ANNUAL REPORT







PUNJAB AGRICULTURAL UNIVERSITY LUDHIANA

PUNJAB GOVERNOR'S VISIT TO PAU KISAN MELA (September 2016)



The Governor of Punjab and Chancellar of Punjab Agricultural University. Sh V.P. Singh Badnore taking salute from Punjab police contingent at PAU.



The Vice Chancellor of Punjab Agricultural University, Dr Baldev Singh Dhillon extending a floral welcome to the Governor of Punjab and Chancellor of PAU, Sh VP. Singh Badhare.



Sh V.P. Singh Badnore, who was the chief guest at PAU Kisan Mela in September 2016, seeing experimental areas and seeds of various crop varieties developed by PAU. Also seen in the picture

WHITEFLY MANAGEMENT IN COTTON



Data being recorded about whitefly incidence in cotton crop.



Students of PAU conducting survey to check whitefly incidence in cotton crop.

Annual Report 2016-17



PUNJAB AGRICULTURAL UNIVERSITY



This Annual Report covers the period from July 1, 2016 to June 30, 2017

Editor Sheetal Chawla

Photographs Manjit Singh

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CRITICAL SUMMARY AND HIGHLIGHTS OF ANNUAL REPORT OF PUNJAB AGRICULTURAL UNIVERSITY (July 2016 to June 2017)

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 2016 to June 2017, the University made remarkable contributions in developing several crop varieties along with their matching production and protection technologies with an aim to enhance food production in the country in general and Punjab in particular. The University also laid emphasis on conserving natural resources with respect to their quality as well as quantity.

University, its main focus is on developing new crop varieties and their production, protection and processing technologies for enhancing productivity and profitability. Special emphasis 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 of different crops (12 of field, 2 of fruit, 9 of vegetable and 3 of ornamental crops) for cultivation in Punjab. Out of these, nine were identified/released at the national level.

RESEARCH

With research being the major mandate of the

	Crops	Varieties			
Field crops	Wheat	Unnat PBW 343 (PBW 723)*, PBW 1 Zn*			
	Rice	PR 126, Punjab Basmati 4, Punjab			
		Basmati 5 and CSR 30			
	Cotton	PAU Bt 1*			
	Mungbean	TMB 37			
	Pigeonpea	PAU 881*			
	Oats	OL 1802* (OL 11) and OL 1804*			
	Napier Bajra	PBN 342*			
Fruits	Bael	Kagzi			
	Grapes	Superior Seedless			
Vegetables	Muskmelon	MH-51			
	Brinjal	PBH-5,* PBHR-41* and PBHR-42			
	Tomato	Punjab Sona Cherry and Punjab Kesar Cherry			
	Okra	Punjab Suhawani			
-	Bottle Gourd	Punjab Bahar			
	Bitter Gourd	Punjab Jhaar Karela-1			
Ornamentals	Pansy	Punjab Sunaina and Punjab Neelma			
	Marigold	Punjab Gainda No. 1			

*Released/identified at national level

- PAU Bt 1, the first public sector Bt cotton variety developed by the University, was released at the national level in 2017.
- Unnat PBW 343 (PBW 723) is the first wheat variety to be released in the country using Marker Assisted Backcross Breeding (MABB) approachthrough in-house wide hybridization and gene tagging
- QTLs (quantitative trait loci) for grain number were transferred from Oryza longistaminata, using molecular marker technque, to basmati ex. Punjab Basmati 3. In case of maize, QTLs for shoot fly resistance were mapped on chromosome 3, 9 and 10, and for maydis leaf blight resistance, on chromosome 3, 8 and 9.
- Phytophthora parasitica resistant rough lemon (kinnow root stock) transgenics were developed through transformation of beta 1,3 glucanose gene from Trichoderma viride.

