received "Best Poster Presentation Award" during Brain Storming Meeting on "Promotion of Pulses in Indo-Gangetic Plains of India," held at PAU on August 31, 2015.

College of Agricultural Engineering and Technology

- Dr Samanpreet Kaur (Soil and Water Engineering) got "Jawaharlal Nehru Award 2015" from ICAR, New Delhi for Best Ph. D. Thesis. Her research work entitled "Modelling the impact of climate change on groundwater

resources in Central Punjab" was carried out under the guidance of Dr K.G. Singh.

- Dr K.G. Singh (Soil and Water Engineering) was conferred with "Manjeet Singh Chhinan Distinguished Professor Chair 2015" by PAU.
- Dr K.B. Singh (Soil and Water Engineering) bagged "Best Oral Presentation Award 2015" from Indian Society of Soil Conservation.

College of Basic Sciences and Humanities

- Dr Sukhpal Singh (Economics and Sociology) was nominated as Member, Sub-group on Farmers' Indebtedness and Suicide by Punjab Government Reforms Commission in 2016. Besides, he was appointed as Vice-President of Indian Society of Agricultural Economics in 2015.
- Dr Baljinder Kaur Sidana (Economics and Sociology) received "Dr N. A. Mujumdar Prize Award 2015" from Indian Society of Agricultural Economics.
- Dr (Mrs) Param Pal Sahota (Microbiology) was conferred with "Manjeet Singh Chhinan Distinguished Professor Chair 2016" by PAU.
- Dr S. Kapoor (Microbiology) got an "Appreciation Certificate 2016" from PAU.

Directorate of Extension Education

- The *Krishi Vigyan Kendra*, Bathinda won the "Best KVK Award 2015" from ICAR for accomplishing the mandated activities of KVK successfully.
- The *Krishi Vigyan Kendra*, Patiala received "Dr G.S. Khush Team Award 2014-15" for technology transfer.

NATIONAL AND INTERNATIONAL LINKAGES

Memoranda of Understanding (MoUs) signed

During the period under report, PAU signed six MoUs with various national and international



organisations:

- Agriculture Skill Council of India, Gurugram, Haryana on September 10, 2015 for the training programme aiming at developing qualification packs as per national skill qualification frame work. It also focuses on creating Skill Development Centre for training and capacity building across various segments of agriculture.
- Maharashtra State Seeds Corporation Limited, Akola, Maharashtra on October 31, 2015 for seed production of maize hybrids.
- Aston University, United Kingdom on November 5, 2015 to develop academic research cooperation.
- M/s Nutech Dairy Engineers Pvt. Ltd., Ambala on January 18, 2016 to fabricate portable maize grain dryer.
- International Crops Research Institute for the



The Punjab Agricultural University, Ludhiana, signing MoU with the Maharashtra State Seeds Corporation Limited, Akola, Maharashtra.



The Punjab Agricultural University, Ludhiana, signing MoU with the Aston University, United Kingdom.

Semi-arid Tropics (ICRISAT), Patancheru, Telengana on February 17, 2016 to develop co-operation in research, particularly, breeding for resistance to shoot fly and stem borer in sorghum and pearl millet. It also focuses on academics and other agreed activities.

- Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur on April 30, 2016 to promote research, teaching, extension and technology commercialization as well as strengthen infrastructure support system.

Eminent Visitors

- A two-member delegation from Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Bangladesh, visited PAU on July 27, 2015 to exchange ideas on agricultural education system and improve course content of BSMRAU.
- A 38-member delegation from Kenya, Liberia and Malawi visited PAU on July 28, 2015 to acquaint themselves with the research and extension programmes of the University.
- A two-member delegation from the Embassy of the Kingdom of Belgium visited PAU on August 10, 2015 to explore collaborative areas. The delegation comprised H.E. Mr Jan Luykv, Ambassador of the Kingdom of Belgium and Mr Antone Delcourt, Counsellor, Economic Affairs, Embassy of the Kingdom of Belgium.
- A nine-member delegation from International Maize and Wheat Improvement Centre



Delegation from Kenya, Liberia and Malawi interacting with senior officials of PAU.



Delegation from International Maize and Wheat Improvement Centre (CIMMYT) seeing experimental areas at PAU.

(CIMMYT) visited PAU on October 5, 2015. The delegation was led by Dr Martin Kropff, Director General, CIMMYT.

- A two-member delegation of PUM Netherlands Senior Experts visited PAU on October 14, 2015 to explore the possibilities of collaboration between the two organizations. The delegation comprised Mr Jacques Eijkens, Country Coordinator, India, and Mr K.R. Jain, a representative of India.
- Prof. Clement Sankat, Pro Vice Chancellor and Campus Principal of St. Augustine Campus, The University of West Indies, Port of Spain, Trinidad and Tobago, visited PAU on November 3-4, 2015 to explore and discuss the scope of mutual cooperation.
- Dr Partap Khanna, Former Senior Principal

Research Scientist, CSIRO, Canberra, Australia, visited PAU on November 3, 2015 to deliver a talk on "Soil Carbon Sequestration - Processes, Assessment Methods and Limitations" during the 5th Dr N.P. Datta Memorial Lecture of Indian Society of Soil Science.

- A six-member delegation from Purdue University, USA, visited PAU on December 7, 2015 to deliberate on the establishment of "PAU-Purdue University Joint Research Centre," initiated with the agreement signed between PAU and College of Agriculture, Purdue University, USA, in August 2014. The delegation comprised Dr K.G. Raghothama, Associate Director, International Programmes in Agriculture; Dr G S. Johal, Professor, Botany and Plant Pathology; Dr Mitch Tuinstra, Professor of Agronomy and three Ph.D. students namely Megan Fenton, Brad Thada and R.S. Khangura.
- A 17-member AGRI PASS Group from France visited PAU on January 15, 2016 to study agricultural scenario of Punjab, and have an overview of PAU's research and extension programmes. The delegation was led by Thomas De Belle and Maryvonne Salaun.
- A Quinquennial Review Team visited PAU on February 2, 2016 to evaluate rapeseed-mustard.
- An eight-member delegation from Nepal visited PAU on February 25, 2016 as a part of policy



Delegation from Purdue University, USA, at PAU.



reform process to accelerate agricultural growth and enhance food security in Nepal. The delegation was led by Dr Yubak Dhoj, Director General, Department of Agriculture, Government of Nepal.

- Sh Suresh Kumar, Former Additional Chief Secretary, Punjab, visited PAU on March 5, 2016 to inaugurate Girls' Hostel.
- Sh Shivraj Chouhan, Chief Minister of Madhya Pradesh, visited PAU on March 6, 2016 to have an overview of the farm technologies being used by the Departments of Plant Breeding and Genetics, and Plant Pathology.



Sh Shivraj Chouhan, Chief Minister of Madhya Pradesh, seeing experimental areas at PAU. Also seen in the picture is Jathedar Tota Singh, Minister for Agriculture, Punjab.

- Dr Kuldip Kumar, Senior Environmental Soil Scientist, Metropolitan Water Reclamation District of Greater Chicago, USA, visited PAU on March 25, 2016 to interact with the postgraduate students, research fellows and faculty of the Department of Soil Science, PAU.
- Dr Manohar Singh Gill, Former Member of Parliament (Rajya Sabha) and Former Chief Election Commissioner of India, visited PAU on March 26, 2016 to lay the foundation stone of Girls' Hostel (west block), for which he donated Rs 60 lakh out of MPLAD fund grants.
- A 22-member Afghan delegation, led by Hamid Halmadi, Advisor to President of Afghanistan, visited PAU on March 26, 2016 to deliberate on



Dr Manohar Singh Gill, Former Member of Parliament (Rajya Sabha) and Former Chief Election Commissioner of India, laying foundation stone of Girls' Hostel (west block) at PAU.

watershed management and seed certification.

- Dr N.K. Pathania, Former Director of Research, CSK Himachal Pradesh Krishi Viswa Vidyalaya, Palampur, visited PAU on March 30, 2016 to deliver a lecture on "Protected Cultivation of Vegetable Crops."
- Dr B.S. Ahloowalia, an Ex-Staff Member, Agriculture and Food Development Authority, Dublin, Ireland, visited PAU on April 4, 2016 to deliver a talk on "Punjab Agriculture and its Problems."
- Dr M.L. Chadha, Former Director, World Vegetable Center, Hyderabad (Regional Centre), visited PAU on April 17, 2016 to deliver a lecture on "Healthy Nursery Production of Vegetables."
- A 24-member delegation of German farmers visited PAU on April 21, 2016 to study agricultural scenario of Punjab.
- Dr V.C. Tomar, Vice-Chancellor, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur and Dr S.K. Rao, Director Research Services, JNKVV visited PAU on April 29, 2016 to interact with senior officials of PAU.
- Three senior scientists from Borlaug Higher Education for Agricultural Research and Development (BHEARD), Michigan State University, USA, visited PAU on May 17, 2016 to explore avenues to fund doctorate level studies of Bangladeshi students at PAU. The delegation was led by Dr Anne Schneller, Co-Director, BHEARD.



Dr Baldev Singh Dhillon, PAU VC, interacting with senior scientists of Borlaug Higher Education for Agricultural Research and Development (BHEARD), Michigan State University, USA.

- Sh Radha Mohan Singh, Union Minister for Agriculture, visited PAU on May 27, 2016 to highlight national agricultural scenario and schemes, started by the Central Government for the benefit of the farmers.



Sh Radha Mohan Singh, Union Minister for Agriculture, speaking at PAU.

- A four-member delegation from Ohio State University, USA, visited PAU on May 27, 2016 to develop mutual cooperation between the two institutions.
- An 11-member delegation from Agricultural Ministry of People's Republic of Angola visited PAU on May 27, 2016 to fortify linkages for the development of agricultural research, teaching and extension in Angola. The delegation was led by Eng. Afonso Pedro Canga, Minister of Agriculture, Angola.



Delegation from Angola seeing seeds of various crops at PAU.

Trainings and visits abroad

College of Agriculture

- Dr Satinder Kaur (School of Agricultural Biotechnology) visited John Innes Centre (JIC), Norwich, United Kingdom, to participate in the training programme on "RenSeq Technology for Cloning of Resistance Genes" from July 1 to September 2015.
- Drs P.S. Sandhu, Virendra Sardana, Pushp Sharma, Sarwan Kumar and Pankaj Sharma (Plant Breeding and Genetics) visited Saskatoon, Saskatchewan, Canada, to attend the "14th International Rapeseed Congress" from July 5-9, 2015.
- Dr Ritu Bala (Plant Breeding and Genetics) visited Kenya Agricultural Research Institute (KARI) Research Station, Kenya Njoro, Kenya, for a study on "Standardization of stem rust note taking and evaluation of germplasm with emphasis on emerging threats of yellow rust and leaf rust" from October 12-18, 2015.
- Dr S.K. Chauhan (Forestry and Natural Resources) visited Kasetsart University, Ubon Ratchathani, Thailand, to attend the "3rd Ayeyawadi - Chao Phraya - Mekong Economic Cooperation Strategy (ACMECS) Bioenergy Workshop on Future Development of ACMECS Bioenergy: Regional Plan and Standardization" from December 8-11, 2015.
- Mr Inderjit Yadav (School of Agricultural



- Biotechnology) visited Australian Centre for Plant Functional Genomics (ACPFPG), Australia, to attend a training programme on "In silico Identification of Candidate Genes Involved in Starch Synthesis in Wheat" from February 1-20, 2016.
- Dr Sandeep Jain (Plant Pathology) visited International Centre for Development Oriented Research in Agriculture, Wageningen, The Netherlands, to attend a training programme from February 29 to March 18, 2016.
 - Mr Hira Singh (Vegetable Science) visited Ohio Agricultural Research and Development Centre, Ohio State University, Wooster, USA to participate in the training programme on "Tomato Grafting" from March 13 to September 13, 2016.
 - Dr S.S. Kukal (Soil Sciences) visited Bangkok, Thailand, as Advisory Committee Member of Sustainable Rice Platform (UNEP) Fund Raising Strategy Workshop on March 24-25, 2016.
 - Dr G.S. Mangat (Plant Breeding and Genetics) visited International Rice Research Institute, Philippines, to attend Hybrid Rice Development Consortium (HRDC) meeting from March 30 to April 1, 2016.
 - Dr Asmita Sirari (Plant Breeding and Genetics) visited International Centre for Agricultural Research in the Dry Area (ICARDA), Rabat, Morocco, to attend an international training programme on "Food Legume Breeding" on April 11-12, 2016.
 - Dr H.S. Rattanpal (Fruit Science) visited Wageningen University, The Netherlands, to participate in the training programme on "Horticulture Sector Development in Emerging Markets" from May 9-27, 2016.
 - Dr Anirudh Thakur (Fruit Science) visited Hebrew University of Jerusalem's Rehovot, Israel, to attend an international training programme on "Bioinformatics and Biotechnology" from May 9 to June 7, 2016.
 - Dr Hari Ram (Plant Breeding and Genetics) visited Sabanci University, Istanbul, Turkey, to attend a project meeting of Harvest Zinc Collaborative Project from May 22-25, 2016.
 - Dr P.K. Chhuneja (Entomology) visited Slovenia and Hungary for exposure and training from May 29 to June 9, 2016.
 - Ms Amrinder Kaur (Plant Pathology) visited Centre for Development Innovation, Wageningen, The Netherlands, to attend a training programme from May 30 to June 17, 2016.
 - Dr Navneet Kaur (Forestry and Natural Resources) visited the University of Life Sciences, Prague, Czech Republic to present paper at the "7th International Congress on Weed Science" from June 19-25, 2016.
- ### College of Agricultural Engineering and Technology
- Dr V.P. Sethi (Mechanical Engineering) visited Gosling Research Institute of Plant Preservation, University of Guelph, Ontario, Canada, as a guest faculty to deliver a seminar on "New Hydroponics Technologies for Developing Countries" from August 14-23, 2015.
 - Dr Manjeet Singh (Farm Machinery and Power Engineering) visited Guangzhou, China, to deliver a keynote address at the "6th Asian Conference on Precision Agriculture" from November 14-23, 2015.
 - Er Ritesh Jain (Civil Engineering) and Er Chetan Singla (Soil and Water Engineering) visited UNESCO-IHE Institute for Water Education, Delft, The Netherlands, to attend a training programme on "Modeling of Wastewater Based Plant Systems" from April 18 to May 5, 2016.
 - Dr Preetinder Kaur (Processing and Food Engineering) visited Michigan State University, USA, for Post-Doctoral Fellowship from May to August 2016.
- ### College of Basic Sciences and Humanities
- Dr (Mrs) Param Pal Sahota (Microbiology) visited Windsor, Canada, to attend "Ontario Water Conference and Trade Show-16" from May 1-4, 2016.

IMPORTANT EVENTS ORGANISED AT PAU**College of Agriculture**

Event	Organizing/sponsoring agency
Summer School on "Entrepreneurship Development Programme" (July 8-28, 2015)	Department of Extension Education, PAU
Training programme on "Mendelian Genetics to Molecular Genetics in Relevance to Plant Breeding" (August 5-27, 2015)	Department of Plant Breeding and Genetics, PAU
Annual Group Meet on "Rabi Pulses (Chickpea & MULLaRP)" and "Brain Storming Meeting on Promotion of Pulses in Indo-Gangetic Plains of India" (August 31 to September 3, 2015)	Department of Plant Breeding and Genetics, PAU
A 10-day "4th National Training Workshop on Principles and Practices of Direct Seeded Rice" (September 22 to October 1, 2015)	CCS Haryana Agricultural University, Hisar and Punjab Agricultural University, Ludhiana under the aegis of Australian Centre for International Agricultural Research (ACIAR), Australia
Short course entitled, "Advances in Genetic Improvement in Vegetables through Conventional and Biotechnological Approaches" (January 1-10, 2016)	Department of Vegetable Science, PAU under the aegis of Indian Council of Agricultural Research, New Delhi
Basic Forest Guard Training (February 1 to March 31, 2016)	Department of Forestry and Natural Resources, PAU and State Forest and Wildlife Preservation, Punjab
Training programme on "Nursery Production, Crop Management and Post-Harvest Handling of Horticultural Crops" (February 15, 2016)	Department of Fruit Science, PAU
Training course on "Pre-harvest Factors Affecting Post-harvest Life of Vegetables" (March 3, 2016)	Department of Vegetable Science, PAU
Basic Beekeeping Training Course (May 2-4, 2016)	Department of Entomology, PAU under the auspices of National Horticulture Mission
"10th Annual Workshop on Monitoring of Pesticides Residues at National Level" and "24th Annual Workshop of All India Network Project on Pesticide Residues" (May 25-27, 2016)	Department of Entomology, PAU under the aegis of Department of Agriculture Cooperation and Farmers Welfare, Government of India, and Indian Council of Agricultural Research, New Delhi



Agricultural experts releasing a set of publications during Annual Group Meet on "Rabi Pulses (Chickpea & MULLaRP)" and "Brain Storming Meeting on Promotion of Pulses in Indo-Gangetic Plains of India" at PAU.



College of Agricultural Engineering and Technology

<p>"Northern Regional Convention for Water Users Associations on Participatory Irrigation Management" (August 25-26, 2015)</p>	Department of Soil and Water Engineering, PAU
<p>-Training course on "Straw Management and Minimum Tillage Machinery" (September 8-9, 2015) -Training course on "Machinery and its Safety for Different Farming Operations" (January 14-15, 2016) -Training course on "Custom Hiring of Farm Machinery" (June 6-7, 2016)</p>	Department of Farm Machinery and Power Engineering in collaboration with Directorate of Extension Education, PAU
<p>Seminar on "Up-scaling Energy Efficiency and Sustainable Practices in Agriculture Sector" (November 3-4, 2015)</p>	School of Energy Studies for Agriculture, PAU; Petroleum Conservation Research Association (PCRA) and PHD Chamber
<p>Training course on "Operation and Maintenance of Submersible Pumps and Electric Motors" (November 4-6, 2015)</p>	Department of Soil and Water Engineering in collaboration with Directorate of Extension Education, PAU
<p>-Training session on "Careers and Start-ups: Leadership Shows the Way" and "Personality Development of Budding Agricultural Engineers" (December 7, 2015) -Training session on "Way to go from Campus to Corporate" (March 2, 2016) -In-house training programme T2 on "Agricultural Engineering" (April 7 to May 23, 2016) -Training course on "Sales and Marketing, Dealership Set-up" through video conferencing session by the team of four experts from John Deere, Pune (May 12, 2016)</p>	Training Unit, College of Agricultural Engineering and Technology, PAU
<p>-Training course on "Agro- Processing and Value Addition Machinery" (December 8-10, 2015) -Training course on "Establishment of Agro-Processing Complexes" (February 9-11, 2016) -Training course on "Agro-processing Technologies" for HDOs/ADOs/KVKs (April 21-22, 2016) -Training course on "Establishment of Agro-based Industries at Small Scale Level" (May 16 to 20, 2016) -Training course on "Storage and Processing of Horticultural Products" (May 25 to 27, 2016)</p>	Department of Processing and Food Engineering in collaboration with Directorate of Extension Education, PAU
<p>Golden Jubilee Alumni Meet (December 19-20, 2015)</p>	Alumni Association, College of Agricultural Engineering and Technology, PAU
<p>Annual Review Meeting of AICRP on "Farm Implement and Machinery (FIM)" (January 28-30, 2016)</p>	Department of Farm Machinery and Power Engineering, PAU
<p>Online Video Conference on "Lipid Cane - New Sustainable Bio-Energy" (February 25, 2016)</p>	School of Energy Studies for Agriculture, University of Illinois, USA and College of Agricultural Engineering and Technology, PAU, Ludhiana



Sushri Uma Bharti, Union Minister for Water Resources, River Development and Ganga Rejuvenation, speaking at the inauguration of "Northern Regional Convention for Water Users Associations on Participatory Irrigation Management" at PAU.



Agricultural engineers seeing farm machinery during Annual Review Meeting of AICRP on "Farm Implement and Machinery" at PAU.



Dr Baldev Singh Dhillon, PAU VC, addressing the gathering at the Golden Jubilee Alumni Meet of the College of Agricultural Engineering and Technology, PAU.