Crop ProductionTechnologies

- Application of Azorhizobium biofertilizer was recommended for enhancing grain yield in rice.
- Need-based N scheduling using leaf color chart (LCC) was recommended for basmati rice.
- Application of rice straw biochar @ 5 t/ha each to rice and wheat increased the grain yield of both the crops and saved 40 kg N.
- Two foliar sprays of potassium nitrate @ 1%, first after two weeks of full bloom and second 10 days thereafter, were recommended for improving fruit yield and quality of plum cv. Satluj Purple.
- Drip fertigation in turmeric saved 40 per cent of irrigation water and 20 per cent of nutrients along with 25 per cent increase in crop productivity.
- Planting two rows of turmeric on 67.5 cm wide beds (37.5 cm bed and 30 cm furrow) with plant to plant spacing of 18 cm was recommended.
- · A nutrition garden plan, suggesting

plantation of 21 different types of fruit plants in an area of 1.25 kanal or 625 m2 (25m x 25m), was recommended.

- Soil test report is now available online for easy access to farmers. ">http://www.oausoil.in/>
- In poplar plantations, wheat varieties PBW 725, PBW 677 and WH 1105 were identified for sowing.

Crop Protection Technologies

- Two releases of *Trichogramma chilonis* @ 1,00,000/ha, first release on 10 day old crop and second release one week after first release, were recommended for the management of maize stem borer in *kharif* sown maize.
- Neem based biopesticides, namely Nimbecidine and Achook @ 1.0 litre per acre were recommended for the management of whitefly in cotton in initial stages.
- For the management of whitefly in cotton, green chemistry insecticides, Lano 10EC (pyriproxyfen) and Ulala 50WG (fionicamid) @ 80 g/acre were recommended for economic threshold level (ETL) based application. New brands, namely Voltage 22.95C (spiromesifen) @ 200 mi/acre; Ruby, Ludo and Shoku (diafenthiuron 50 WP) @ 200 g/acre and Goldmit 50EC (ethion) @ 800 mi/acre were also recommended for the management of whitefly.
- New insecticides, namely Osheen 205G (dinotefuran) @ 60 g/acre (adhoc) and Isogashi 17.8 5L (imidacloprid) were recommended for the management of jassid in cotton.
- Treating of seeds with Metalaxyl 35% WS @ 6 g per kg seed was recommended for the management of sunflower downy mildew.
- Spray of Coragen 18.5 SC (chlorantraniliprole) was recommended for the management of maize stem borer in fodder maize.
- Spray of Katsu 4% GR (cartap hydrochloride) or Shinzen 0.3% GR (fipronil) was



recommended for the management of rice stem borers and leaf folder in basmati rice.

 Spray of Almix 20 WP (metsulfuron methyl-chlorimuron ethyl) at 20 g/ha was recommended for the control of sedges and broadleaf weeds in direct seeded rice.

Food Science Technology and Processing

- Technology was developed for naturally fermented baby corn pickle from byproducts during processing of baby corn.
- Pre-biotic drink from finger millet and oats, double toned milk and rose based functional drink were prepared.
- Technology for preparing fruit bars, using different blends of kinnow, guava and grape juice wastes, was standardized.
- On the basis of nutritional composition, the juices of sugarcane, kinnow, aonla, lemon and ginger were found to be the best source for the development of carbonated and non-carbonated sugarcane juice beverages.
- Blends of different juices from fruit and vegetable concentrates were developed and standardized for Punjab Agro Juices, Hoshiarpur.
- Five quinoa (Chenopodium quinoa) based gluten free bakery products were prepared by supplementing quinoa flour at 5, 10 and 15 per cent with rice and oats flour.
- Debittering technology of citrus juices was standardized using yeast Clavispora lusitaniae, reducing limonin by 18.4 per cent and naringin by 38.96 per cent.
- The shelf life of grapefruit cv. Star Ruby can be enhanced up to 14 days under ambient storage by treating the fruits with citrashine wax.
- Pleurotus florida mushroom soup powder was prepared which could be stored up to six months.

Beekeeping and Mushroom Production

 In beekeeping, studies on pollination of Brassica carinata revealed that pollination by Apis mellifera enhances seed yield and noney production potential. In mushrooms, a short method composting formula, based on wheat straw formulation and poultry manure, was standardized for the cultivation of Agaricus bisporus.

Farm Machinery

During the period under report, farm engineers modified and developed several machines.

- Developed PAU Super Straw Management System (SMS), an attachment for combine harvester, for chopping and uniform spreading of straw to improve the efficiency of Happy Seeder for wheat sowing.
- A 'PAU Straw Cutter-cum Spreader' was recommended for chopping and simultaneous spreading of left over straw (loose and standing stubbles after harvesting paddy with combine harvester) to improve the efficiency of PAU Happy Seeder for wheat sowing.
- Tractor operated Auto Rotate Gun Type Sprayer and PAU Multipurpose High Clearance Sprayer were recommended for effective sprays on cotton crop.
- A six row tractor operated Garlic Planter was developed for planting garlic cloves on beds as well as on flat surface.
- An inclined Solar Cooker-cum-Drier was designed with modified cooking vessel of parallel piped shape for cooking food and drying vegetables and other crops for domestic use.
- A 56-plant capacity modified Nutrient Film Technique (NFT) was designed and developed for growing leafy vegetables on rooftop kitchen garden.
- A prototype design of forced draft paddy straw bale combustor was developed with pilot fuel injection system and grate shaker.
- An upgraded Decision Support System was developed for appropriate selection of submersible pump set and accessories such as pump horse power, PVC pipe diameter, wire diameter and wire length.

Agro-processing

· Seven agro-processing complexes were



established in various districts of Punjab with the technical guidance of the Department of Processing and Food Engineering, PAU. About 200 farmers were motivated and guided regarding establishment of agro-processing complexes.

- A naturally ventilated onion storage structure was designed, fabricated and evaluated
- A system for curing of kharif onion using solar energy was developed.
- A forced circulation solar dryer was installed at Unnati Processing-cum-Marketing Cooperative Society, Talwara, for drying of amla, bitter gourd, harad, etc.

Seed and Nursery Production

- The University produced 59,629 g seed of field crops (breeder, foundation, certified and truthfully labelled) and 7,409 g seed of vegetable crops.
- It also produced 3.61 lakh nursery plants of kinnow, guava, pear and plum for distribution to farmers.
- The University produced nearly 1.30 lakh plants of different tree species mainly poplar, eucalyptus, shisham and dek for distribution to farmers during 2016-17.

Clothing and Textiles

- Essential oils, namely Citronella, Eucalyptus and Rosemary, having mosquito repellent properties, were optimized to finish cotton fabric with microcapsules.
- Cotton waste and hemp fibres were blended in three proportions (65:35, 50:50 and 35:65) to develop yarns.

Technologies Commercialized

 The University commercialized several technologies which include seed production of chilli hybrid CH-27, brinjal hybrid PBHR-42, pumpkin hybrids PPH-1 and PPH-2; and licensing of Lucky Seed Drill design, Consortium biofertilizer, bottling of sugarcane julce, mushroom processing and its use in value addition, and koddu churper.

EDUCATION

- During 2016-17, the University offered 10 Undergraduate programmes, 44 Master's programmes, 29 Doctorate programmes and two Diploma courses. In all, 3,497 students were enrolled during academic session 2016-17. A total of 24 foreign students from countries like Afghanistan, Bhutan, Iran, Maldives, Nepal 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 1,000 students in various programmes were awarded scholarships and financial assistance.
- A PAU student bagged Jawaharlal Nehru Best Thesis Award from Indian Council of Agricultural Research, New Delhi. In addition, 19 students were awarded ICAR National Talent Scholarship, 16 ICAR (SRF), one CSIR (SRF), 22 ICAR (JRF) and seven UGC (JRF). The ICAR (NET) was cleared by 13, 11and 1 student from College of Agriculture. College of Agricultural Engineering and Technology, and College of Basic Sciences and Humanities, respectively. Six students of College of Basic Sciences and Humanities, and three of College of Home Science cleared ARS (NET). A total of 82 students got University Merit scholarship, 12 Maulana Azad UGC Fellowship, 13 Innovation in Science Pursuit for Inspired Research (INSPIRE) Fellowship from Department of Science and Technology, and nine Rajiv Gandhi National Fellowship from UGC. The students also participated in various international conferences and training programmes.
- In sports, PAU was declared overall champion in Team Games (M) during the 17^a All India Inter-Agricultural Universities Sports and Games Meet, organized by CCS Haryana Agricultural University, Hisar,



Haryana, from March 25-29, 2017. The University team won two Gold Medals and three Silver Medals in the Team Games (M&W). Besides, the outstanding sportspersons/artists of PAU were awarded 37 Merit Certificates, 13 University Colour and 2 Roll of Honour for their proficiency in sports, games, cultural and literary events for the session 2015-16.