College of Basic Sciences and Humanities

"75th Annual Conference of the Indian Society of Agricultural Economics" (November 19-21, 2015)	Department of Economics and Sociology, PAU
-Workshop on "Office Communication Skills" (January 19-25, 2016)	Department of Agricultural Journalism, Languages and Culture, PAU
-Workshop on "Journalistic and Creative Writing Skills" (February 26, 2016)	
One-day brainstorming session on "Strategies for Fostering Mushroom Production in Punjab" (February 25, 2016)	Department of Microbiology, PAU
Training programme on "Potato Seed Marketing Practices for Potato Seed Growers of Punjab" (June 9-10, 2016)	School of Business Studies, PAU



Agricultural stalwarts releasing a publication during the "75" Annual Conference of the Indian Society of Agricultural Economics" at PAU.



College of Home Science

Orientation course on "Effective Teaching, Research and Extension" (August 18 to 28, 2015)	Department of Home Science Extension and Communication Management, PAU
<ul style="list-style-type: none"> - Inter-College Salad Making Competition (September 2, 2015) - Inter-School Nutrition Quiz (September 3, 2015) - Training course on "Baking Techniques" (November 2 to December 18, 2015) - Training course on "Decorative Icings and Innovative Bakery Products" (December 12-13, 2015) - Training course on "Craft Baker" (March 1 to April 22, 2016) - Training course on "Fondants and Icings" (March 29, 2016) - Short Training Course on "Cooking and Baking" (June 27-July 1, 2016) 	Department of Human Development, PAU
Workshop on "Disability Rehabilitation: Issues and Challenges" (May 12-13, 2016)	Department of Food and Nutrition, PAU

PAU Science Club

<ul style="list-style-type: none"> - Orientation programme for newly admitted postgraduate students of PAU (August 13, 2015) - Interactive session by Dr Harjinder Singh Sandhu and Dr Swaran Singh Dhaliwal from West Virginia University, USA with PAU faculty for collaborative software product (yoCamp) (November 4, 2015) - ANVESHAN: Students' Research Convention (North Zone) of Association of Indian Universities for Undergraduate/Postgraduate students at ICAR-National Dairy Research Institute, Karnal (December 28-30, 2015) - Talk on "Entry of Nanotechnology in Agricultural Arena" by Dr (Ms) Madhuri Sharon, Director, Walchand Centre for Research in Nanotechnology and Bio-nanotechnology, Solapur, Maharashtra (January 19, 2016) - Lecture on "Communication and Presentation Skills" by Dr Priya Kanwar, Associate Professor, Department of Psychology, University of Delhi (February 1-2, 2016) - Talk on "Motivational Programme for Attaining Excellence in Science" by Dr P.K. Chhonkar, a renowned scientist, philanthropist and an Adjunct Faculty, Indian Agricultural Research Institute, New Delhi (February 3, 2016) - Lecture on "Addressing Agricultural Challenges through Technology" by Prof. Garry Fehr, Director, Agriculture Centre of Excellence, University of Fraser Valley, Abbotsford Campus, British Columbia (March 16, 2016) 	PAU Science Club
Management Development Programme on "Strategies for Enhancing the Performance of Research Managers of Punjab Agricultural University" (April 26-30, 2016)	National Academy of Agricultural Research Management (NAARM), Hyderabad and Education Technology Cell, PAU

FINANCES

The Board of Management in its 276th meeting held on March 28, 2016 approved the budget estimates of Punjab Agricultural University for the year 2016-17 amounting to Rs 57060.68 lakh in respect of 392 schemes in operation. The details of these schemes, budget allocation for research, teaching, extension and for the administrative and miscellaneous activities are as under:-

Sr. No.	Schemes	Total no. of schemes (2016-17)	Budget estimates (2016-17) (Rs in lakh)	Total no. of schemes (2015-16)	Budget estimates (2015-16) (Rs in lakh)
1	State Schemes				
i)	Non Plan Agriculture Schemes	13	233,97.75	12	200,46.09
ii)	Plan Agriculture Schemes	120	218,47.97	119	217,40.94
2	Rashtriya Krishi Vikas Yojana (RKVY)	-	-	1	20.25
3	ICAR Schemes (including AICRP/ KVK/ Adhoc and Central Assistance)	92	88,58.85	88	85,99.32
4	UGC Schemes	8	26.65	46	1,19.72
5	Centrally Sponsored Schemes	72	13,71.98	68	12,34.20
6	Other Schemes (including National Horticultural Mission/ Ratan Tata Trust/Misc. Schemes/Misc. (Foreign Contribution Schemes)	75	11,00.42	63	13,18.14
7	Self-financing Schemes	5	4,17.54	5	3,99.41
8	Revolving Fund Schemes	7	39.52	6	53.58
	Total	392	570,60.68	408	535,31.65

The Board of Management in its 270th meeting held on March 30, 2015 had approved the budget estimates of Punjab Agricultural University for the year 2015-16 amounting to Rs 53531.65-lakh in respect of 408 schemes in operation. The actual grants received during the financial year 2015-16 were Rs 40619.70 lakh. The University raised money through tuition fee and other sources/services. An amount of Rs 74,64.71 lakh was raised during the year 2015-16.

Sources	Grant received (2015-16) (Rs in lakh)	Allocation (%)
State Government		
Non Plan	13,265.30	32.7
Plan	16,000.00	39.4
ICAR Funding*		
All India Coordinated Research Project, <i>Krishi Vigyan Kendra</i> and others	7,203.15	17.7
Central Government Funding		
Centrally Sponsored Scheme (Govt. of India), University Grants Commission and <i>Rashtriya Krishi Vikas Yojna (RKVY)</i>	2,636.68	6.5
Foreign Contributions	194.15	0.5
Other Funding		
Misc./UT/Sir Ratan Tata Trust/Navaj Bhai Ratan Tata Trust/National Horticulture Mission Projects	1,320.42	3.2
Total	40,619.70	100

*Includes Rs 624.81 lakh for strengthening and development of PAU and Rs 78.00 lakh for strengthening of library services.



Allocation of funds for various activities

Budget allocation	As per budget estimates 2016-17		As per actual grant received 2015-16	
	Amount (Rs in lakh)	Allocation (%)	Amount (Rs in lakh)	Allocation (%)
Research	312,56.66	54.8	218,94.02	53.9
Teaching	121,28.24	21.2	82,86.42	20.4
Extension	76,45.69	13.4	58,49.24	14.4
General administration and others	60,30.09	10.6	45,90.02	11.3
Total	570,60.68	100	406,19.70	100

During the year 2014-15, the actual expenditure incurred was 49.66% on research, 23.36% on teaching, 14.31% on extension, and 12.67% on general administration and others.

ESTATE ORGANIZATION

Estate Organization looks after the construction and maintenance of University buildings. A total of 20 projects were completed by the Engineering Unit during the period under report. (Annexure I)

FACULTY PARTICIPATION IN NATIONAL AND INTERNATIONAL EVENTS

The University faculty participated in various national and international seminars, conferences, symposia, workshops, etc. Details are given below:

International participation

Name	Events	Date and Place
Drs Sandeep Singh and H.S Rattanpal (Fruit Science)	"V th International Symposium on Fig" by International Society for Horticultural Science (ISHS), Belgium	August 31 to September 3, 2015 Naples, Italy
Dr Poonam Sachdev (Food Science and Technology)	"4 th KCC 2016 Conference on Chemistry and Life Sciences"	March 20-22, 2016 Kuwait
Dr Dharminder Pathak (Plant Breeding and Genetics) and Dr Satnam Singh (RRS, Faridkot)	"World Cotton Research Conference-6" by International Cotton Advisory Committee, International Cotton Researchers' Association	May 2-6, 2016 Goiania, Brazil
Dr M.S. Bhullar (Agronomy)	"7 th International Weed Science Congress" by International Weed Science Society and Czech Weed Science Society	June 19-25, 2016 Prague, Czech Republic

National participation

Name of the College	No. of faculty members participated
College of Agriculture	102
College of Agricultural Engineering and Technology	35
College of Basic Sciences and Humanities	50
College of Home Science	25
Total	212

NEW EQUIPMENTS ACQUIRED

New equipments were acquired by constituent colleges of PAU.

Instrument/equipment	Cost (in lakh)	Utility
Microplate Reader	20.9	For analyzing SNP markers
Green House at Keylong Growth Chamber at PAU	16.3	For developing double haploid populations
Real Time PCR Machine	14.99	For studying expression of different genes
Gel Documentation System	14.41	For gel image capturing
IRGA-PS System, Ultra Compact Portable Photosynthesis	13.00	Photosynthesis analyzer
IRGA-PS	12.15	For measuring photosynthesis, stomatal conductance, leaf temperature etc
Microwave Digestion System	10.0	For research work of students
Evos FL Colure Imaging System	9.00	For recording and analyzing PCR profiles
Freeze Dryer	7.87	For low temperature drying
Bio Spectrophotometer	7.0	For DNA/RNA analysis
Canopy Analyzer	6.6	For agro-forestry experiments
Ultra Deep Freezer	6.5	For long term storage of samples
Stand Mixer Extruder	5.0	For cold extrusion
Total	143.72	

NEW LABORATORIES AND INFRASTRUCTURE CREATED AND UPDATED

College of Agriculture

- A conference room and two labs were established by the Department of Food Science and Technology in the Food Industry Centre (FIC) building.
- A Molecular Lab was established by the Department of Fruit Science.
- A plant growth chamber for vernalization and doubled haploid production, and two span field stores were constructed by the Department of Plant Breeding and Genetics.

College of Agricultural Engineering and Technology

- A PG lecture-cum-seminar room and a PG seminar-cum-committee room were established in the Departments of Mechanical Engineering, and Processing and Food Engineering, respectively.
- Infrastructural facilities in the Drawing Hall, Heat Technology Lab and Fluid Mechanics Lab were upgraded with the purchase of new equipment and instruments.
- The B. Tech. Computer Lab and SEEIT Examination Hall in the School of Electrical Engineering and Information Technology (SEEIT) were upgraded.
- A ducting cooling system was installed in the



Training Unit-cum-Examination Hall

College of Basic Sciences and Humanities

- A FIST (Funds for Infrastructure Development in Science and Technology) Lab was established in the Department of Zoology.
- The Department of Mathematics, Statistics and Physics purchased Gamma Reference Set, Beta Reference Set, Cathode Ray Osciloscopes and Hand Refractometer. It also fabricated

viscometer for honey.

College of Home Science

- The Analytical Lab in the Department of Food and Nutrition was renovated.
- Persian wheel was installed in the Museum of Rural Life of Punjab.
- The College also purchased LED lights, replaced photographs, and repaired electric points, wooden cabinets and dummies in the Museum.

M.S. RANDHAWA LIBRARY

Mohinder Singh Randhawa Library caters to the informational needs of the academia of Punjab Agricultural University (PAU) by keeping pace with digital technologies. It plays a vital role in supporting research, teaching and extension activities of the University. It renders automated services to its users in order to facilitate expeditious, exhaustive, easy and efficient access to the literature. The library made rapid progress and worked effectively during the period under report.

Membership

The library registered 2,402 members which include PAU students and staff. In addition, 12,966 books were issued to the library members during this period.

Documents procured and subscribed

During this period, the library procured 1,705 books, 305 theses and 334 Compact Discs (CDs). At present, the library is subscribing to 86 print journals (national and international) including 16 print plus online journals, 34 online journals and 12 online databases including 102 e-books. Thus, the total collection of library as on 30-06-2016 stands at 3,97,977.

Digitization

The library got 1,135 theses documents digitized which have been uploaded in PAU theses database and are accessible from the library web page.

Online services

The library is subscribing to 12 online databases, namely Consortium for e-Resources in Agriculture (CeRA) which provides access to online journals, Krishiprabha (online theses), Mylibrary (e-books), CRCnetBASE (e-books), EBSCO NetLibrary (e-books), ISO standards on Food Products (online standards), Business Source Elite (Bibliographic database and full text journals on Business Management), Commodities Database (Statistical information on agricultural



PAU students studying at M.S. Randhawa Library.

commodities), e-quest (online database of PAU theses), CAB Abstracts (Abstracting database on Agricultural Sciences), Food Science and Technology Abstracts (Abstracting database on Food Science and Technology) and Indiatat.com (statistical information).

New software purchased

In order to enhance the quality of research, library has been instrumental in procuring anti-plagiarism software TURNITIN for the University costing Rs 3,40,150/-. It aims at checking plagiarism in theses and other related research publications of the University.

Library web page

Library web page provides complete information about resources, rules and regulations, services, e-resources, list of print journals, circulars and new additions to library collection. All the e-resources like e-journals, e-books, e-theses, e-standards etc. are accessible campus wide from the web page. Only Indiatat.com database is accessible within the library.

Library usage

Books - 1,73,154; Theses - 40,345; Bound periodicals - 23,780; Current periodicals - 20,606; Abstracts and Indexes - 9,347; Newspapers - 2,382; Reference books - 14,623; Textbooks - 8,738 and Rare books - 2,055.



IMPACT

RESEARCH AND EXTENSION

- The PAU developed and released short duration high yielding rice varieties namely PR 121, PR 122, PR 124 and PR 126 during 2013-2016. Among these, PR 121 emerged as the most popular variety as it occupied 29 per cent of total parrmal area in 2016 against 17 per cent area in 2015. Considerable area was also under PR 124, a short duration high yielding variety. The rice variety PR 126 is an early maturing (123 days) variety. Cultivation of this variety besides giving high yield would also save water.
- Area under recommended short duration parrmal rice varieties increased from 42 per cent in 2014 to 54 per cent in 2015 and further to 63 per cent in 2016. Along with other technologies, this resulted in bringing down the rate of fall in ground water table.
- The wheat varieties PBW 725 and PBW 677 are resistant to stripe rust and leaf rust; their adoption will help in reducing the disease inoculum load, especially in the areas adjoining submontane regions. Moreover, the *chapatti* making quality of these varieties is also very good.
- Area under PAU recommended improved wheat varieties increased from 92 per cent in 2014-15 to 96 per cent in 2015-16.
- *Gobhi sarson* canola variety GSC-7 is highly favoured by the farmers and is being adopted very quickly. This variety meets international canola norms (<2% in erucic acid oil and < 30 μ moles glucosinolates per gram defatted meal) for oil and meal quality. RLC-3 is a first canola mustard variety having yield potential of 7.3 q/acre and meets the international standards for canola type. Now, Punjab farmers have options of canola type both in mustard and *gobhi sarson*.
- *Kharif moong* variety ML 2056 yields 10.7 per cent higher than the check variety and is resistant to yellow mosaic virus, leading to higher economic returns to the farmers.
- The new variety of Napier Bajra, PBN 346 gives good quality fodder, which will help in improving the milk yield.
- Punjab Gaurav and Punjab Sartaj are the first released indeterminate varieties of tomato for cultivation in poly-net houses under Punjab conditions. Due to their high yield, these varieties are able to compete with commercially released hybrids. Other improved varieties of vegetable crops include cherry tomato (salad purposes) and brinjal (PBHR-41, PBHR-42 and PBHL-4). The PBHL-4 has been identified for Bihar, Uttar Pradesh, Uttarakhand and Punjab.
- Less seeded mutant of *Kinnow* viz., PAU *Kinnow* 1, already released for commercial cultivation under Punjab conditions will solve the issue of seediness in *Kinnow* and improve the processing potential of the variety.
- The University produced around 72,000 q of raw seed of different field crops, out of which, 3,595 q was produced through public-private partnership. About 8,920 q of vegetable seed was produced for the farmers of the state. The University also produced 3,18,000 nursery fruit plants for distribution among farmers of Punjab.
- Bud forcing in *Kinnow* and *Kagzi* lime nursery plants, a technique which induces early scion bud break and faster growth of nursery plants, will result in early saleability of nursery plants. Wedge grafting in mango will provide an additional method of propagation, which assures better survival of mango grafts. The technology of de-greening of lemon fruits using ethephon will advance the marketing period of lemon, helping farmers to fetch better price for their produce. Recommendation on safer ripening technique of mango fruits will solve the issue of use of harmful chemicals for ripening. Use of citrashine wax on *Daisy* mandarin will help in improving the appearance and maintaining the fruit quality during transit, storage and marketing for two weeks.
- Drip irrigation and fertigation schedules in

spring sunflower and turmeric are expected to increase the crop yield by 25 per cent apart from saving 40 per cent of irrigation water and 20 per cent of chemical fertilizers.

- Area under direct seeded rice, a water saving agricultural practice, increased from 79,564 acre in 2014 to 1,02,242 acre in 2015, mainly in Muktsar and Ferozepur districts.
- Use of biofertilizers in major crops is gaining popularity among the farmers of the state. Biofertilizer was sold for 6,000 acre wheat crop in 2015-16. *Consortium*, *Azorhizobium*, dual wheat biofertilizer application in different crops resulted in crop yield increase by 1-5 per cent apart from improving soil health. Use of *Rhizobium* and PGPR biofertilizer enhances crop yield by 7-13 per cent in different legume crops.
- By creating awareness among the farmers of the state about the use of recommended dosage of nutrients based on crop rotation, the consumption of NPK decreased from 102 kg/acre in 2012-13 to 88.4 kg/acre in 2014-15.
- The green manuring before *basmati* rice with 45-55 days old sunhemp/*dhaincha* or summer *moong* residues (after picking of pods) is expected to save urea fertilizer to the extent of 90-135 kg/ha.
- The management of fruit fly in mango and plum by fixing of PAU fruit fly traps @16 traps/acre, and control of citrus psylla and aphids by Horticulture Mineral Oil and Dotara sprays have resulted in considerable saving of insecticides in the orchards.
- The new Eucalyptus clones and their fertilizer requirement recommendation would help in enhancing the wood productivity and economic returns of the farmers. The ideal tree-crop combinations, and recommended agronomic and silvicultural practices would ensure higher productivity and income from agro-forestry systems, thus, increasing their adoption at farmers' fields.
- Web-based Advisory Service to the potato and wheat farmers for the management of late blight

and yellow rust will reduce fungicide use and increase net returns of the farmers.

- Modified Happy Seeder (PAU Happy Seeder), developed for efficient paddy straw management (enables normal and early growth of wheat), resulted in less lodging of wheat during this *rabi* season as compared to conventional method of sowing. About 400 farmers approached PAU to adopt direct drilling of wheat in paddy residues on their fields during 2016-17 wheat season.
- Area under paddy residue management technologies such as Happy Seeder sown wheat and Baler is increasing slowly but steadily. The coverage of Happy Seeder increased from 3,700 acre in 2014-15 to 8,025 acre in 2015-16 in Sangrur district (with the joint efforts of PAU and District Administration). Baler covered an area of 29,577 acre in 2015-16 as compared to 11,980 acre in 2014-15. It was primarily concentrated in those areas where paddy straw is used for power generation such as Mansa and Fazilka districts.
- The spraying cost for pre-emergence herbicides with Lucky Seed Drill (Rs 9,20/acre) is 11.5 times lower than the cost (Rs 102/acre) using conventional method. This is expected to reduce the input costs of the farmers.
- The pest surveillance coupled with recommended pest management technologies in south-west districts of Punjab resulted in saving of pesticides worth Rs 29 crore (Rs 2,268/ha).

EDUCATION

- The University bagged two coveted Prime Minister Fellowships, two Jawahar Lal Nehru Awards, one Monsanto Beachell Borlaug Fellowship and two International Travel Grants, which are testimony to the quality education, being provided by PAU to create a pool of very competent human resource, capable of taking up future agricultural research, education and extension.
- The University has been successful in attracting the rural youth towards agricultural



courses, with rural students constituting 50.8 per cent of the total students in different programmes.

- The trainings provided to the faculty through various summer/winter schools and Centre of Advanced Faculty Training (CAFT) programmes have updated their knowledge and skills, enabling them to address the future challenges in their respective domain in a more competent manner.

SKILL DEVELOPMENT

- Due to skill development trainings in subsidiary occupations, 976 new bee keeping units and 165 new units of mushroom production were started by the entrepreneurs. Enhancement in income of such units was about Rs 2,000 per bee box in case of stationary units and Rs 10,000 per unit of 10 q compost in case of mushroom production. Similarly, formation of Self-Help Groups helped in raising income of their members by Rs 1,000-1,500 per month

per member in case of hand embroidery and about Rs 5,000 per month per member in case of garment making.

COMMERCIALIZATION OF TECHNOLOGIES

- Various technologies generated by the University were also commercialized. These include offering of non-exclusive rights to private company for producing and selling seeds of vegetable crops; licensing the formulation of multigrain flour, multigrain instant porridge; and manufacturing and selling of forced circulation solar dryer.
- Four products and technologies were submitted for patenting. These include Modified PAU Fly Trap, Bacteriological Food Testing Kit, Improvement and Evaluation of Filter for Canal Water Potability, and Microencapsulation of Rosemary Oil on Cotton Fabric for Mosquito Repellency.

ADMINISTRATION**BOARD OF MANAGEMENT**

Sr.No.	Name and Designation	Period
Honorary Chairman		
	Sh Kaptan Singh Solanki Hon'ble Governor, Punjab & Chancellor	01.07.2015 to 30.06.2016
Working Chairman		
	Dr Baldev Singh Dhillon Vice Chancellor	01.07.2015 to 30.06.2016
Members		
1	Sh Sarvesh Kaushal, IAS Chief Secretary to Govt. of Punjab Chandigarh	01.07.2015 to 30.06.2016
2	Sh Suresh Kumar, IAS Addl. Chief Secretary (Development) to Govt. of Punjab Department of Agriculture, Chandigarh	01.07.2015 to 30.04.2016
	Dr N.S. Kalsi, IAS Addl. Chief Secretary (Development) to Govt. of Punjab Department of Agriculture, Chandigarh	01.05.2016 to 30.06.2016
3	Sh D.P. Reddy, Addl. Chief Secretary (Finance) to Govt. of Punjab Department of Finance, Chandigarh	15.06.2015 to 30.06.2016
4	Dr Mangal Singh Sandhu Director of Agriculture, Punjab SCO 83-84, Sector 34-A, Chandigarh	01.07.2015 to 31.10.2015
	Sh Jasbir Singh Bains Director of Agriculture, Punjab Kheti Bhawan, Phase - VI, Mohali	04.05.2016 to 30.06.2016
5	Dr R.K. Gupta, Director, Central Institute of Post-Harvest Engineering & Technology (CIPHET), PAU Campus, Ludhiana	01.07.2015 to 30.06.2016
6	Dr G.S. Nanda H. No.1142, Sector 71 Mohali-160071	01.07.2015 to 30.06.2016
7	Dr J. S. Kolar 35-B, Kitchlu Nagar Ludhiana	01.07.2015 to 03.07.2015



Sr.No.	Name and Designation	Period
	Dr S.S. Gosal Former Director of Research, PAU Opposite State Bank of India ATM Sugandh Vihar, Pakhowal Road, Ludhiana	08.07.2015 to 30.06.2016
8	S. Kulwant Singh Ahluwalia Village - Chhauni Kalan, P.O. Ram Colony Distt. Hoshiarpur	01.07.2015 to 30.06.2016
9	Sh Hardev Singh Riar Flat No. 314, Punjab Mandi Board Colony Sector 66, Mohali	01.07.2015 to 30.06.2016
10	Dr A.R. Sharma Chairman & Managing Director, Ricela Group of Companies Saron Road, Dhuri, Distt. Sangrur	01.07.2015 to 30.06.2016
11	Smt. Karamjit Kaur Danewalia VPO - Danewalia Satkoshi Tehsil - Abohar, Distt. Fazilka	01.07.2015 to 06.05.2016
Secretary		
	Dr P.K. Khanna Registrar	01.07.2015 to 30.06.2016

ACADEMIC COUNCIL

Designation	Name	Period
Vice Chancellor	Dr Baldev Singh Dhillon	01.07.2015 to 30.06.2016
Dean, Postgraduate Studies	Dr (Mrs) Neelam Grewal	01.07.2015 to 30.06.2016
Dean, College of Agriculture	Dr Harvinder Singh Dhaliwal	01.07.2015 to 30.06.2016
Dean, College of Agricultural Engineering & Technology	Dr Jaskaran Singh Mahal	01.07.2015 to 30.06.2016
Dean, College of Basic Sciences & Humanities	Dr (Mrs) Gurinder Kaur Sangha	01.07.2015 to 30.06.2016
Dean, College of Home Science	Dr (Mrs) Jatinder Kishitwaria	01.07.2015 to 15.02.2016
	Dr (Mrs) Gurinder Kaur Sangha	16.02.2016 to 30.06.2016
Director of Research	Dr Balwinder Singh	01.07.2015 to 31.05.2016
	Dr R. K. Gumber	01.06.2016* to 30.06.2016
Director of Extension Education	Dr Rajinder Singh Sidhu	01.07.2015 to 30.06.2016
Head, Department of Botany	Dr (Mrs) S.K. Thind	01.07.2015 to 31.01.2016
Director, School of Business Studies	Dr Sandeep Kapur	09.02.2016 to 12.03.2016
Head, Department of Microbiology	Dr (Mrs) Param Pal Sahota	15.03.2016 to 30.06.2016
Head, Department of Family Resource Management	Dr (Mrs) Muninder Sidhu	01.07.2015 to 30.04.2016
Head, Department of Apparel & Textile	Dr Sandeep Bains	01.05.2016 to 30.06.2016
Head, Department of Vegetable Science	Dr M.S. Dhaliwal	01.07.2015 to 08.09.2015
Head, Department of Food Science & Technology	Dr (Mrs) Amarjeet Kaur	26.09.2015 to 30.06.2016
Head, Department of Farm Machinery & Power Engineering	Dr Gursahib Singh Manes	01.07.2015 to 30.06.2016
Registrar, Secretary	Dr P.K. Khanna	01.07.2015 to 30.06.2016

* Additional Charge

OFFICERS OF THE UNIVERSITY

Designation	Name	Period
Vice Chancellor	Dr Baldev Singh Dhillon	01.07.2015 to 30.06.2016
Registrar	Dr P.K. Khanna	01.07.2015 to 30.06.2016
Director of Research	Dr Balwinder Singh	01.07.2015 to 31.05.2016
	Dr R.K. Gumber	01.06.2016* to 30.06.2016
Director of Extension Education	Dr Rajinder Singh Sidhu	01.07.2015 to 30.06.2016
Dean, Postgraduate Studies	Dr (Mrs) Neelam Grewal	01.07.2015 to 30.06.2016
Dean, College of Agriculture	Dr Harvinder Singh Dhaliwal	01.07.2015 to 30.06.2016
Dean, College of Agricultural Engineering & Technology	Dr Jaskaran Singh Mahal	01.07.2015 to 30.06.2016
Dean, College of Basic Sciences & Humanities	Dr (Mrs) Gurinder Kaur Sangha	01.07.2015 to 30.06.2016
Dean, College of Home Science	Dr (Mrs) Jatinder Kishitwaria	01.07.2015 to 15.02.2016 (FN)
	Dr (Mrs) Gurinder Kaur Sangha	16.02.2016* to 30.06.2016
Director Students' Welfare	Dr (Mrs) Ravinder Kaur Dhaliwal	01.07.2015 to 30.06.2016
Librarian	Dr Pritpal Singh Lubana	01.07.2015* to 30.06.2016
Estate Officer	Dr Vishavjeet Singh Hans	01.07.2015* to 30.06.2016
Comptroller	Dr Sandeep Kapur	01.07.2015* to 30.06.2016
Chief Engineer	Dr Jaspal Singh	01.07.2015* to 30.06.2016

* Additional Charge



IMPORTANT DECISIONS OF THE BOARD OF MANAGEMENT

During the period under report, the Board of Management held six meetings (272nd to 277th). The important decisions taken by the Board are as under:

A. Amendment in Statutes

- The Board approved the amendment in Clause 2(a) of Schedule Part-III of Chapter-V of PAU Statutes. C-1/273
- The Board approved the amendment in Clause 2(b) (ii) of Schedule Part-III of Chapter-V of PAU Statutes. C-2/273
- The Board approved the deletion of Schedule Part VI of Chapter V of PAU Statutes. C-1/275
- The Board approved the amendment in Clause 2(a) of Sr. No. 2 of Schedule Part-III of Chapter-V of PAU Statutes. C-1/276
- The Board approved the amendment in Clause 2(b), 2(b) (ii) and Note at the end of 2(b) of Sr. No. 2 of Schedule Part-III of Chapter-V of PAU Statutes. C-2/276
- The Board approved the amendment in Clause 6(2) and the criteria mentioned in Mode of Selection of Schedule Part-III of Chapter-V of PAU Statutes. C-1/277

B. Concession to Staff

- The Board of Management approved the enhancement of officiating fee for Referees/Assistant Referees/Umpires/Judges/Table Officials invited for the conduct of Inter-College/Inter-Varsity Tournaments/Matches. B-1/274

C. Incentives to Students

- The Board of Management approved to charge summer session fee at half rates of the normal semester fee realized during the 2nd semester of the Academic Session in which a student has got admission. B-2/272

D. Other Decisions

- The Board approved the audited accounts of

(the University for the year 2013-14.

B-1/272

- The Board approved the exchange of 1.5 acre land between PAU and Animal Husbandry Department involving land at PAU Campus, Ludhiana and University Seed Farm, Nabha. C-2/272
- The Board approved the exchange of 400 acres land at Ladhawal Seed Farm of Punjab Agricultural University with the Punjab Land Development and Reclamation Corporation Limited. C-3/272
- The Board noted and appreciated the Establishment of Skill Development Centre for Agriculture at Punjab Agricultural University, Ludhiana. C-4/272
- The Board approved the Establishment of 'Manjeet S. Chinnan and Lata Mahajan Chinnan Endowment for Promoting Excellence in Academics and Sports at PAU' and also approved the Establishment of 'Manjeet Singh Chinnan Distinguished Professor Chair.' C-5/272
- The Board approved the transfer of 175.1 acres of land by PAU Regional Research Station, Bathinda to Govt. of Punjab for establishment of AIIMS. C-2/274
- Dr G.S. Nanda was nominated as non-official member of the Finance Committee for a period of one year by the Board. C-3/274
- The Board approved the creation and inclusion of the new Revolving Fund Scheme entitled "Food Processing and Business Incubation Centre at Regional Station, Bathinda, RF-7 (PC-3103)" in the University Budget for the year 2015-16. B-1/275
- The Board approved the Annual Report of Punjab Agricultural University for the year 2014-2015. C-2/275
- The Board approved the re-employment of Dr Pardeep Kumar Khanna as Registrar of the University for a period of one year w.e.f 01.03.2016. C-4/275
- The Board approved the Budget Estimates of PAU for the year 2016-17.

B-1/276

- The Board approved the accounts of the University for the year 2014-15 duly audited by the Examiner, Local Fund Accounts, Punjab, Chandigarh.

B-1/277

IMPORTANT DECISIONS OF THE ACADEMIC COUNCIL

During the period under report, eight meetings (365th to 372nd) of the Academic Council were held. The important decisions taken by the Academic Council during this period are as under:-

- Approved the draft of Punjab State Council for Higher Agricultural Education Act 2015.
Item No.1/365th
- Approved the institution of scholarship in the name of 'Shri Bal Krishan Vaid Merit Scholarship' for B.Sc. Agri. (Hons) 4-year programme w.e.f. academic year 2016-17.
C-2/367th
- Approved the institution of 'Dr S.K. Vasal Scholarship' for PG students of the Department of Plant Breeding and Genetics w.e.f. academic year 2015-16. C-3/367th
- Approved the revival of M.Sc. programme in Statistics w.e.f. academic session 2016-17.
C-1/368th
- Approved the institution of fellowship in the name of 'Dr S.S. Guraya' for the student securing first position in M.Sc. (Zoology).
C-7/368th
- Approved the change of name of Fruit Research Station, Gangian (Hoshiarpur) to M.S. Randhawa Fruit Research Station, Gangian (Hoshiarpur).
C-10/368th
- Approved the institution of fellowship/scholarship at PAU in the name of 'Mrs Jaswant Kaur Bindra,' W/o Dr Onkar Singh Bindra, in the discipline of Entomology from the

academic session 2016-17 for Ph.D. and M.Sc. students.

C-5/369th

- Approved the institution of 'HARSUKH Medal' for the overall best graduate of the College of Agriculture.
C-7/369th
- Approved the rechristening of state-of-the-art Biocontrol Lab as 'Dr G.S. Kalkat Biocontrol Laboratories.'
C-8/369th
- Approved the rechristening of International Guest House as 'Dr D.S. Athwal International Guest House.'
C-9/369th
- Approved the institution of medal in the name of 'Dr Jugraj Singh Dhillon' for the best all round student in Master's programme w.e.f. 2016-17.
C-4/371th
- Approved the institution of medal in the name of 'Dr Bhupinder Singh Sekhon' for the student securing first position in M.Sc. (Chemistry).
C-5/371th
- Approved the institution of 'Plant Pathology Alumni Medal' along with a cash prize of Rs 25,000/- for students of M.Sc. (Plant Pathology).
C-6/371th
- Approved the starting of two-year Diploma Course in Agriculture from the academic session 2016-17. Item No 8/372nd
- Approved the starting of two-year Diploma in Agrochemicals w.e.f. 2016-17 at PAU, Institute of Agriculture (Gurdaspur & Bathinda), Regional Research Stations (Faridkot and Abohar) and KVKs (Kapurthala and Amritsar).
Item No.21/372nd

PUBLICATIONS

The University scientists published nearly 450 publications which included research papers, books, book chapters, manuals, bulletins etc. Details are given in **Annexure II**.



ANNEXURE I

Important projects undertaken by the Engineering Unit:

Sr. No.	Projects	Cost (Rs in lakh)
1	Construction of Bio Control Lab, and renovation of buildings and bathrooms at Regional Research Station, Abohar	65.77
2	Construction of Experimental Learning Unit for the Department of Clothing and Textile, and Department of Food and Nutrition at PAU, Ludhiana	65.09
3	Construction of Bio Control Lab at Regional Research Station, Gurdaspur	48.64
4	Repair/renovation of various buildings at Department of Farm Power and Machinery, PAU, Ludhiana	48.04
5	Sitting area of VVIPs at University playground adjoining athletic tracks and construction of Shooting Range at PAU, Ludhiana	44.59
6	Construction of <i>Pucca</i> Water Channel and Threshing Floor at University Seed Farm, Nabha	27.78
7	Repair of damaged boundary wall of the University at PAU, Ludhiana	25.30
8	Repair of wood work in Hostel No. 1 at PAU, Ludhiana	23.91
9	Construction of two 30 sqm, three 80 sqm and one 100 sqm houses at <i>Krishi Vigyan Kendra</i> , Langroya	21.98
10	Construction of concrete paved road at Jodhpur Farm, Regional Research Station, Bathinda	21.30
11	Repair and renovation of farm store, school building and other buildings at Regional Research Station, Ballawal Saunkri, district Shaheed Bhagat Singh Nagar	20.36
12	Repair and renovation of Hostel No.2, repair of geyser room for Girls Hostel, repair and renovation of mess in Hostel No.7 and repair of Girls Hostel and Farm Women Hostel at PAU, Ludhiana	18.49
13	Renovation of two old stores and construction of seed shed at Regional Research Station, Gurdaspur	16.36
14	Repair and renovation of Hostel No. 6 at PAU, Ludhiana	15.37
15	Painting and Plinth protection of UG Hostel of Girls at PAU, Ludhiana	13.96
16	Repair of wood work and paint in Hostel No. 2 at PAU, Ludhiana	13.94
17	Construction of boundary wall around SRF Quarters at PAU, Ludhiana	12.98
18	Repair and renovation of Hostel no.1 at PAU, Ludhiana	12.52
19	Construction of closed shed for storage of machines for the Department of Farm Machinery and Power Engineering at PAU, Ludhiana	11.99
20	Repair and renovation of Mess in Hostel No.6 at PAU, Ludhiana	10.43
	Total	538.8

ANNEXURE II

PUBLICATIONS

The University scientists published nearly 450 publications which included research papers, books, book chapters, manuals, bulletins, etc. Details are given below:

College of Agriculture

Research Papers in Indian and Foreign Journals

- Ahuja H, Kaur S, Gupta A K, Singh S and Kaur J (2015). Biochemical mapping of lentil (*Lens culinaris* Medik) genotypes for quality traits. *Acta Physiol Plant* **37**: 179. (NAAS rating 7.58)
- Ashish and Arora A (2015). Influence of weather parameters on bacterial blight of pomegranate in Punjab. *Indian J Ecol* **42**: 482-484. (NAAS rating 4.47)
- Ashish and Arora A (2015). Standardization of field inoculation techniques for progression of bacterial blight of pomegranate in Punjab. *The Bioscan* **10**: 1475-1481. (NAAS rating 4.70)
- Aulakh G S and Singh R (2015). Socio-economic characteristics of farmers and status of buffalo health care practices. *Indian J Agric Sci* **85**: 116-118. (NAAS rating 6.14)
- Aulakh P S, Dhaliwal M S, Jindal S K, Schafleitner R and Singh K (2016). Mapping of male sterility gene *ms10* in chilli pepper (*Capsicum annum* L). *Plant Breed* **135**: 531-535 (NAAS rating 7.6)
- Badaya V K, Gill B S and Sirari A (2016). Assessment of genetic diversity in soybean (*Glycine max* (L.) Merrill) using morphological and molecular markers. *Green Farm* **7**: 22-25. (NAAS rating 4.79)
- Badaya V K, Gill B S, Kaur J and Dhakad U K (2015). Assessment of genetic diversity and path coefficient in reproductive phases and quality traits and their correlation with seed yield in soybean [*Glycine max* (L.) merill]. *The Ecoscan* **7**: 209-13. (NAAS rating 5.06)
- Bajwa U and Mittal S (2015). Quality characteristics of no added sugar ready to drink milk supplemented with mango pulp. *J Food Sci Tech* **52**: 2112-2120. (NAAS rating 8.20)
- Bala M and Singh K P (2015). In vitro mutagenesis in rose (*Rosa hybrida* L.) cv. Raktima for novel traits. *Indian J Biotech* **14**: 525-531. (NAAS rating 6.39)
- Bala M and Singh K P (2016). Gamma irradiation of *in vitro* proliferated cultures of rose (*Rosa hybrida* L.) for induction of novel mutants. *Indian J Agr Sci* **86**: 137-142. (NAAS rating 6.14)
- Bala R, Sharma I and Bains N S (2015). Identification of new donors of Karnal bunt (*Tilletia indica*) resistance in winter wheats. *PI Dis Res* **30**: 73-75. (NAAS rating 3.11)
- Banta G, Jindal V, Mohindru B, Sharma S, Kaur J and Gupta VK (2016). Molecular phylogenetic analysis of mango mealybug, *Drosicha mangiferae* from Punjab. *J Environ Biol* **37**: 49-55. (NAAS rating 6.56)
- Barbetti M J, Li C X, Banga S S, Banga S K, Singh D, Sandhu P S, Singh R, Liu S Y and You M P (2015). New host resistances in *Brassica napus* and *Brassica juncea* from Australia, China and India: Key to managing *Sclerotinia* stem rot (*Sclerotinia sclerotiorum*) without fungicides. *Crop Protec* **78**: 127-130. (NAAS rating 7.49)
- Barbetti M J, Li C X, You M P, Singh D, Agnihotri A, Banga S K, Sandhu P S, Singh R and Banga S S (2016). Valuable new leaf or inflorescence resistances ensure improved management of white rust (*Albugo candida*) in mustard (*Brassica juncea*) crops. *J Phytopathol* **164**: 404-411 (NAAS rating 6.82)
- Baswal AK, Rattanpal H S and Sidhu G S (2015). Assessment of pollen viability and floral biology in sweet orange (*Citrus sinensis* Osbeck) cultivars under sub-tropical conditions of Punjab. *The Bioscan* **10**: 1573-1576. (NAAS rating 4.57)
- Bhandari K, Siddique K H M, Turner N, Kaur J, Singh S, Aggarwal S K and Nayyar H (2016). Heat stress at reproductive stage disrupts leaf carbohydrate metabolism, impairs reproductive function, and severely reduces



yield in lentil. *J Crop Improve* **30**: 118-151. (NAAS rating 5.12)

- Bharaj T S, Mangat G S, Kaur R, Singh K and Singh N (2015). PR 123: A new high yielding variety of superfine rice (*Oryza sativa* L.). *Agric Res J* **52**: 98-99. (NAAS rating 5.88)
- Bhullar M S, Kumar S, Kaur S, Kaur T, Singh J, Yadav R, Chauhan B S and Gill G (2016). Management of complex weed flora in dry-seeded rice. *Crop Protec* **83**: 20-26. (NAAS rating 7.49)
- Bons H K and Kaur J (2015). Studies on intercropping of rabi onion in mentha in light textured soils. *Indian J Ecol* **42**: 496-97. (NAAS rating 4.47)
- Brar B S, Romana P S and Saini S P (2015). Long-term chemical fertilization impacts on kinetics of K release, wheat yield and K uptake in a typic ustrochrept soil of Punjab, India. *J Crop Improve* **30**: 47-64. (NAAS rating 5.12)
- Champa W A H, Gill M I S, Mahajan B V C and Arora N K (2015). Pre-harvest salicylic acid treatments to improve quality and post-harvest life of table grapes (*Vitis vinifera* L.) cv. Flame Seedless. *J Food Sci Tech* **52**: 3607-3616. (NAAS rating 7.12)
- Champa W A H, Gill M I S, Mahajan B V C and Bedi S (2015). Exogenous treatment of spermine to maintain quality and extend post-harvest life of table grapes (*Vitis vinifera* L.) cv. Flame Seedless under low temperature storage. *LWT-Food Sci Tech* **60**: 412-419. (NAAS rating 8.47)
- Chandi A K and Singh G (2016). A new study on oviposition behaviour of susceptible and resistant *Plutella xylostella* (Linnaeus). *J Insect Sci* **29**: 93-95. (NAAS rating 7.03)
- Chandi R S and Chandi A K (2015). Insecticide use pattern on tomato crop in Punjab. *Indian J Ext Edu* **50**: 90-93. (NAAS rating 3.26)
- Chandi R S and Sun K S (2016). Field efficacy of newer insecticides against tobacco caterpillar, *Spodoptera litura* in cabbage. *J Insect Sci* **29**: 196-199. (NAAS rating 7.03)
- Chandi R S and Sun K S (2016). Field efficacy of newer insecticides against fruit borer, *Helicoverpa armigera* (Hübner) in tomato. *Pestic Res J* **28**: 15-19. (NAAS rating 4.16)
- Chandi R S, Kumar V, Bhullar H S and Dhawan A K (2016). Field efficacy of flonicamid 50 WG against insect-pests and predatory complex on Bt cotton. *Indian J Plant Protec* **44**: 1-8. (NAAS rating 4.90)
- Chauhan S K, Saini K S, Saralch H S, Rani S and Verma A (2015). Wheat and barley crop performance under different sowing methods under poplar based agro-forestry system. *Indian J Ecol* **42**: 528-30. (NAAS rating 4.47)
- Chauhan S K, Saini K S, Saralch H S, Rani S and Verma A (2015). Wheat and barley crop performance under different sowing methods under poplar based agro-forestry system. *Indian J Ecol* **42**: 528-530. (NAAS rating 4.47)
- Cheema H K, Kang B K and Singh B (2015). Baseline toxicity of insecticides against tobacco caterpillar, *Spodoptera litura* (Fabricius). *Pestic Res J* **27**: 84-87. (NAAS rating 4.16)
- Chhuneja P, Arora J, Kaur P, Kaur S and Singh K (2015). Characterization of wild emmer wheat *Triticum dicoccoides* germplasm for vernalization alleles. *J Plant Biochem Biotech* **24**: 249-253. (NAAS rating 7.09)
- Chhuneja P, Yadav B, Daniel S, Humi S, Kaur S, Elkot A F, Beat K, Thomas W, Sehgal S, Gill B S and Singh K (2015). Fine mapping of two powdery mildew resistance genes *PmTb7A.1* and *PmTb7A.2* in *Triticum boeoticum* using the shotgun sequence data of chromosome 7AL. *Theor Appl Genet* **128**: 2099-2111. (NAAS rating 9.79)
- Dalal P K and Arora R (2016). Impact of temperature on food consumption and nutritional indices of tomato fruit borer, *Helicoverpa armigera* (Hübner) (Noctuidae: Lepidoptera). *J Agromet* **18**: 62-67. (NAAS rating 6.15)
- Dar S B and Ram H (2016). Grain yield, nutrient uptake and water use efficiency of wheat (*Triticum aestivum*) under different moisture regimes, nutrient and hydrogel levels. *Indian J Agron* **61**: 101-104. (NAAS rating 5.00)
- Das T K, Singh C B and Mukhopadhyay R (2015). Effect of straw mulch, irrigation and land configuration on soil hydrothermal regime under Bt cotton (*Gossypium hirsutum* L.). *Eco Env Conis* **21**: 135-139. (NAAS rating 5.02)
- Devi R, Singh K, Umakanth B, Renuka P, Sudhakar V K, Prasad M S, Viraktamath B C and Madhav M S (2015).

Development and identification of blast resistant rice introgression lines and their characterization through morphological and molecular markers. *Rice Sci* **22**: 300-308.

- Dhadli H S and Brar B S (2016). Effect of long-term differential application of inorganic fertilizers and manure on soil CO₂ emissions. *PL Soil Environ* **62**: 195-201. (NAAS rating 7.11)
- Dhadli H S, Brar B S and Black T A (2016). N₂O emissions in long-term soil fertility experiment under maize-wheat cropping system in northern India. *Geoderma* **7**: 102-109. (NAAS rating 8.51)
- Dhadli H S, Brar B S and Kingra P K (2016). Temporal variations in N₂O emissions in maize and wheat crop seasons: Impact of n-fertilization, crop growth and weather variables. *J Crop Improve* **30**: 17-31. (NAAS rating 5.12)
- Dhillon T S and Kumar A (2015). Variability, heritability and genetic divergence studies in dolichos bean (*Labiab purpureus* L.). *J Hort Sci* **10**: 147-153. (NAAS rating 3.07)
- Dubey M, Thind T S, Dubey R K and Jindal S K (2016). Efficacy of plant extracts against tomato late blight under net house conditions. *Indian J Ecol* **43**: 375-377. (NAAS rating 4.47)
- Elkot A F, Chhuneja P, Kaur S, Beat K and Singh K (2015). Marker assisted transfer of two powdery mildew resistance genes *PmTb7A.1* and *PmTb7A.2* from *Triticum boeoticum* (Boiss.) to *Triticum aestivum* (L.). *PLoS ONE* **10**: 0128297. (NAAS rating 9.23)
- Ellur R K, Khanna A, Krishnan S G, Bhowmick P K, Vinod K K, Nagarajan M, Mondal K K, Singh N K, Singh K, Prabhu K V and Singh A K (2016). Marker-aided incorporation of *xa38*, a novel bacterial blight resistance gene, in PB1121 and comparison of its resistance spectrum with *xa13+Xa21*. *Scient Reports* **6**: 291. (NAAS rating 11.58)
- Gaba J, Sharma S, Arora G and Sharma P (2016). Synthesis, characterization and microbial activity of N-substitute pyrazolines. *Asian J Chem* **28**: 2031-2037. (NAAS rating 6.8)
- Gandhi N and Singh B (2015). Study of extrusion behaviour and porridge making characteristics of wheat and guava blends. *J Food Sci Technol* **52**: 3030-3036. (NAAS rating 8.20)
- Gill A K, Arora R and Jindal V (2015). Beet armyworm, *Spodoptera exigua* Hubner; A newly emerging pest of Egyptian clover in Punjab. *Range Mgmt Agroforest* **36**: 170-174. (NAAS rating 6.06)
- Gill B S, Kumar A, Dhillon S K and Singh T P (2015). SL 958: A new high yielding and yellow mosaic resistant variety of soybean. *Agric Res J* **52**: 124-125. (NAAS rating 5.88)
- Gill K K, Kaur N and Gill R I S (2016). Evaluation of growth and yield of wheat cultivars using agro-climatic indices under poplar based agro-forestry system in Punjab. *J Agromet* **18**: 124-127. (NAAS rating 6.15)
- Gill M S and S Navpreem (2015). Genetic parameters, character association and path analysis for fruit yield and its component characters in mango (*Mangifera indica* L.). *Indian J Plant Genetic Res* **28**: 292-295. (NAAS rating 4.61)
- Gill P P S, Jawandha S K, Kaur N, Singh N P and Sangwan A (2015). Influence of LDPE packaging on post-harvest quality of mango fruits during low temperature storage. *The Bioscan* **10**: 1177-1180. (NAAS rating 4.57)
- Gill P P S, Jawandha S K, Sangwan A, Singh N P and Kaur N (2016). Influence of post-harvest calcium chloride treatment and shrink film packaging on storage life of pear fruits. *Appl Biol Res* **18**: 71-75. (NAAS rating 4.35)
- Gill R K, Singh I, Kumar A and Singh S (2015). Assessment of combining ability for various quantitative traits in summer urdbean. *Electronic J Plant Breed* **6**: 412-416. (NAAS rating 4.19)
- Gill R, Sandhu P S and Sharma P (2015). Morphological and cultural variability among the isolates of *Sclerotinia sclerotiorum* causing stem rot of rapeseed-mustard. *Plant Dis Res* **30**: 28-33. (NAAS rating 3.30)
- Goyal M and Asthir B (2016). Role of sulphhydryl compounds on antioxidant defense mechanism under high temperature stress in wheat. *Indian J Agricul Biochem* **29**: 17-22. (NAAS rating 4.03)
- Goyal M and Soni G (2016). Differential effect of additives on thermostability of β -glucosidase from *Aspergillus niger* S1. *The Bioscan* **11**: 165-168. (NAAS rating 4.51)



- Goyal M and Tiwana U S (2016). Ensiling legume with cereal fodder **influences quality of silage mixture**. *Indian J Animal Nutr* **33**: 228-232. **(NAAS rating 4.51)**
- Gupta M, Rattanpal H S, Bons H K and Sidhu G S (2016). Response of W Murcott mandarin to wax coating under ambient conditions. *Indian J Ecol* **43**: 349-350. **(NAAS rating 4.47)**
- Gupta N, Ram H and Kumar B (2016). Mechanism of zinc absorption in plants: Uptake, transport, translocation and accumulation. *Rev Environ Sci Bio Technol* **15**: 89109. **(NAAS rating 9.33)**
- Gupta R K, Sharma S, Singh Y, Sikka R and Chopra S (2016). Evaluating time of first split of N application on the performance of transplanted rice. *Int J Trop Agric* **34**: 425-428. **(NAAS rating 3.03)**
- Hussain S Z, Singh B and Rafiqe A (2015). Cooking behaviour of re-fabricated rice as affected by extrusion: A response surface analysis. *Res Crops* **16**: 189-194. **(NAAS rating 5.00)**
- Jalota S K and Vashisht B B (2016). Adapting cropping systems to future climate change scenario in three agro-climatic zones of Punjab, India. *J Agromet* **18**: 48-56. **(NAAS rating 6.15)**
- Jariyal M, Gupta V K, Jindal V and Mandal K (2015). Isolation and evaluation of potent *Pseudomonas* species for bioremediation of phorate in amended soil. *Ecotoxicol Environ Saf* **122**: 24-30. **(NAAS rating 8.76)**
- Jariyal M, Gupta V K, Mandal K and Jindal V (2015). *Brevibacterium frigoritolerans* as a novel organism for the bioremediation of phorate. *Bull Environ Contam Toxicol* **95**: 680-686. **(NAAS rating 7.26)**
- Jawandha S K, Singh H, Kaur K and Arora A (2016). Effect of pre-cooling on storage behaviour of peach fruit. *Eco Env Cons* **21**: 311-315. **(NAAS rating 5.02)**
- Jha N, Beri V, Jassal H S and Sharma B D (2015). Factors influencing microbial and biochemical parameters of soils in different agro-climatic regions of Punjab. *Env Ecol* **33**: 1783-1787. **(NAAS rating 4.09)**
- Jhanji S, Sadana U S and Shukla A K (2015). Manganese efficiency in relation to differential production and allocation of carbohydrates between source and sink organs of diverse wheat genotypes. *Acta Physiol Plant* **37**: 38. **(NAAS rating 7.98)**
- Jhanji S, Sadana U S, Sekhon N K, Sharma A, Khurana M P S and Shukla A K (2015) Evaluation of different Mn efficiency indices and their relation to morpho-physiological traits in diverse wheat genotypes. *J Plant Nutr* **38**: 938-958. **(NAAS rating 6.49)**
- Jyoti G and Singh B (2015). An overview of persistence of thiamethoxam in biotic and abiotic components of the environment and advances in estimation techniques. *Pollut Res* **34**: 174-178. **(NAAS rating 4.75)**
- Jyoti, Singh D and Sikka R (2016). Comparative evaluation of arsenate sorption-desorption in two soils of north India. *Environ Earth Sci* **75**: 249. **(NAAS rating 7.77)**
- Kahlon M S and Singh C B (2015). Onion yield and water productivity under different planting methods. *Env Ecol* **33**: 1654-1657. **(NAAS rating 4.09)**
- Kang J S, Sandhu S S, Singh J, Singh H, Kang H, Grewal K and Singh G (2015). Climate change: Causes, contributors and impact on crop production. *Int J Agric Sci* **7**: 601-05. **(NAAS rating 4.10)**
- Kalyal P, Sahota P P, Singh D and Sikka R (2015). Prevalence of heavy metal resistant bacteria in samples from sewage treatment plants and common effluents treatment plants. *J Env Bio Sci* **29**: 533-538. **(NAAS rating 4.20)**
- Kaur A and Brar A S (2016). Influence of mulching and irrigation scheduling on productivity and water use of turmeric (*Curcuma longa* L.) in north-western India. *Irrig Sci* **34**: 261-269. **(NAAS rating 8.06)**
- Kaur A, Sodhi G P S and Singh S (2016). Impact of frontline demonstrations on PAU fruit fly traps in guava crop in Bassi Pathana block of district Fatehgarh Sahib. *Int J Trop Agric* **34**: 185-190. **(NAAS rating 3.03)**
- Kaur A and Singh H (2016). Effect of pre-harvest foliar sprays on fruit quality and nutritional status of peach cv. Shan-Punjab. *Int J Trop Agr* **34**: 191-197. **(NAAS rating 3.03)**
- Kaur A, Bains N S, Sood A, Yadav B, Sharma P, Kaur S, Garg M, Midha V, and Chhuneja P (2016). Molecular characterization of α -glucanase gene sequences in Indian wheat cultivars vis-à-vis celiac disease eliciting epitopes. *J Plant Biochem Biotech* **1-7**. **(NAAS rating 7.09)**

- Kaur A, Dubey R K, Thind H S and Singh S (2015). Effect of different potting media on growth and flowering of kalanchoe (*Kalanchoe blossfeldiana* Poelln). *Indian J Hort* **72**: 388-391. (NAAS rating 6.13)
- Kaur A, Mandal K and Singh B (2015). Estimation and validation of propanil residues in rice and soil samples by gas liquid chromatography with electron capture detector. *Bull Environ Contam Toxicol* **95**: 368-372. (NAAS rating 7.26)
- Kaur A, Sharma V K, Sirari A, Kaur J, Singh G and Kumar P (2015). Variability in *Fusarium oxysporum* f.sp. *cicereis* causing wilt in chickpea. *African J Microbiol Res* **9**: 1089-1097. (NAAS rating 4.00)
- Kaur H, Aulakh P S, Jawandha S K and Singh H (2015). Influence of different post-harvest treatments on physico-chemical characteristics of grapefruit at ambient conditions. *Eco Env Cons* **21**: 937-940. (NAAS rating 5.02)
- Kaur H, Mohan C and Hunjan M S (2016). Morphological and pathological characterization of *Fusarium verticillioides* from different maize growing areas of Punjab. *Indian Phytopath* **69**: 190-194. (NAAS rating 4.59)
- Kaur H, Ram H, Sikka R and Kaur H (2016). Productivity, agronomic efficiency and quality of bread wheat [*Triticum aestivum* (L.)] cultivars in relation to nitrogen. *International J Agri Environ Biotechnol* **9**: 101-106. (NAAS rating 4.1)
- Kaur H, Singh G, Gill K K and Sharma P (2015). Growth and yield of soybean (*Glycine max*) varieties as influenced by sowing time. *Indian J of Ecol* **42**: 412-416. (NAAS rating 4.47)
- Kaur J, Bhatti D S and Manchanda J S (2015). Response of oats to copper applied through seed priming foliar and soil application. *Indian J Ecol* **42**: 549-551. (NAAS rating 4.47)
- Kaur J, Khanna V, Kumari P and Sharma R (2015). Influence of psychotolerant plant growth promoting rhizobacteria (PGPR) as co-inoculants with *Rhizobium* on growth parameters and yield of lentil (*Lens culinaris* Medikus). *Afr J Microbiol Res* **9**: 258-264 (NAAS rating 4.0)
- Kaur J, Mahal S S and Kaur A (2016). Yield and quality evaluation of direct seeded basmati rice (*Oryza sativa* L.) under different irrigation and nitrogen regimes. *Cereal Res Comm* **44**: 330-340. (NAAS rating 6.51)
- Kaur J, Pannu P P S, Sethi S and Puyam A (2015). Comparative production of pectinases by *Fusarium verticillioides* (*Gibberella fujikuroi*) isolates causing Bakanae disease of basmati rice. *Plant Dis Res* **30**: 123-126 (NAAS rating 3.3)
- Kaur J, Ram H, Gill B S and Kaur J (2015). Agronomic performance and economic analysis of soybean (*Glycine max*) in relation to growth regulating substances in Punjab, India. *Legume Res* **38**: 603-608. (NAAS rating 6.15)
- Kaur J, Sharma S and Singh H (2015). Comparative assessment of microbial enzyme activity with compost and sewage sludge amendment. *J App Natural Sci* **7**: 1021-1028. (NAAS rating 5.08)
- Kaur K and Dhillon W S (2015). Influence of maturity and storage period on physical and biochemical characteristics of pear during post cold storage at ambient conditions. *J Food Sci Tech* **52**: 5352-5356. (NAAS rating 8.20)
- Kaur M, Dhaliwal H S, Thakur A, Singh G and Kaur M (2015). *In vitro* plantlet formation in Carrizo citrange: A promising citrus rootstock. *Indian J Hort* **72**: 1-6. (NAAS rating 6.13)
- Kaur M, Dhath A S, Sandhu J S and Gossal S S (2015). Effect of genotype, explant and culture media on direct plant regeneration in eggplant (*Solanum melongena* L.). *Indian J Hort* **72**: 232-238. (NAAS rating 6.13)
- Kaur M, Kaur N, Kaur K and Kaur P (2015). MgFe₂O₄ nanoparticles loaded on activated charcoal for effective removal of Cr (VI) - A novel approach. *Ceramics Intern* **41**: 13739-13750. (NAAS rating 8.60)
- Kaur M, Sardana V and Sharma P (2015). Quality of component crops as influenced by intercropping of canola oilseed rape (*Brassica napus*) and Ethiopian mustard (*Brassica carinata*) with Indian rape (*Brassica rapa* var. Toria). *J Oilseed Brassica* **6**: 233-240. (NAAS rating 3.43)
- Kaur M, Singh M, Mukhopadhyay S S, Singh D and Gupta M (2015). Structural, magnetic and adsorptive properties of clay ferrite nanocomposite and its use for effective removal of Cr (VI) from water. *J Alloys Comp* **653**: 202-211. (NAAS rating 8.73)



- Kaur M, Singh R, Saharan M S, Mandhan R P, Bala R and Sharma I (2016). REPPCR fingerprinting based genetic variability in *Tilletia indica*. *Indian Phytopath* **68**: 380-385. (NAAS rating 4.59)
- Kaur N and Bhullar M S (2015). Changes in soil microflora with herbicides application in autumn sugarcane based intercropping systems. *Indian J Ecol* **42**: 156-159. (NAAS rating 4.47)
- Kaur N and Bhullar M S (2015). Harvest time residues of pendimethalin and oxyfluorfen in vegetables and soil in sugarcane-based intercropping systems. *Env Mon Assess* **187**: 221. (NAAS rating 7.68)
- Kaur N and Sharma P (2015). Studies on factors affecting root and nodule endophytic bacteria from mungbean rhizosphere. *J Pure App Microbiol* **9**: 1591-1609 (NAAS rating 6.0)
- Kaur N, Bhullar M B and Kaur P. (2015). Biology of two-spotted spider mite, *Tetranychus urticae* Koch (Acari:Tetranychidae) and its feeding preference on citrus. *J Insect Sci* **28**: 330-337. (NAAS rating 3.44)
- Kaur N, Bhullar M B and Sharma D R (2015). Diversity and seasonal incidence of mites on citrus. *J Insect Sci* **28**: 284-289. (NAAS rating 3.44)
- Kaur N, Bhullar M S and Gill G (2015). Weed management options for sugarcane-vegetable intercropping systems in north-western India. *Crop Protec* **74**: 18-23. (NAAS rating 7.54)
- Kaur N, Bhullar M S and Gill G (2016). Weed management in sugarcane-canola intercropping systems in northern India. *Field Crops Res* **188**: 1-9. (NAAS rating 8.98)
- Kaur N, Bons H K, Rattanpal H S and Kaur R (2016). Manipulation of source-sink relationship for management of fruit drop in kinnow mandarin. *International J Agri Env Biotech* **9**: 403-410. (NAAS rating 4.10)
- Kaur N, Dhaliwal M S, Jindal S and Singh P (2016). Evaluation of hot pepper (*Capsicum annum* L.) genotypes for heat tolerance during reproductive phase. *International J Bio-resource Stress Manage* **7**: 126-129. (NAAS rating 4.46)
- Kaur N, Gill R I S and Bhullar M S (2016). Integrated weed management in poplar (*Populus deltoides*)-turmeric (*Curcuma longa*) based agro-forestry system in Punjab. *Indian J Agron* **61**:13-18. (NAAS rating 5.0)
- Kaur N, Jawandha S K and Singh H (2015). Effect of calcium and shrink film on post-harvest behavior of cold stored plum fruits. *Int J Agric Env Biotech* **8**: 951-956. (NAAS rating 4.1)
- Kaur N, Mahal S S and Saini K S (2015). Growth, yield ad water productivity of bed planted summer moong in relation to irrigation regimes. *Indian J Ecol* **42**: 514-16. (NAAS rating 4.47)
- Kaur P and Kang B K (2015). Effect of selected synergists on insecticidal toxicity of deltamethrin and biochemical mechanisms on the field populations of tobacco caterpillar from Punjab, India. *Phytoparasitica* **43**: 565-575. (NAAS rating 6.90)
- Kaur P, Vashist V K and Kumar A (2015). Evaluation of potato genotypes for yield characters in late autumn season. *J Krishi Vigyan* **4**: 23. (NAAS rating 2.77)
- Kaur P and Mavi H K (2015). Female agricultural labourers in rural Punjab: Present status and problems. *Indian Res J Ext Edu* **15**:114-117. (NAAS rating 3.92)
- Kaur R and Kang B K (2015). Status of insecticide resistance in leaf hopper, *Amrasca biguttula biguttula* (Ishida) on cotton. *The Bioscan* **10**: 1441-1444. (NAAS rating 4.57)
- Kaur R, Bains T S, Madhava B H and Nayyar H (2015). Responses of mungbean (*Vigna radiate* L.) genotypes to heat stress: Effects on reproductive biology, leaf function and yield traits. *Scientia Horti* **197**: 527-541. (NAAS rating 7.50)
- Kaur R, Kaur N and Rattanpal H S (2016). Effect of mineral nutrients and growth regulators on management of fruit drop and improvement of fruit quality in kinnow mandarin. *The Bioscan* **11**: 589-596. (NAAS rating 4.57)
- Kaur R, Mandal K, Sahoo S K, Kumar R, Arora R and Singh B (2016). Estimation and risk assessment of flubendamide on fodder berseem clover (*Trifolium alexandrinum* L.) by QuEChERS methodology and LC-MS/MS. *Environ Sci Pollut Res* **23**: 9791-9798. (NAAS rating 8.53)
- Kaur R, Kaur S, Mandal K and Singh B (2015). Dissipation behavior and risk assessment of acephate in brinjal

using GLC with FPD. *Environ Monit Assess* **187**: 4279. (NAAS rating 7.68)

- Kaur S and Aggarwal P (2016). Development and quality characteristics of nutritionally enhanced potato legume based *wan-A* Indian traditional savoury. *J Food Sci Technol* **53**: 1899-1908. (NAAS rating 8.20)
- Kaur S and Sharma P (2015) Biochemical characterization of Indian mustard (*Brassica juncea* L.) genotypes in response to moisture stress and irrigation modules. *J Oilseed Brassica* **6**: 265-272. (NAAS rating 3.43)
- Kaur S and Sharma P (2015). Correlation between leaf traits and moisture availability in Indian mustard (*Brassica juncea* L.). *App Bio Res* **17**: 174-184. (NAAS rating 4.35)
- Kaur S and Sharma P (2015). Physiological response of Indian mustard (*Brassica juncea* L.) to different moisture regimes. *The Bioscan* **10**: 1259-1267. (NAAS rating 4.57)
- Kaur S I, Kang S S and Sharma A (2015). Occurrence of begomoviruses in cotton vegetable agro eco-system in India. *African J Microb Res* **9**: 1798-1805. (NAAS rating 4.00)
- Kaur S, Jawandha S K and Singh H (2016). Effect of chemicals and modified atmosphere packaging on selected physico-chemical characteristics of *baramasi* lemon fruits at ambient conditions. *J Env Biol* **37**: 349-354. (NAAS rating 6.56)
- Kaur S, Kaur S, Gupta A K and Kaur J (2015). DNA Finger printing of cold stress tolerant and susceptible chickpea genotypes with RAPD markers. *Indian J Agric Biochem* **28**: 132-137. (NAAS rating 4.03)
- Kaur S, Kular J S and Chandi R S (2016). Studies on growth index and population dynamics of *Thrips tabaci* Lindeman in Bt cotton. *J Insect Sci* **29**: 203-208. (NAAS rating 7.03)
- Kaur S, Sharma S, Singh B, and Dar B N (2015). Effect of extrusion variables (temperature, moisture) on the anti-nutrient components of cereal brans. *J Food Sci Technol* **52**: 1670-1676. (NAAS rating 8.20)
- Kaur T and Bhullar M S (2015). Weed management in lentil (*Lens culinaris Medic L.*) in north-west India. *Pesticide Res J* **27**: 111-114. (NAAS rating 4.3)
- Khehra S, Rattanpal H S and Gill M S (2015). Influence of integrated nutrient management under high density plantation in kinnow mandarin. *Res Environ Life Sci* **9**: 69-71. (NAAS rating 4.09)
- Khehra S, Gill M S and Rattanpal H S (2015). Periodic application of fertilizers in kinnow mandarin for plant growth and fruit yield. *Indian J Ecol* **42**: 520-522. (NAAS rating 4.47)
- Kumar A, Hunjan M S, Kaur H and Singh P P (2015). Characterization of *Dickeya zeae* isolates causing stalk rot of maize based on biochemical assays and antibiotic sensitivity. *Indian Phytopathology* **68**: 375-379. (NAAS rating 4.59)
- Kumar B, Dhaliwal S S, Singh S T, Lamba J S and Ram H (2016). Herbage production, nutritional composition and quality of Teosinte under Fe Fertilization. *Int J Agric Biol* **18**: 319-329. (NAAS rating 6.0)
- Kumar P, Uppal R S, Ram H and Manchanda J S (2015). Agronomic biofortification, nutrient uptake and productivity of wheat as influenced by fertilization strategies. *Indian J Fert* **11**: 38-48. (NAAS rating 3.78)
- Kumar P, Singh K and Kaur P (2015). Economic impact of frontline demonstration on pulses in Punjab- A step towards diversification. *Indian J Econ Dev* **2**: 111-116. (NAAS rating 4.01)
- Kumar R and Jindal J (2015). Economic evaluation of biorational and conventional insecticides for the control of maize stem borer *Chilo partellus* (Swinhoe) in *Zea mays*. *J App Natural Sci* **7**: 644-648. (NAAS rating 5.08)
- Kumar R and Kaushik N (2015). Variability for seed oil content and seedling traits in *Pongamia pinnata* L (Pirre). *J App Natural Sci* **7**: 1036-1041. (NAAS rating 5.08)
- Kumar R, Mandal K, Taggar G K, Singh R and Singh B (2016). Bioefficacy and persistence of acephate in mungbean *vigna radiata* (L.) Wilczek. *Environ Monit Assess* **188**: 392. (NAAS rating 8.02)
- Kumar R, Singh D, Walia S S and Singh R (2016). Strategies for accelerated adoption in improved farm technologies and allied enterprises for income enhancement. *Indian J Econ Dev* **12**: 519-524. (NAAS rating 4.01)
- Kumar R, Uppal S K and Walia S S (2016). Impact of integrated nutrient management strategies on productivity of



plant and ratoon crops of sugarcane. *Indian J Ecol* **43**: 415-419. **(NAAS rating 4.47)**

- Kumar S (2015). Evaluation of petroleum spray oil against turnip aphid, *Lipaphis erysimi* (Kaltenbach) infesting oilseed brassica. *Intern J Biores Stress Manage* **6**: 583-590. **(NAAS rating 4.46)**
- Kumar S (2015). Relative abundance of turnip aphid and the associated natural enemies on oilseed Brassica genotypes. *J Agric Sci Technol* **17**: 1209-1222. **(NAAS rating 6.68)**
- Kumar S, Garg AK and Aulakh M S (2016). Effects of conservation agriculture practices on physical, chemical and biological attributes of soil health under soybean-rapeseed rotation. *Agric Res* **5**: 145-161. **(NAAS rating 3.01)**
- Kumar V and Grewal G K (2016). Effect of Bt cotton hybrids on larval mortality and development of *Helicoverpa armigera* (Hubner) and *Spodoptera litura* (Fabricius). *J Cotton Res Dev* **30**: 252-259. **(NAAS rating 3.41)**
- Lore S, Jain J, Hunjan M S, Gargas G, Mangat G S, Sandhu J S (2015). Virulence spectrum and genetic structure of *Rhizoctonia* isolates associated with rice sheath blight in northern region of India. *European J Plant Path* **143**: 847-860.
- Mahajan G and Chauhan B S (2015). Weed control in dry direct-seeded rice using tank mixtures of herbicides in South Asia. *Crop Protec* **72**: 90-96. **(NAAS rating 7.49)**
- Mahajan G and Chauhan B S (2016). Performance of dry direct-seeded rice in response to genotype and seeding rate. *Agronomy J* **108**: 257-265. **(NAAS rating 7.44)**
- Mahajan G, Ramesha M S and Chauhan B S (2015). Genotypic differences for water-use efficiency and weed competitiveness in dry direct-seeded rice (*Oryza sativa* L.). *Agronomy J* **107**: 1573-1583. **(NAAS rating 7.44)**
- Mahajan G, Sharma N, Kaur R and Chauhan B S (2015). Comparison of photoperiod-sensitive and photoperiod-insensitive basmati cultivars for grain yield, water productivity, and quality traits under varied transplanting dates in northwest India. *Crop Pasture Sci* **66**: 793-801. **(NAAS rating 7.48)**
- Makkar G S and Chhuneja P K (2015). Diversity assessment of regional crop pollinating bee fauna in ecological perspective. *Ecol Env Cons* **21**: 1811-1816. **(NAAS rating 5.02)**
- Mangat G S, Kaur R, Lore J S, Singh K, Bharaj T S and Singh N (2015). PR 124: A new early maturing variety of rice (*Oryza sativa* L.). *Agric Res J* **52**: 210-211. **(NAAS rating 4.34)**
- Mansotra P, Sharma P, Sirari A and Sharma S (2015). Impact of *Piriformospora indica*, *Pseudomonas* species and *Mesorhizobium cicer* on growth of chickpea (*Cicer arietinum* L.). *J App Natural Sci* **7**: 373-380. **(NAAS rating 5.08)**
- Mason AS, Nelson MN, Takahira J, Atri C, Samans B, Hayward A, Cowling WA, Batley J. and Nelson MN (2015). Microspore culture reveals complex meiotic behaviour in a trigonomic Brassica hybrid. *BMC Plant Biol* **15**: 173. **(NAAS rating 9.81)**
- Mittal A, Jiang Y, Ritchie G, Burke J J and Rock C D (2015). ATRAV1 and RAV2 over expression in cotton increases fiber length and delays flowering. *Plant Sci* **241**: 78-95. **(NAAS rating 9.68)**
- Neha and Sandhu J S (2016). Agrobacterium mediated In-planta transformation of rough lemon (*Citrus jambhiri* Lush.). *Agri Res J* **53**: 184-189. **(NAAS rating 4.34)**
- Padbhushan R and Kumar D (2015). Distribution of boron in different fractions in some alkaline calcareous soils. *Comm Soil Sci Plant Ana* **46**: 939-953. **(NAAS rating 6.39)**
- Padbhushan R and Kumar D (2015). Soil boron fractions and response of green gram in calcareous soils. *J Plant Nutr* **38**: 1143-1157. **(NAAS rating 6.54)**
- Padbhushan R and Kumar D (2015). Yield and nutrient uptake of green gram (*Vigna radiata* L.) as influenced by boron application in boron-deficient calcareous soils of Punjab. *Comm Soil Sci Plant Ana* **46**: 924-939. **(NAAS rating 6.39)**
- Pandey M, Singh T and Sikka R (2016). Effect of different intercropping systems and levels of nutrients applied to intercrops on periodic nutrient uptake of bed planted wheat. *Eco Env Cons* **22**: 261-265. **(NAAS rating 5.02)**
- Parkash O and Brar A S (2015). Effect of planting methods and plant population on growth, yield and quality of

turmeric (*Curcuma longa* L.). *Indian J Eco* **42**: 490-492 (NAAS rating 4.47)

- Qibin Y, Plotto A, Baldwin E A, Bai J, Huang M, Yu Y, Dhalwal H S and Gmitter F G (2015). Proteomic and metabolomic analyses provide insight into production of volatile and non-volatile flavor components in mandarin hybrid fruit. *BMC Plant Biology* **15**:76. (NAAS rating 9.94)
- Rachana D B, Sharma A, Sharma H and Srivastava P (2015). Role of gallic acid pretreatment in inducing the antioxidant response of two wheat cultivars differing in drought tolerance. *Indian J Agric Biochem* **28**: 155-165. (NAAS rating 4.03)
- Raina D, Dhillon W S, Gill P P S and Singh N P (2015). Assessment of genetic divergence using Mahalanobis D2 and principal component analysis of qualitative and quantitative characters in pomegranate genotypes under subtropics. *Indian J Hort* **72**: 451-456. (NAAS rating 6.11)
- Ram H and Singh G (2015). Growth and productivity of sunhemp (*Crotalaria juncea* (L.) cultivars under different sowing dates and phosphorus application rates. *Intern J Agri Statist Sci* **11**: 129-133 (NAAS rating 4.00)
- Ram H, Rashid A, Zhang W, Duarte A P, Phattarakul N, Simunji S, Kalayci M, Freitas R, Retkasesm B, Bai R S, Mahmood K, Savasil E, Lungu O, Wang Z H, De Barros V L N P, Malik S S, Arisoy R Z, Guo J X, Sohu V S, Zou C Q and Cakmak I (2016). Biofortification of wheat, rice and common bean by applying foliar zinc fertilizer along with pesticides in seven countries. *Plant Soil* **403**: 389-401. (NAAS rating 8.95)
- Ram H, Singh G and Aggarwal N (2016). Effect of irrigation, straw mulching and weed control on growth, water use efficiency and productivity of summer mungbean. *Legume Res* **39**: 284-288. (NAAS rating 6.15)
- Ram H, Singh G and Aggarwal N (2016). Pigeonpea (*Cajanus cajan* L.) performance in relation to sowing methods, fertilizer application methods and rates. *Prog Res* **11**: 66-68. (NAAS rating 3.16)
- Ram H, Sohu V S, Cakmak I, Singh K, Buttar G S, Sodhi G P S, Gill H S, Bhagat I, Singh P, Dhalwal S S and Mavi G S (2015). Agronomic fortification of rice and wheat grains with zinc for nutritional security. *Curr Sci* **109**: 1171-1176. (NAAS rating 6.93)
- Randhawa N, Kaur J, Kaur S and Singh S (2016). Moisture stress induced changes in metabolites and cellular functions in chickpea (*Cicer arietinum* L.) genotypes. *J App Nat Sci* **7**: 355-358 (NAAS rating 5.08)
- Randhawa H S and Saini M K (2015). Efficacy of different insecticides against pod borer, (*Maruca vitrata* Geyer) in pigeonpea. *Legume Res* **38**: 687-690 (NAAS rating 6.15)
- Randhawa H S, Sharma D R and Saini M K (2015). Efficacy of different insecticides against leaf roller, *Stathopis leucaspis* (Meyrick) of litchi. *J Insect Sci* **28**: 120-121. (NAAS rating 3.44)
- Rani R, Sharma V K, Lore J S and Pannu P P S (2015). Cultural studies on *Ustilaginoidae* incitant of false smut of rice (*Oryza sativa*). *Indian J Agr Sci* **85**: 888-891. (NAAS rating 6.14)
- Rani S, Chauhan S K, Dhatt K, Sharma R and Babuta R (2015). Flower seed production for remunerative returns under poplar based agro-forestry system. *Ind J Agroforest* **17**: 61-69 (NAAS rating 4.50)
- Rattanpal H S and Sidhu G S (2015). Development of low seeded kinnow through mutation breeding. *Agro Res J* **52**: 198-199. (NAAS rating 4.54)
- Rawal S, Mehta A K, Thakral S K and Kumar M (2016). Productivity and profitability of Bt cotton as influenced by different doses of nitrogen and phosphorus under irrigated conditions. *Ecol Env Cons* **22**: 281-284 (NAAS Rating: 5.02)
- Saini M K and Chopra S (2015). Influence of weed control methods on weed, yield energetics and economics of basmati rice under sub-mountainous conditions of Punjab. *Indian J Agron* **60**: 410-413. (NAAS rating 5.00)
- Saini M K, Aggarwal N and Kumar V (2016). Impact of integrated pest management programme in Bt cotton in district Faridkot, Punjab. *J Cotton Res Dev* **30**: 247-251 (NAAS rating 3.41)
- Sandhu C and Suri K S (2015). Influence of variable temperature on feeding of *Sogatella lucifera* (Horvath) on rice. *J Insect Sci* **28**: 96-98. (NAAS rating 3.44)
- Sandhu J S, Kaur M, Kaur A and Kalra A (2016). Single step direct transgenic plant regeneration from adventive embryos of agro-infected sugarcane (*Saccharum* spp.) spindle leaf roll segments with assured genetic fidelity.



Plant Cell Tiss Org Cul **120**: 339-350. (NAAS rating 8.13)

- Sandhu P S, Brar K S, Chauhan J S, Meena P D, Awasthi R P, Rathi A S, Kumar A, Gupta J C, Kolte S J and Manhas S S (2015). Host-pathogen interaction of Brassica genotypes for white rust (*Albugo candida*) disease severity under aided epiphytic conditions in India. *Phytoparasitica* **43**: 197-207. (NAAS rating 6.90)
- Sandhu P S, Mahal S S and Sardana V (2015). Performance of promising hybrids of Indian mustard (*Brassica juncea* L. Czern & Coss) under varying levels of nitrogen and row spacing. *J. Crop Weed.* **11**: 204-207. (NAAS rating 3.56)
- Sandhu S K, Dhaliwal L K and Pannu P P S (2016). Role of microclimate in management of yellow rust (*Puccinia striiformis* f.sp. *tritici*) of wheat (*Triticum aestivum*) under Ludhiana conditions. *Ind J Agric Sci* **86**: 930-934. (NAAS rating 6.14)
- Sandhu S S, Mahal S S and Kaur P (2015). Calibration, validation and application of AquaCrop model in irrigation scheduling for rice under north-west India. *J App Nat Sci* **7**: 691 – 699. (NAAS rating 5.08)
- Sekhon B S and Bhumbra D K (2016). Using soil survey data for modeling phosphorus sorption capacity. *Environ Earth Sci* **75**: 638. (NAAS rating 7.77)
- Sethi R and Kaur N (2016). Germination ecology of herbicide-resistant population of little seed canary grass from north-western India. *J Crop Improv* **30**: 274-286. (NAAS rating 5.12)
- Sethi R R, Mandal K G, Sarangi A, Behra A, Aggarwal R, Brar A S, Sahu A S, Bandyopadhyay K K and Ambast S K (2016). Simulating paddy crop response to irrigation using FAO AquaCrop model: A case study. *J Food Agric Environ* **14**: 99-103. (NAAS rating 5.0)
- Sharma A, Sharma S and Gill B S (2015). Effect of nitrogen and sulphur on their ratio, seed yield and protein related parameters in developing soybean. *Appl Biol Res* **17**: 84-89. (NAAS rating 4.35)
- Sharma P (2015). Relationship of photosynthesis and related traits to seed yield in oilseed Brassicas. *J App Nat Sci* **7**: 851-856. (NAAS rating 5.08)
- Sharma P and Sardana V (2015). Correlation and heat susceptible index analysis for high temperature tolerance in Indian mustard (*Brassica juncea* L.). *Phytomorphology* **65**: 75-83. (NAAS rating 2.95)
- Sharma P and Sardana V (2015). Evaluating morpho-physiological and quality traits to compliment seed yield under changing climatic conditions in Brassicas. *J Envir Biol* **37**: 493-502. (NAAS rating 6.52)
- Sharma P, Khanna V and Kumari S (2015). Potential of ACC-deaminase producing plant growth promoting rhizobacteria on water stress mitigation in lentil (*Lens culinaris* L. Medikus) under axenic conditions. *Intern J Adv Res* **3**: 59–67. (NAAS rating 4.00)
- Sharma S and Uppal S K (2015). Occurrence of insect-pests of sugarcane and their natural enemies in relation with weather parameters and effect on cane quality. *Int Sugar J* **8-15**. (NAAS rating 6.13)
- Sharma S, Thind H S, Singh Y, Singh V and Singh B (2015). Soil enzyme activities with biomass ashes and phosphorus fertilization to rice–wheat cropping system in the Indo-Gangetic plains of India. *Nut Cycl Agroecosys* **101**: 391–400. (NAAS rating 7.73)
- Shama Shruti, Thind S S and Kaur A (2015). In vitro meat production system: Why and how? *J Food Sci Technol* **52**: 7599–7607. (NAAS rating 8.02)
- Sharma S, Kaur J, Thind H S, Singh Y, Sharma N and Kirandip (2015). A framework for refining soil microbial indices as bioindicators during decomposition of various organic residues in a sandy loam soil. *J App Nat Sci* **7**: 700–708. (NAAS rating 5.08)
- Sheoran P, Sardana V, Chahal V P, Sharma P and Singh S (2015). Effect of sowing time on the yield and quality parameters of sunflower (*Helianthus annuus*) hybrids under semiarid irrigated conditions of northern India. *Indian J Agri Sci* **85**: 549–554. (NAAS rating 6.14)
- Sheoran P, Sardana V, Kumar A, Mann A and Singh S (2015). Integrating herbicidal and conventional approach for profitable weed management in groundnut (*Arachis hypogaea*). *Indian J Agron* **60**: 581-584. (NAAS rating 5.0)

- Sheorn P, Singh S, Bawa S S, Sardana V, Kumar A, Kumar R, Bhushani B and Dheri G S (2016). Assessing long term impact of nutrient management and rainfall variability on the agro-ecological resilience of maize (*Zea mays*)-wheat (*Triticum aestivum*) system in NW India. *Indian J Agric Sci* **86**: 113-119. **(NAAS rating 6.00)**
- Shera P S and Arora R (2016). Comparative study on oviposition and larval preference of spotted bollworm *Earias vitella* on Bt and non-Bt cotton. *J Environ Bio* **37**: 121-127. **(NAAS rating 6.56)**
- Shera P S and Arora R (2016). Survival and development of spotted bollworm, *Earias vitella* (Fabricius) (Lepidoptera: Nolidae) on different transgenic Bt and isogenic non-Bt cotton genotypes. *Phytoparasitica* **44**: 99-113. **(NAAS rating 6.72)**
- Shera P S, Arora R and Singh P (2015). Comparative susceptibility of transgenic Bt cotton hybrids to *Earias* spp and other non target insects. *Crop Prot* **71**: 51-59. **(NAAS rating 7.30)**
- Sikka R and Nayyar V K (2016). Monitoring of Lead (Pb) pollution in soils and plants irrigated with untreated sewage water in some industrialized cities of Punjab, India. *Bull Environ Contam Toxicol* **96**: 443-448. **(NAAS rating 7.26)**
- Singh A K, Rehal J, Kaur A and Kaur G J (2015). Enhancement of attributes of cereals by germination and fermentation. *A review. Crit Rev Food Sci Nutr* **55**: 1575-1589. **(NAAS rating 11.18)**
- Singh A, Kahlon M S and Singh C B (2016). Yield and water productivity of direct dry seeded rice in relation to cultivars and irrigation regimes in north-west India. *Env Ecol* **35**: 229-236. **(NAAS rating 4.09)**
- Singh B and Kular J S (2015). Influence of abiotic factors on seasonal dynamics of pink stem borer *Sesamia inferens* Walker in rice wheat cropping system of India. *J Wheat Res* **7**: 23-28. **(NAAS rating 3.11)**
- Singh B, Singh V, Purba J, Sharma R K, Jat M L, Singh Y, Thind H S, Gupta R K, Choudhary O P, Chandrà P, Khurana H S, Kumar A, Singh J, Uppal H S, Uppal R K, Vashistha M and Raj Gupta (2015). Site-specific nitrogen management in irrigated transplanted rice (*Oryza sativa*) using an optical sensor. *Prec Agr* **16**: 455-475. **(NAAS rating 7.93)**
- Singh B, Singh V, Singh Y, Kumar A, Singh J, Vashistha M, Thind H S and Gupta R K (2016). Fertilizer nitrogen management in irrigated transplanted rice using dynamic threshold greenness of leaves. *Agr Res* **52**: 174-181. **(NAAS rating 5.88)**
- Singh B and Kular J S (2015). Management of termites with broadcasting of insecticides in wheat crop. *J Insect Sci* **28**: 88-91. **(NAAS rating 3.44)**
- Singh B and Kaur A (2015). Comparative efficacy of chlorantraniliprole and indoxacarb for the management of *Helicoverpa armigera* in berseem (*Trifolium alexandrinum*) seed crop. *J Insect Sci* **28**: 85-87. **(NAAS rating 3.44)**
- Singh C B, Singh S, Arora V K and Sekhon N K (2015). Residue mulch effects on potato productivity and irrigation and nitrogen economy in a subtropical environment. *Potato Res* **58**: 245-260. **(NAAS rating 6.84)**
- Singh D, Gill M I S, Boora R S and Arora N K (2015). Genetic diversity analysis in guava (*Psidium guajava* L.) on the basis of morphological and physico-chemical traits. *Indian J Agric Sci* **85**: 678-683. **(NAAS rating 6.0)**
- Singh D, Kumar R, Singh A, Gosal S K, Walla S S, Singh R and Brar A S (2015). Influence of bio-fertilizers in conjunction with organic and inorganic fertilizer on soil properties and productivity of turmeric (*Curcuma longa* L.). *Indian J Ecol* **43**: 174-178. **(NAAS rating 4.47)**
- Singh D, Kumar R, Singh A, Gosal S K, Walla S S, Singh R and Brar A S (2015). Influence of bio-fertilizers in conjunction with organic and inorganic fertilizers on soil properties and productivity of turmeric (*Curcuma longa* L.). *Indian J Eco* **42**: 170-173. **(NAAS rating 4.47)**
- Singh G, Aggarwal N, Ram H, Kaur H, Gill K K and Sharma P (2015). Phenology, thermal requirement and productivity of mungbean as influenced by sowing time. *Ecol Env Cons* **21**: 1415-1419. **(NAAS rating 5.02)**
- Singh G, Aulakh P S, Sarao N K, Sidhu G S and Rattanpal H S (2016). Genetic diversity and DNA fingerprinting of indigenous and exotic mandarin genotypes in India using SSR markers. *Australian J Crop Sci* **10**: 24-31. **(NAAS rating 4.0)**
- Singh G, Kaur H, Aggarwal N, Ram H, Gill K K and Khanna V (2016). Symbiotic characters, thermal requirement,



growth, yield and economics of pigeonpea (*Cajanus cajan*) genotypes sown at different dates under Punjab conditions. *J App Nat Sci* 8: 381-385. **(NAAS rating 5.08)**

- Singh G, Ram H, Aggarwal N and Turner N C (2016). Irrigation of chickpea (*Cicer arietinum* L.) increases yield but not water productivity. *Exp Agr* 52: 1-13. **(NAAS rating 7.08)**
- Singh G T and Yadav S P (2015). Income enhancement and employment generation through apiculture enterprise for rural youth in Punjab. *Indian Res J Ext Edu* 16: 112-115. **(NAAS rating 3.92)**
- Singh H, Dhillon N K, Kaur J and Vashisht V K (2015). Reaction of muskmelon genotypes to *Meloidogyne incognita* and *Fusarium oxysporum* f. sp. *melonis*. *Plant Dis Res* 30: 163-168. **(NAAS rating 3.3)**
- Singh H and Mavi H K (2016). Economic analysis of poplar based agro-forestry system under riparian wet land conditions of Punjab. *Indian J Econ Dev* 12: 191-196. **(NAAS rating 4.01)**
- Singh J, Kaur R and Singh P (2016). Economics and yield gap analysis of front line demonstrations regarding scientific practices of Indian mustard in district Amritsar. *Indian J Econ Dev* 12: 515-517. **(NAAS rating 4.01)**
- Singh K and Brar A S (2015). Effect of planting methods and irrigation schedules on cane yield, quality, economics and water productivity of spring sugarcane (*Saccharum officinarum*) in south-western Punjab. *Indian J Agron* 60: 601-605. **(NAAS rating 5.0)**
- Singh K B, Jalota S K and Gupta R K (2015). Soil water balance and response of spring maize (*Zea mays*) to mulching and differential irrigation in Punjab. *Indian J Agron* 60: 132-137. **(NAAS rating 5.0)**
- Singh K, Buttar G S, Singh S, Sarlach R S, Brar A S and Rathore P (2015). Productivity enhancement in Bt cotton (*Gossypium hirsutum*) through foliar feeding of nutrients in north-western India. *Intern J Agri Stat Sci* 11: 419-426. **(NAAS rating 5.00)**
- Singh K, Choudhary O P, Singh K, Singh S and Singh R S (2015). Identification of integrated nutrient management for sustaining soil health and sugarcane yield in south western Punjab. *J Environ Biol* 36: 551-555. **(NAAS rating 6.5)**
- Singh K, Sharma R, Chauhan S K and Singh N B (2016). Multi-location evaluation of variation in growth of *Salix* clones in Punjab. *Ind J Ecol* 43: 300-305. **(NAAS rating 4.47)**
- Singh K, Kaur T, Bhullar M S and Brar A S (2016). The critical period for weed control in spring maize in north-west India. *Maydica* 61: 1-7. **(NAAS rating 6.53)**
- Singh M and Bala M (2015). Induction of mutation in chrysanthemum (*Dendranthema grandiflorum* Tzvelev.) cultivar Bindiya through gamma irradiation. *Indian J Hort* 72: 376-381. **(NAAS rating 6.13)**
- Singh N, Ghosh M, Singh D, Rainaa S and Hefishi A I (2015). Antagonistic activity of indigenous strains of *Pseudomonas fluorescens* against fungal plant pathogens. *J Pure App Microbiol* 9: 2255-2262. **(NAAS rating 6.00)**
- Singh N, Kaur G and Pujara M K (2016). Role of direct sown technology for conservation of water resources in Punjab-A case study of Amritsar district. *Indian J Econ Dev* 12: 531-536. **(NAAS rating 4.01)**
- Singh P and Singh H (2016). Kinetics of phosphorus release in press mud amended calcareous and non-calcareous soils of semi – and north-western India. *Indian J Fert* 12: 44-52. **(NAAS rating 3.78)**
- Singh S, Dubey R K and Kukal S S (2015). Effect of nitrogen application on growth of potted chrysanthemum in cocopeat amended farm yard manure based media mixtures. *Indian J Ecol* 42: 126-130. **(NAAS rating 4.47)**
- Singh S, Gill P P S, Aulakh P S and Singh S (2015). Changes of mineral in fruit peel and pulp of grapefruit (*Citrus paradisi* Macf.) cv. Star Ruby during fruit development. *Res Crops* 16: 669-674. **(NAAS rating 6.00)**
- Singh Y, Mandal K and Singh B (2015). Dissipation pattern and risk assessment studies of triazophos residues on capsicum (*Capsicum annum* L.) using GLC-FPD and GC-MS. *Environ Monit Assess* 187: 637. **(NAAS rating 7.68)**
- Singh Y, Mandal K and Singh B (2015). Persistence and risk assessment of cypermethrin residues on chilli (*Capsicum annum* L.). *Environ Monit Assess* 187: 4341. **(NAAS rating 7.68)**

- Srivastava A, Srivastava P, Khobra R, Sharma A, Sarlach R S, Dogra A and Bains N S (2016). Association of morpho-physiological traits in recombinant inbred population of wheat under rainfed environments. *Indian J Ecol* **43**: 7277. (NAAS rating 4.7)
- Suri K S and Makkar G S (2016). Efficacy assessment of Fipronil 0.6% GR against rice stem borer and leaf folder. *J Exp Zoo* **19**: 857-861. (NAAS rating 4.8)
- Taggar G K, Khanna V, Malhotra and Gupta M (2015). Field efficacy and molecular characterization of native *Bacillus thuringiensis* isolates against blister beetle, *Mylabris presstulata* (Thunberg) (Coleoptera: meloidae) in pigeonpea. *J Pure Appl Microbiol* **9**: 2405-2410. (NAAS rating 6.00)
- Taggar G K, Singh R, Cheema H K, Randhawa H S, Gill H S, Singh S, Pandher S, Kumar S, Kaur A and Kumar R (2015). Efficacy and time of application of insecticides for the management of pod borer complex in pigeonpea. *J Insect Sci* **28**: 24-30. (NAAS rating 3.44)
- Thakur R, Dubey R K, Kukal S S and Kapoor Shammi (2016). Interactive effect of biofertilizers and organic potting media on growth and flowering of calendula (*Calendula officinalis* Linn.). *Indian J Ecol* **43**: 245-246. (NAAS rating 4.47)
- Thakur T and Grewal H S (2016). Effect of duration of night interruption on growth and flowering of *chrysanthemum* cv. Kikiobiory. *J App Nat Sci* **8**: 894-898. (NAAS rating 5.08)
- Thakur T, Dhatt K K and Ahmed S (2015). Effect of planting time on growth and flowering of gladiolus. *Int J Curr Res Aca Rev* **3**: 145-152. (NAAS rating 7.5)
- Tyagi M, Singh H and Jawandha S K (2015). Performance of papaya cultivars grown under protected conditions. *Indian J Hort* **72**: 334-337. (NAAS rating 6.11)
- Tyagi V, Dhillon S K and Gill B S (2015). Morpho-physiological expression in cms analogues of sunflower (*Helianthus annuus* L.) under water stress environment. *Electronic J Plant Breed* **1150**-1156. (NAAS rating: 4.19)
- Vashist B B, Nigon T, Mulla D J, Rosen C, Xu H, Twine T and Jalota S K (2015). Adaptation of water and nitrogen management to future climates for sustaining potato yield in Minnesota: Field and simulation study. *Agr Water Manage* **152**: 198-206. (NAAS rating 8.29)
- Walla S S, Aulakh C S, Gill R S, Dhawan V and Kaur J (2016). Intensive integrated farming system approach- A vaccination to cure agrarian crisis in the Punjab. *Indian J Econ Develop* **12**: 451-455. (NAAS rating 4.01)
- Walla S S, Chopra S and Singh J (2016). Effect of different seed rates, weed control methods and irrigation intervals on growth, yield and water productivity of direct seeded rice (*Oryza sativa*) under irrigated conditions of Punjab. *Indian J Ecol* **43**: 140-143. (NAAS rating 4.47)
- Walla S S, Gill R S, Aulakh C S, Kaur J and Chaudhary A (2015). Evaluation of prominent bio-intensive complementary cropping systems in relation to intensification and diversification under assured input conditions. *Indian J Ecol* **42**: 319-325. (NAAS rating 4.47)
- Wubneh W Y and Taggar G K (2016). Role of morphological factors of pigeonpea in importing resistance to spotted pod borer, *Maruca vitrata* Geyer (Lepidoptera: Crambidae). *J Appl Nat Sci* **8**: 218-224. (NAAS rating 5.08)

Books

- Rattan R K, Katyal J C, Dwivedi B S and Kukal S S (eds) (2015). *Soil Science: An Introduction*, Indian Society of Soil Science, New Delhi.
- Miglani G S (2016). *Genetic Engineering Principles, Procedures and Consequences*, Narosa Publishing House, New Delhi, India and Alpha Science International, Oxford, U.K.
- Singh B, Arora R and Gosal S S (eds) (2015). *Biological and Molecular Approaches in Pest Management*, Scientific Publishers, Jodhpur, pp.429

Book Chapters

- Arora S and Hadda M S (2016). Diversifying Land Use: Case of Shiwaliks in Indian Himalayas. In: *Land-Use and Environmental Resources Methods and Management*, Gupta A K, Nair S S and Yunus M (eds), Associated



Publishing Company, New Delhi. pp 81-92

- Aulakh C S (2015). *Faslaan dee vand*. In: *Khetibari-6*, Punjab School Education Board, SAS Nagar, Punjab.
- Aulakh C S, Walla S S and Gill R S (2016). Trans-gangetic plains: Punjab. In: *Organic Farming: Technologies and Strategies*, Gangwar B and Jain N K (eds), Today and Tomorrow's Printers and Publishers, New Delhi. pp 149-171
- Bons H K (2016). Major fruit crops of Punjab. In: *Agriculture for Class VI*, Punjab School Education Board, SAS Nagar, Punjab. pp 35-38
- Bhattacharya R, Kukal S S, Kundu S, Saha J K, Srivastava M and Lal R (2015). Management of urban soils. In: *State of Indian Agriculture - Soil*. National Academy of Agricultural Sciences, New Delhi. pp 215-233
- Chauhan S K, Sharma R, Panwar P and Chander J (2016). Short rotation forestry: A path for economic and environmental prosperity. In: *Forestry Technologies - A Complete Value Chain Approach*, Parthiban K T and Seenivasan R (eds), Scientific Publishers, Jodhpur. pp 260-288
- Choudhary O P and Kharche V K (2015). Soil salinity and sodicity. In: *Soil Science: An Introduction*, Rattan R K et al (ed), Indian Society of Soil Science, New Delhi. pp 353-382
- Hadda M S and Arora S (2016). Impact of integrated watershed management on sustainable use of natural resources and livelihoods in bio-industrial watershed: A case study. In: *Natural Resource Management in Arid and Semi-Arid Ecosystem for Climate Resilient Agriculture*, Pareek N K and Arora S (eds), Soil Conservation Society of India, New Delhi. pp 113-130
- Kaur P and Bhullar M B (2015). Biological and molecular approaches in management of mite pests. In: *Biological and Molecular Approaches in Pest Management*, Singh B, Arora R and Gosal S S (eds). pp 312-328
- Kaur S and Sharma P (2015). Mitochondrial impact on efficient photosynthesis: An overview. In: *Innovation in Plant Sciences and Biotechnology*, Wani S H, Malik C P, Hora A and Kaur R (eds), Agrobios Publishers, Jodhpur. pp 227-243
- Kukal S S and Singh M J (2015). Soil erosion and conservation. In: *Soil Science: An Introduction*, Rattan R K et al (ed), Indian Society of Soil Science, New Delhi. pp 217-254
- Kumar S and Singh Y P (2015). Insect-pests. In: *Brassica Oilseeds Breeding and Management*, Kumar A, Banga S S, Meena P D and Kumar P R (eds), CABI Publishing, Wallingford, United Kingdom. (ISBN No. 978-17-80644-83-7). pp 193-232
- Manhas S S, Sidhu A and Brar K S (2015). Conservation tillage for soil management and crop production. In: *Sustainable Agriculture Review*, Springer International Publishers, Switzerland. pp 61-87
- Mohanpuria P, Sandhu S K and Arora R (2015). RNA interference research: Current status and future outlook for utilization in insect-pest management. In: *Biological and Molecular Approaches in Pest Management*, Singh B et al (ed), Scientific Publishers (India). pp 52-72
- Ram H, Singh S, Gupta N and Kumar B (2016). Biofortified wheat for mitigating malnutrition. In: *Biofortification of Food Crops*, Singh U, Praharaj C S, Singh S S and Singh N P (eds), Springer, India. pp 375-385
- Sanghera G S, Bhatia D and Thind K S (2015). Access and benefit sharing on the use of indigenous traditional knowledge. In: *Plant Genetic Resources and Traditional Knowledge for Food Security*, Salgotra R K and Gupta B B (eds), Springer Science + Business Media, Singapore. pp 163-182
- Sanyal S K, Gupta S K, Kukal S S and Jeevan Rao K (2015). Soil degradation, pollution and amelioration. In: *State of Indian Agriculture - Soil*. National Academy of Agricultural Sciences, New Delhi. pp 234-266.
- Sekhon B S (2015). *Jaag किसान जाग*. In: *Kheti Vich Geet Ate Kavita*, Sharma A (ed), PAU, Ludhiana. pp 106-107
- Singh R (2015). *Kheti lai mitti ate paani di parkh*. In: *Khetibari-7*, Singh D and Dhaliwal R K (eds), Punjab School Education Board, Mohali, Punjab, India. pp 11-18
- Singh S, Kaur G and Haldhar S (2016). Current status of biocontrol agents of insect and mite pests of citrus in Punjab. In: *Compendium National*, Pareek O P, Singh D, Samadia D K, Chaudhary M, Jatav M K, Birbal, Haldhar S M, Soni M L, Chhangani A K and Choyal R R (eds). pp 9-20

- Thakur T and Grewal H S (2016). Genetically engineered ornamentals. In: *Commercial Ornamentals II, Traditional and Loose Flowers*, Misra R L and Misra S (eds), Astral International Private Ltd. Publishers, New Delhi (accepted).
- Walia S S, Gill M S, Gill R S, Kaur J and Chaudhary A (2015). Effect of organic nutrient management packages on crop yield and soil fertility in maize-potato-onion cropping system in Punjab. In *System Based on Organic Farming*, Pal S S and Gangwar B (eds), ICAR- Indian Institute of Farming Systems Research, Modipuram, Meerut. pp 107-127

Manuals

- Bajwa U and Thind S S (2016). Practical Manual on Introduction to Food Science and Post- Harvest Value Addition. Department of Food Science and Technology, PAU, Ludhiana.
- Brar B S, Dhaliwal S S, Dheri G S, Sekhon B S, Mavi M S, Gill R S and Gupta R K (2016). Practical Manual on Manures and Fertilizers (for Soils 204). Department of Soil Science, PAU, Ludhiana
- Brar J S, Sarabha J S and Gill M I S (2016). Practical Manual on *Faidar Bootiyan Di Nursery Tyar Karu*. Department of Fruit Science, PAU, Ludhiana. p 48
- Sarabha J S, Brar J S and Gill M I S (2016). Practical Manual on *Baghyan Di Sambhal-Sambhal Ate Navein Baag Lagauna*. Department of Fruit Science, PAU, Ludhiana. p 50
- Singh H and Thakur A (2016). Practical Manual on Tropical and Dry Land Fruit Production (for Hort- 501). Department of Fruit Science, PAU, Ludhiana.
- Singh K, Manchandha J S, Kahlon M S and Brar B S (2016). Experiential Learning on Evaluating Soil Health and Irrigation Water Quality. Department of Soil Science, PAU, Ludhiana.
- Thind K S, Gill M S, Dhillon S K, Bhatia D and Gupta N (2015). Training Manual on Mendelian Genetics to Molecular Genetics in Relevance to Plant Breeding. Centre of Advanced Faculty Training, August 6-26, PAU, Ludhiana. p 1-278

Research Bulletins

- Bhullar M B, Sharma R K and Kaur P (2015). Mites Infesting Agri-Horticultural Crops in Punjab and their Management. AINP on Agricultural Acarology, Department of Entomology, PAU, Ludhiana. p 27
- Gill K K, Kingra P K and Kukal S S (2016). Long-term Weather Variability in Central Punjab. School of Climate Change and Agricultural Meteorology, PAU, Ludhiana.
- Grewal H S and Singh P (2016). Nursery Production of Ornamental Plants. PAU, Ludhiana. p 104
- Tiwari A K, Singh K P, Shephalika A, Girsh K S and Singh P J (2015). Lawn Management. ICAR-Directorate of Floricultural Research, Extension Bulletin No.14, College of Agriculture, Shivajinagar, Pune-411005 (Maharashtra), India. p 48

College of Agricultural Engineering and Technology

Research Papers in Indian and Foreign Journals

- Alam M S, Kaur J, Khaira H and Gupta K (2016). Extrusion and extruded products: Changes in quality attributes as affected by extrusion process parameters: A review. *Critical Rev Food Sci Nutr* 56: 445-473 (NAAS rating 11.18)
- Alam M S, Khaira H, Pathania S, Kumar S and Singh B (2015). Extrusion process optimization for soy-carrot pomace powder incorporated wheat-based snacks. *J Agril Engg* 52: 1-13 (NAAS rating 4.27)
- Alam M S, Kumar S and Khaira H (2015). Effect of extrusion process parameters on a cereal based ready to eat expanded product formulated by carrot pomace. *Cereal Food World* 60: 287-295 (NAAS rating 6.45)
- Anand G, Khurana R, Manes G S and Dixit A K (2016). Studies on physical properties of pelleted radish (*Raphanussativus*) seeds. *Res Environ Life Sci* 9: 473-476. (NAAS rating 4.09)
- Bhardwaj A, Mahal J S, Manes G S and Verma A (2015). Optimization of operational parameters of a dust



separation system for straw combine. *J of Agril Engg* **52**: 8-14. **(NAAS rating 4.27)**

- Dhimate A, Mahal J S, Singh M, Dixit A and Manes G S (2015). Refinement and evaluation of wheat straw combine for better straw quality. *Sci J Agri Engg XL*: 31-40. **(NAAS rating 4.24)**
- Gill R S, Hans V S, Singh S, Singh P and Dhaliwal S S (2015). A small scale honey dehydrator. *J Food Sci Technol* **52**: 6695-6702. **(NAAS rating 8.20)**
- Grewal R S, Khurana R, Manes G S, Dixit A and Verma A (2015). Development and evaluation of tractor operated inclined plate metering device for onion seed planting. *Agric Engg Int CIGR J* **17**: 31-38. **(NAAS rating 6.6)**
- Hans V S, Gill R S, Singh R P (2016). Effect of rib roughness pitch on thermal and thermo-hydraulic performance of a solar air heater roughened artificially with arc rib having gap. *J App Nat Sci* **8**: 251-256. **(NAAS rating 5.08)**
- Jasowal N S, Singh S K, Dixit A K and Khurana R (2016). Field evaluation of a tractor operated trailed type boom sprayer. *Agric Engg Today* **40**: 41-52. **(NAAS rating 3.66)**
- Kaur B, Bhatia S and Phutela U (2015). Production of cellulases from *Hemicola fuscoatra* MTCC 1409: Role of enzymes in paddy straw digestion. *African J Microbiol Res* **9**: 631-638. **(NAAS rating 5.0)**
- Kaur G, Sharma R and Singh J (2016). GIS based spatial modelling for cost optimized energy generation from biomass. *J Agri Engg* **53**: 16-26. **(NAAS rating 4.27)**
- Kaur K and Phutela U G (2016). Sodium carbonate pretreatment: An approach towards desilication of paddy straw and enhancement in biogas production. *Paddy Water Env* **14**: 113-121. **(NAAS rating 7.15)**
- Khalid G, Singh A K, Sonkawade R G (2016). Physicochemical, thermal and pasting characteristics of gamma irradiated rice starches. *Int J Bio Macromolecules* **85**: 460-466. **(NAAS rating 8.86)**
- Kumar R, Dixit A, Singh S K, Singh G and Sachdeva M (2015). Production and characterization of ethyl ester crude Jatropha Curcas oil having high free fatty acid content. *J Inst Enggs (India): Series A* **96**: 229-235. **(NAAS rating 4.0)**
- Kumari R and Kaushal A (2015). Economic viability of drip irrigated sweet pepper under different kinds of fertilizers. *Env Eco* **33**: 1322-1326. **(NAAS rating 4.09)**
- Parmar M and Phutela U G (2015). Biocolors: The new generation additives. *Int J Curr Microbiol App Sci* **4**: 688-694. **(NAAS rating 6.0)**
- Sahni N and Phutela U G (2015). Potential of thermophilic fungal isolates for cellulolytic and lignolytic enzyme production from paddy straw. *Agric Res J* **52**: 29-32. **(NAAS rating 3.0)**
- Saimbhi V S (2016). Effect of puddling equipment on puddling characteristics under paddy cultivation in Punjab. *Int J App Engg Res* **2**: 332-338. **(NAAS rating 3.19)**
- Saimbhi V S and Pal R (2016). Mapping the soil fertility status of different villages of district Shaheed Bhagat Singh Nagar, Punjab in India. *Eco Env Cons* **22**: 253-256. **(NAAS rating 5.02)**
- Sethi V P and Kumar A (2016). Design and installation of pot-based indigenous hybrid hydroponics technology with water and nutrient recirculation system for commercial greenhouse vegetable production: Part-I. *Agri Mech Asia, Africa Latin America, Japan* **47**: 60-68. **(NAAS rating 6.06)**
- Sethi V P, Kumar A, Dhatt A S and Sidhu M K (2016). Experimental and economic evaluation of pot-based indigenous hybrid hydroponics technology with water and nutrient recirculation system for commercial greenhouse vegetable production: Part II. *Agri Mech Asia, Africa Latin America, Japan* **47**: 89-95. **(NAAS rating 6.06)**
- Sharda R, Mahajan G, Siag M, Singh A and Chouhan B S (2016). Performance of drip irrigated dry seeded rice (*Oryza sativa* L.) in South Asia. *Paddy Water Env* (In Press). **(NAAS rating 7.15)**
- Sharma P and Kaushal A (2015). Economics of growing okra under drip fertigation. *Indian J Sci Tech* **8**: 1-5. **(NAAS rating 4.06)**
- Sharma P, Kaur L, Mittal R, Kaur S, Kaur S (2016). Awareness about effects of climate change on water resources and its solution. *Indian J Econ Dev* **12**: 573-578. **(NAAS rating 4.01)**

- Sharma R (2016). Decadal change analysis of biomass intensity and estimating surplus agricultural biomass using GIS in Punjab. *Indian J Econ Dev* 12: 565-572. (NAAS rating 4.1)
- Sharma R and Singh I (2015). Biogas technology infusion in rural Punjab. *Indian J Econ Dev* 11: 177-181 (NAAS rating 4.1)
- Sharma R, Chandel A, Thakur S S, Singh G and Singh B (2016). Impact assessment of tractor operated paddy straw management technologies in Punjab. *Agric Res J* 52: 287-289. (NAAS rating 3.01)
- Singh A K, Rehal J, Kaur A and Kaur G J (2015). Enhancement of attributes of cereals by germination and fermentation: A review. *Critical Rev Food Sci Nutr* 55: 1575-1589. (NAAS rating 11.18)
- Singh D (2015). Computer aided leaf morphometric approach for the identification of regional plant species. *Env Ecol* 34: 1556-1561. (NAAS rating 4.09)
- Singh D and Singh K B (2016). Evaluation of vocational training programmes on mushroom cultivation. *Indian J Econ Dev* 12: 387-392. (NAAS rating 4.01)
- Singh G, Mahal J S, Manes G S, Prakash A and Dixit A (2015). Effect of blade shape and speed of rotary puddler on puddling quality in sandy clay loam soil. *Agri Mech Asia, Africa and Latin America* 46: 13-18. (NAAS rating 6.01)
- Singh M, Thakur S S, Chandel R and Sharma A (2015). Development and field evaluation of corn-stover collector attachment for maize combine harvester. *Agri Eng Today* 39: 1-7. (NAAS rating 3.66)
- Sooch S S (2015). Infusion of biogas technology in Punjab: A case of large capacity biogas plant. *Indian J Econ Dev* 11: 239-243. (NAAS rating 4.01)
- Taggar M S (2015). Insect cellulolytic enzymes: Novel sources for degradation of lignocellulosic biomass. *J Appl Nat Sci* 7: 625-630. (NAAS rating 5.0)
- Verma A, Singh A, Singh A, Sidhu G S and Dixit A (2016). Performance evaluation of tractor operated paddy straw mulcher. *J Krishi Vigyan* 4: 70-75. (NAAS rating 2.77)

Manuals

- Singh D (2016). Laboratory Manual Digital Electronics (for EE 302). School of Electrical Engineering and Information Technology, PAU, Ludhiana. p.46
- Singh D (2016). Laboratory Manual Electrical Machines (for EE 204). School of Electrical Engineering and Information Technology, PAU, Ludhiana. p.52
- Lohan S K, Saimbhi V S and Verma A (2016). Farm Power and Machinery: A Practical Manual (for FMPE 202). Department of Farm Machinery and Power Engineering, PAU, Ludhiana. p.54

Research Bulletins

- Bhullar M S, Brar A S, Sharma S, Kaur P, Soni A, Saimbhi V S, Gangawar M, Kaur J and Shera P S (2016). Integrated Management of Aquatic Weeds in Drains and Water Bodies in Punjab. Annual Technical Report of Research Project, PAU, Ludhiana.

College of Basic Sciences and Humanities

Research Papers in Indian and Foreign Journals

- Aggarwal N and Gupta M (2016). Gender, financial literacy and stock market participation: An experience with University and College teachers. *Ind J Econ Develop* 12: 49-54. (NAAS rating 4.01)
- Ahuja H, Kaur S, Gupta A K, Singh S and Kaur J (2015). Biochemical mapping of lentil (*Lens culinaris* Medik) genotypes for quality traits. *Acta Physiol Plant* 37: 179. (NAAS rating 7.58)
- Asthir B, Kaur R and Bains N S (2015). Variation of invertase activities in four wheat cultivars as influenced by thiourea and high temperature. *Acta Physiol Plant* 37: 1712. (NAAS rating 7.58)
- Bashir S and Kaur N (2016). Effects of different doses of lead on morphological and biochemical parameters of chickpea (*Cicer arietinum* L.). *Ind J Ecol* 43: 157-159. (NAAS rating 4.47)



- Bhardwaj R D, Sharma A, Sharma H and Srivastava P (2015). Role of gallic acid pre-treatment in inducing the antioxidant response of two wheat cultivars differing in drought tolerance. *Ind J Agric Biochem* **28**: 155-165. **(NAAS rating 4.03)**
- Brar A K and Kataria P (2015). Sugarcane production scenario in India with particular reference to Punjab. *Indian J Econ Dev* **11**: 833-842. **(NAAS rating 4.01)**
- Brar H S, Vashist K K and Bedi S (2016). Phenology and yield of spring maize (*Zea mays L.*) under different drip irrigation regimes and planting methods. *J Agric Sci Tech* **18**: 831-843. **(NAAS rating 6.70)**
- Chahal K K, Bhardwaj U, Kaushal S and Sandhu A (2015). Chemical composition and biological properties of *Chrysopogon zizanioides* (L.) Robertysyn. *Vetiver azizanioides* (L.) Nash- A review. *Indian J Nat Prod Resour* **6**: 251-260. **(NAAS rating 4.10)**
- Chahal K K, Kaur P, Kataria D and Kaur R (2016). Bioefficacy of carrot seed essential oil as stored grain protectant against red rust flour beetle *Tribolium castaneum*. *Pestic Res J* **28**: 76-83. **(NAAS rating 4.16)**
- Chahal K K, Kaur P, Katania D and Kaur R (2016). Carotol: A sesquiterpenoid isolated from carrot seed oil. *Asian J Chem* **28**: 1004-1006. **(NAAS rating 6.00)**
- Chahal K K, Kumar A, Kataria D, Singh T and Chadha B K (2016) Dynamics of demand and consumption of pesticides in agriculture - An overview. *Indian J Econ Dev* **12**: 171-177. **(NAAS rating 4.01)**
- Chahal K K, Singh R, Kumar A and Bhardwaj U (2016) Antifungal potential of coriander seed essential oil and its constituents. *Indian J Ecol* **43**: 292-295. **(NAAS rating 4.47)**
- Chahal K K, Vashist M, Bhardwaj U, Kaur R and Kumar A (2015). Composition and assessment potential of wild ginger oil and its fractions as stored grain protectants. *Indian J Ecol* **42**: 326-330. **(NAAS rating 4.47)**
- Chauhan S K, Sharma R, Singh B and Sharma S C (2015). Biomass production carbon sequestration and economic in on-farm poplar plantations in Punjab, India. *J Appl Nat Sci* **7**: 452-458. **(NAAS rating 5.08)**
- Gaba J, Sharma S, Arora G and Sharma P (2016). Synthesis, characterization and microbial activity of N-substituted pyrazolines. *Asian J Chem* **28**: 2031-2037. **(NAAS rating 6.00)**
- Gaba J, Sharma S, Arora G, Joshi S and Goyal A (2015). Synthesis and microbial activity of pyrazolines. *J Indian Chem Soc* **92**: 1587-1593. **(NAAS rating 6.17)**
- Gangwar M, Dhaliya S and Kaur S (2015). Potential of Rhizobium species to enhance growth and symbiosis in Berseem. *Ind J Ecol* **42**: 174-178. **(NAAS rating 4.47)**
- Garg N and Singla N (2015). Blood clotting response test for detecting resistance to second generation anticoagulant bromadiolone in house rat, *Rattus rattus*. *Ind J Anim Res* **49**: 607-611. **(NAAS rating 6.04)**
- Goyal A, Kalia A and Sodhi H S (2015). Selenium stress in *Ganoderma lucidum*: A scanning electron microscopy appraisal. *African J Microbiol Res* **9**: 855-862. **(NAAS rating 5.0)**
- Goyal A, Sharma S, Gaba J and Kaur H (2016). Green synthesis of isoxazoline derivatives using microwave irradiation and their antifungal activity. *Asian J Chem* **28**: 2169-2172. **(NAAS rating 6.00)**
- Goyal R and Sharma S (2015). Genotypic variability in seed storage protein quality and fatty acid composition of soybean. *Legume Res* **38**: 297-302. **(NAAS rating 6.15)**
- Grover S, Kaur S, Gupta A K, Taggar G K and Kaur J (2016). Potential protease inhibitor isoforms from pigeonpea against *Helicoverpa armigera* gut proteases. *Ind J Agric Biochem* **29**: 68-73. **(NAAS rating 4.03)**
- Grover K, Batra A and Choudhary M (2015). Development of risk assessment index to evaluate cardiovascular diseases among young adult males in Punjab. *Indian J Ecol* **42**: 207-213. **(NAAS rating 4.47)**
- Grover K, Choudhary M and Batra A (2015). Income and physical activity level as risk factors for cardiovascular diseases in young males. *Agri Res J* **52**: 192-197. **(NAAS rating 3.01)**
- Gumber K, Sidhu A and Kumar V (2015). Green synthesis of thiazol-2ylthiazolidin-4-ones as potential antifungals. *Russian J App Chem* **88**: 2065-2073. **(NAAS rating 6.6)**
- Gupta K and Dharni K (2016.) Use and influence of nutrition labeling: An emerging market experience. *Nutr Food*

Sci 46: 441-456. (NAAS rating 5.09)

- Joya and Sangha G K (2016). Development and behavioural toxicity of deltamethrin on *Rattus norvegicus* following gestational exposure. *J Appl Nat Sci* 8: 40-45. (NAAS rating 5.08)
- Kataria D, Chahal K K and Kumar A (2016) Chemical transformations of carotol isolated from carrot seed oil. *Asian J Chem* 28: 1790-1792. (NAAS rating 5.00)
- Kaur A and Saran S K (2016). Nutrient usage in Punjab Agriculture- Status and constraints. *Indian J Econ Dev* 12: 501-506. (NAAS rating 4.01)
- Kaur A, Singh K and Kaur N (2016). Post harvest keeping quality of gladiolus (*Gladiolus* spp.) in relation to pulsing treatment and refrigerated storage. *Indian J Ecol* 43: 219-223. (NAAS rating 4.47)
- Kaur B, Sangha M K and Kaur G (2016). Calibration of NIRS for the estimation of fatty acids in *Brassica juncea*. *J Am Oil Chem Soc* (In Press) 93: 673-680. (NAAS rating 7.54)
- Kaur B, Vatta K and Sidhu R S (2015). Optimising irrigation water use in Punjab agriculture: Role of crop diversification and technology. *Indian J Agril Econ* 70: 307-318. (NAAS rating 5.04)
- Kaur D, Grewal S, Kaur J, Singh S and Singh I (2016). Water deficit stress tolerance in chickpea is mediated by the contribution of integrative defence systems in different tissues of the plant. *Funct Plant Biol* (In Press). (NAAS rating 9.15)
- Kaur G and Ghai N (2016). Effect of foliar application of mineral nutrients on anatomical changes and hydrolytic enzyme activities of pedicel of pigeonpea (*Cajanus cajan* L.). *Indian J Ecol* 43: 410-414. (NAAS rating 4.47)
- Kaur G and Mavi H K (2016) Farmers' suicide in Punjab - Problems and possible solutions. *Indian J Econ Dev* 12: 45-49. (NAAS rating 4.01)
- Kaur J and Gosal S K (2015). Influence of weather parameters on activities of bacterial population associates with rhizobium soil of rice crop. *Ecol Env Conser* 21: 145-152. (NAAS rating 5.02)
- Kaur J, Sodhi H S, Jaswal R K and Kapoor S (2015). Nutritional assessment of mutants of *Calocybe indica* produced by protoplast mutagenesis. *J Appl Nat Sci* 7: 686-690. (NAAS rating 5.08)
- Kaur K and Kocher D K (2015). Effect of water salinity and pH on survival and developmental period of *Aedes* mosquito larvae. *J Insect Sci* 28: 153-157 (NAAS rating 4.3)
- Kaur L and Zhawar V K (2015). Phenolic parameters under exogenous ABA, water stress, salt stress in two wheat cultivars varying in drought tolerance. *Ind J Plant Physiol* 20: 151-156. (NAAS rating 4.66)
- Kaur L and Zhawar V K (2016). Antioxidant parameters under salt stress in drought tolerant and susceptible wheat cultivars. *Ind J Plant Physiol* 21: 101-106. (NAAS rating 4.66)
- Kaur M, Kaur N, Jeet K and Kaur P (2015). MgFe₂O₄ nanoparticles loaded on activated charcoal for effective removal of Cr(VI) – A novel approach. *Ceram Inter* 41: 13739–13750. (NAAS rating 8.61)
- Kaur M, Singh M, Mukhopadhyay S S and Gupta M (2015). Structural, magnetic and adsorptive properties of clay ferrite nanocomposite and its use for effective removal of Cr(VI) from water. *J Alloys Compds* 653: 202-211. (NAAS rating 8.73)
- Kaur N, Bons H K, Rattanpal H S and Kaur R (2016). Effect of growth regulators and mineral nutrients on source-sink relationship for management of fruit drop in kinnow mandarin. *Int J Agr Environ Biotech* 9: 403-410. (NAAS rating 4.10)
- Kaur N, Singla N and Singh R (2016). Efficacy of tyre bait station for rodenticide application in rice crop fields during monsoon season. *Ind J Ecol* 43: 354-356. (NAAS rating 4.47)
- Kaur S and Kaur P (2016). Marginal and small farmers access to modern milk marketing chains in Punjab. *Indian J of Econ Dev* 12: 1-6. (NAAS rating 4.01)
- Kaur S, Gupta A K and Zhawar V K (2015). ABA-dependent sucrose regulation of antioxidant metabolism in wheat cultivars varying in ABA-sensitivity. *Biologia* 70: 165-173. (NAAS rating 6.83)
- Kaur S, Kaur S, Gupta A K and Kaur J (2015). DNA fingerprinting of cold stress tolerant and susceptible chickpea



genotypes with RAPD Markers. *Ind J Agric Biochem* **28**: 132-137. **(NAAS rating 4.03)**

- Melkani A and Katania P (2015). The development-conservation trade off facing Indian agriculture: Carbon costs of Punjab agriculture. *Agril Econ Res Rev* **28**: 219-228. **(NAAS rating 5.68)**
- P Katyal, Sahota PP, Singh D and Sikka R (2015). Prevalence of heavy metal resistant bacteria in samples from sewage treatment plants and common effluents treatment plants. *J Env Biosci* **29**: 533-538. **(NAAS rating 4.2)**
- Raina D, Kaur R and Aulakh G S (2016). Evaluation of mushroom farming among rural masses. *Int J Farm Sci* **6**: 17-22. **(NAAS rating 3.54)**
- Raju S S, Chand R, Srivastava S K, Kaur A, Singh J, Jain R, Immanuelraj K and Kaur P (2015). Comparing performance of various crops in Punjab based on market and economic prices and natural resource accounting. *Agril Econ Res Rev* **28**: 189-198. **(NAAS rating 5.68)**
- Randhawa N, Kaur J, Kaur S and Singh S (2016). Moisture stress induced changes in metabolites and cellular functions in chickpea (*Cicer arietinum* L.) genotypes. *J Appl Natural Sci* **8**: 225-231. **(NAAS rating 5.08)**
- Rani M, Khan SA, Yusuf M, Sahota P and Pandove G (2015). Synthesis, studies and in vitro-antibacterial activity of N-substituted-5-(furan-2-yl)-phenylpyrazolines. *Arab J Chem* **8**: 174-180. **(NAAS rating 9.73)**
- Rani S, Chauhan S K, Dhath K, Sharma R and Babuta R (2015). Flower seed production for remunerative returns under poplar based agro-forestry system. *Indian J Agrofor* **17**: 61-69. **(NAAS rating 4.5)**
- Saini P, Gangwar M, Kalia A, Singh N and Narang D (2016). Isolation of endophytic actinomycetes from *Syzygium cumini* and their antimicrobial activity against human pathogens. *J Appl Nat Sci* **8**: 416-422. **(NAAS rating 5.08)**
- Saini P, Khaanna V and Gangwar M (2015). Mechanisms of plant growth promotion by Rhizobacteria. *J Pure Appl Microbiol* **9**: 1163-1177. **(NAAS rating 6.07)**
- Sangha G K and Kalra S (2016). Evaluation of oxidative stress in rats (*Rattus rattus*) inhabiting Bathinda region of Punjab, India. *Indian J Animal Res* **50**: 168-174. **(NAAS rating 6.03)**
- Sharma A, Bhardwaj R D and Gupta A K (2015). Ferulic acid: A novel inducer of antioxidant enzymes in wheat (*Triticum aestivum* L.) seedlings. *Cereal Res Comm* **43**: 394-402. **(NAAS rating 6.61)**
- Sharma P, Utreja D and Bedi S (2016). Chemical transformations and biological studies of terpenoids isolated from essential oil of *Cyperus scanosus*. *Asian J Chem* **28**: 2153-2158. **(NAAS rating 6.00)**
- Sharma S, Bansal T and Gaba J (2015). Comparative studies on synthesis of amides by using environmentally benign methods. *Indian J of Ecol* **42**: 335-338. **(NAAS rating 4.47)**
- Sidhu A, Sharma P, Gumber K and Sharma V K (2016). Synthesis and antifungal evaluation of benzothiazol-2-ylcarbomidothioates against covered smut and loose smut infections in barley and wheat. *Pl Dis Res* **31**: 114-116. **(NAAS rating 3.3)**
- Singh A and Kathuria L M (2016) Understanding drivers of branded food choice among low-income consumers. *Food Qual Pref* **52**: 52-61 **(NAAS rating 9.688)**
- Singh M and Goyal M (2016). Imperfections in implementation of MGNREGA – A study of Punjab. *Indian J Econ Dev* **12**: 181-86. **(NAAS rating 4.01)**
- Singh M and Singh R (2016) Intervention for promoting integration between organised retailers and agribusiness groups. *Indian J Eco Dev* **12**: 489-492. **(NAAS rating 4.01)**
- Singh M P, Jaswal R K and Sodhi H S (2015). Evaluation of *Agaricus bisporus* Lange (Sing.) strains and their steeping for improved shelf life. *J Pure Appl Microbio* **9**: 1633-1640. **(NAAS rating 6.07)**
- Singh N and Bhardwaj R D (2016). Ascorbic acid alleviates water deficit induced growth inhibition in wheat seedlings by modulating levels of endogenous antioxidants. *Biologia* **71**: 402-413. **(NAAS rating 6.83)**
- Singh P, Sahota P and Singh R K (2015). Evaluation and characterization of new alpha-L-rhamnosidase producing yeast strains. *J Gen Appl Microbiol* **61**: 149-156. **(NAAS rating 6.94)**
- Singh P, Sahota P, Bhadra F and Singh R K (2015). Optimization, production and scale up of debittered kinnor beverage by alpha-L-rhamnosidase producing yeast. *Emir J Food Agric* **27**: 548-555. **(NAAS rating 5.34)**

- Singh S and Bhogal S (2015). Commission agent system: Significance in contemporary agricultural economy of Punjab. *Econ Pol Weekly* 50: 56-62. (NAAS rating 4.66)
- Singh S and Kaur P (2016). Price spread and marketing efficiency in the marketing of broilers in Ludhiana district of Punjab. *Indian J Econ Dev* 12: 117-122. (NAAS rating 4.01)
- Singh S, Sharma V K, Kaur M, Kingra H S and Bhogal S (2016) Employment of different resources in Punjab agriculture. *Indian J of Econ Dev* 12: 213-218. (NAAS rating 4.01)
- Srivastava S, Chand R, Raju S S, Jain R, Kingsly I, Sachdeva J and Singh J (2015) Unsustainable groundwater use in Punjab agriculture: Insights from cost of cultivation survey. *Indian J Agril Econ* 70: 365-378. (NAAS rating 5.04)
- Sukhmani and Kapur S (2015). Financial viability and problems of manufacturers dealing in waste based business. *Ind J Econ Develop* 11: 751-754. (NAAS rating 4.01)

Bulletins

- Hundal S S (2016). Earthworms in Agriculture. PAU, Ludhiana. pp 1-20
- Kler T K and Kumar M (2016). Agriculturally Important Birds of Punjab. PAU, Ludhiana. pp 1-43
- Singla N, Babbar B K, Singh R and Kaur N (2015) Rodent Pests: A Practical Guide for Management. PAU, Ludhiana.
- Sooch S S and Grewal N S (2016). Renewable Energy: Biogas- An Ideal Source. PAU, Ludhiana. p 176
- Verma Aseem et al (2016). Care and Maintenance of Farm Machinery. PAU, Ludhiana. p 62

Book Chapters

- Aggarwal and Dharni K (2016). A study of relative performance of scheduled commercial Banks in India. In: *Management Mosaic: Traversing Across Assorted Research Areas*, Anshra U, Mangalaya and Savita U (eds). Wisdom Publications, Delhi. pp 74-83
- Katyal P, Sahota P P, Kocher G S and Kaur J (2015). Baker's and Brewer's yeast: Production, applications and genetic manipulations. In: *Frontiers in Food Biotechnology*, NOVA Publishers, USA.
- Kumar A (2015). Use of e-journals by research scholar at M.S. Randhawa Library, Punjab Agricultural University, Ludhiana: A study. In: *Emerging Trends in Libraries*, Rao P V (ed), Kanchi Publishers, Mohali. pp 276-285
- Pandove G, Sahota P and Garg N (2016). *Listeria* species: Re-emerging pathogen in drinking water utilities. In: *Microbes in Food and Health*, Springer Int. pp 317-331
- Sharma A and Vermani S K (2016). Preserving the cultural heritage in digital environment. In: *Libraries Issues and Challenges in Digital Era*, Singh B (ed), Agri-Biovet Press, New Delhi. pp 129-141
- Sharma A and Vermani S (2016). Why preserving the manuscripts? In: *Advanced Applications of ICT in Academic Libraries*, Veer D K (ed), Agri-Biovet Press, New Delhi. pp 84-89
- Srivastava S K, Chand R, Raju S S, Jain R, Kingsly I, Sachdeva J, Singh J and Kaur A P (2016) Volumetric assessment of groundwater irrigation in major crops in Punjab. In: *Analytical Techniques for Decision Making in Agriculture*, Raju S S, Jain R and Ahuja U (eds), Daya Publishing House, New Delhi. pp 165-172
- Srivastava S K, Raju S S, Kaur A P, Singh J, Jain R, Kingsly I and Sachdeva J (2016). Unit level cost of cultivation data: Extraction and retrieving procedure. In: *Analytical Techniques for Decision Making in Agriculture*, Raju S S, Jain R and Ahuja U (eds), Daya Publishing House, New Delhi. pp 309-314
- Sukhpal S and Bhogal S (2016). Critical perspectives on agrarian transition: India in the global debate. In: *Punjab's Small Peasantry: Thriving or Deteriorating*, Mohanty B B (ed), CRC Press, Routledge London. pp 276-292
- Vermani S K and Sharma A (2015). Reference services in the digital environment: Changing dimensions. In: *Emerging Trends in Libraries*, Rao P V (ed), Kanchi Publishers, Mohali. pp 99-102



Manuals

- Bala P, Kaur J and Singh P (2016). Laboratory Manual on Engineering Physics (for Phys. 203). Department of Math., Stat., & Physics, PAU, Ludhiana.
- Bedi S, Ghai N, Kaur J and Sarlach R S (2016). Laboratory Manual on Crop Physiology (revised for Bot. 206). Department of Botany, PAU, Ludhiana.
- Bhandari S (2015). A Manual-cum-Workbook (for Eng. 92). Department of Agricultural Journalism, Languages and Culture, PAU, Ludhiana. p 150
- Gupta U, Jaswal R K and Sodhi H S (2016). Practical Manual on Microbiology. Department of Microbiology, PAU, Ludhiana. p 159
- Kumari R, Cheema H P J, Singh H and Singh K (2016). Basic Mathematics-II (revised for Math.108). Department of Math., Stat., & Physics, PAU, Ludhiana.

College of Home Science

Research Papers in Indian and Foreign Journals

- Bains K, Kaur H, Bajwa N, Kaur H, Kapoor S and Singh A (2015). Iron and zinc status of 6 month to 5 year old children from low income rural families of Punjab, India. *Fd Nutr Bull* **36**: 254-263. (NAAS rating 7.15)
- Batra A, Choudhary M, Grover K and Javed M (2015). Dietary fat intake and risk of cardiovascular diseases in young adult males. In: *Proceedings of the National Academy of Sciences- Section B: Biolo Sci* **85**: 777-785. (NAAS rating 6.0)
- Brar N, Sadana B and Bakgetia P (2015). The Impact of storage period on chemical composition of value added supplementary food. *Int J Fd Nutr Diet* **3**: 5-10. (NAAS rating 3.10)
- Choudhary M, Grover K and Kaur G (2015). Development of rice bran oil blends for quality improvement. *Food Chem* **173**: 770-777. (NAAS rating 9.26)
- Grover K, Batra A and Choudhary M (2015). Development of risk assessment index to evaluate cardiovascular diseases among young adult males in Punjab. *Indian J Ecol* **42**: 207-213. (NAAS rating 4.47)
- Jain R and Singla N (2016). Formulation and nutritional evaluation of food products supplemented with niger seeds. *Nutr Fd Sci* **46**. (NAAS rating 5.09)
- Kaur B and Kaur D (2015) An economic analysis of eco-fashion accessories developed from different left over fabrics. *Indian J Econ Dev* **3**: 767-772. (NAAS rating 4.01)
- Kaur L, Shama P and Garg J. (2016). Causes and cure of farmer's suicide. *Indian J Econ Dev* **12**: 305-310. (NAAS rating 4.01)
- Kaur R and Bains S (2016). Protective clothing for pesticide applicators. *Indian J Ecol* **3**: 271-275 (NAAS rating 4.47)
- Mahal R, Chawla A and Kanwar V (2015). Critical thinking as correlate of stress management among rural adolescent girls. *Adv Res J Soc Sci* **6**: 32-35. (NAAS rating 2.72)
- Miglani N, Bains K and Kaur H (2015). Development of baked and extruded functional foods from metabolic syndrome specific ingredient mix. *J Food Sci Tech* **52**: 5850-5857. (NAAS rating 8.20)
- Miglani N, Bains K and Singh P (2015). Diet and physical activity in relation to metabolic syndrome among urban Indian men and women. *Ecol Fd Nutr* **54**: 43-56. (NAAS rating 6.81)
- Prasad P and Kochhar A (2016). Development of ready to eat supplementary foods using germinated cereal pulse mix, potato flour and green leafy vegetable for malnourished children. *Nutr Fd Sc* **46**: 30-42. (NAAS rating 5.09)
- Ranjit A, Aggarwal R and Bains K (2016). Study of body perception and overweight prevalence among Punjabi college girls. *Indian J Ecol* **43**: 286-291. (NAAS rating 4.47)
- Sharma P, Kaur L, Mittal R, Kaur S and Kaur S (2016). Awareness about effects of climate change on water resources and its solution. *Indian J Econ Dev* **12**: 573-578. (NAAS rating 4.01)

- Sharma S and Sangha J K (2016). Food safety issues and related standards: Awareness and knowledge of home food preparers in Ludhiana. *Indian J Ecol* **43**: 276-279. (NAAS rating 4.47)
- Singh A and Grover K (2015). Nutritional Inputs and awareness to manage seasonal variation in iron status of adolescent girls. *Indian J Ecol* **42**: 437-443. (NAAS rating 4.47)
- Singh A, Bains K and Kaur H (2015). Effect of inclusion of key foods on *in vitro* iron bio-accessibility in composite meals. *J Food Sci Tech* **53**: 2033-2039. (NAAS rating 8.20)
- Singla N, Singla P and Kaur N (2015). The impact of thermal processing methods on the beta carotene content of some commonly consumed vegetables. *Int J Food Ferment Tech* **5**: 253-257. (NAAS rating 4.26)
- Smita, Kaur H and Bains K (2015). Assessment of food and nutrient intake of university resident girls. *Indian J Ecol* **42**: 431-436. (NAAS rating 4.47)
- Verma N, Grewal N and Bains S (2016). Evaluation of comfort and handle behavior of mulberry silk waste/wool blended fabrics for end use. *J Nat Fib* **13**: 277 – 288. (NAAS rating 6.46)

Manual

- Kawatra B L, Brar B, Sadana B, Mann S K, Bains K and Bakheta P (2015). A Manual on Research Methods in Human Nutrition. Department of Food and Nutrition, PAU, Ludhiana. p 27

2015-16



PAU VC along with senior officials of the University seeing Chrysanthemum Show at PAU.



Dr D.R. Bhumbra, former Vice Chancellor, Haryana Agricultural University, Hisar, releasing a publication during 53rd Annual Meet of Alumni Association of College of Agriculture, PAU.



Agricultural stalwarts and meritorious students of PAU posing for a group photo with Dr G.S. Khush, Father of Rice Revolution.

Our Farmers, Our Strength



**Punjab Agricultural University
Ludhiana**