In cultural activities, PAU won the overall trophy during the 17" All India Inter-Agricultural Universities Youth Festival, organized by Indian Council of Agricultural Research, New Delhi, at Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, from February 22-25, 2017. The students clinched Gold Medal in debate; Silver Medals in elocution and one-act play; Bronze Medals in group mime, rangoll and collage; and fourth position in patriotic group song and spot painting during the fest. The PAU students also won Silver Medal in cultural procession and Bronze Medals in skit, cartooning and light vocal solo during the 32" Inter-University North Zone Youth Festival 2016-17. organized by Chhatrapati Shahu Ji Maharaj University, Kanpur, from January 2-6,2017.

EXTENSION

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

 It organized 14 Kisan Melas during September 2016 and March 2017. A huge number of farmers from Punjab and adjoining states of Haryana, Himachal Pradesh, Jammu and Kashmir, and Rajasthan thronged these melas, discussed their farm problems with experts, purchased quality seeds and farm literature, and participated in produce competitions. Eleven progressive farmers were honoured during PAU Kisan Melas at Ludhiana for their outstanding. contributions to agriculture, horticulture and allied enterprises.

- Special campaigns on whitefly management in cotton, paddy straw management and recommended crop varieties were organized across Punjab.
 - Whitefly was effectively controlled through integrated Pest Management technologies.
 - Campaign on paddy straw management and awareness about harmful effects of straw burning and benefits accruing from incorporation of paddy straw resulted in fewer incidence of burning straw as compared to last year and made few villages as zero burning villages.
 - Area under PAU developed wheat and rice varieties increased to 96.9 per cent and 61.9 per cent, respectively.
- A total of 713 adaptive research trials (ARTs) were conducted at different locations to evaluate new crop varieties as well as production and protection technologies on farmers' fields before their recommendation.
- in all, 3,568 front line demonstrations (FLDs), showcasing new technologies, were conducted by all Krishi Vigyan Kendras on improved varieties of oilseed crops (groundnut, sesame, gobhi sarson, toria, raya and sunflower), pulses (summer moong, main season moong, mash, soybean, gram and lentil), parmal rice, basmati rice, cotton (American and desi), maize and maize fodder. Besides these, 165 on farm trials (to test a new technology/idea under farmer's field conditions along with PAU recommended practice and farmer's own practice) and 1,464 training programmes were conducted by various KVKs.
- Four Research and Extension Specialists' Workshops were also organized.
- A total of 230 field days were organized in different villages to promote direct seeded rice technique, use of biofertilizers, mat-



type nursery raising, use of Happy Seeder, integrated pest management in parmal/basmotirice, PAU fruit fly traps and cultivation of pulses (soybean, gram, etc.).

- As many as 2,40,300 farmers were enrolled for weather based agro-advisory.
- A 'Farmer Portal', which has been put on PAU website (www.pau.edu), was started for the benefit of stakeholders.
- The University coordinated with Doordarshan Kendra, Jalandhar, for 248 TV talks and All India Radio, Jalandhar, for 333 talks of PAU scientists.
- A total of 1,046 press releases (529 in English and 517 in Punjabi) were issued to various newspapers. About 170 articles (25 in English and 145 in Punjabi), authored by PAU scientists, were released for publication in vernacular newspapers and magazines.
- The University publishes two monthly farm magazines namely Changi Kheti (in Punjabi) and Progressive Farming (in English). The combined circulation of these magazines was2.07,700 during 2016-17.
- The Package of Practices for Khorif and Rabi Crops were published twice a year both in English and Punjabi. In addition, 44 new/revised farm publications (20 in English and 24 in Punjabi) were brought out.

MEMORANDA OF UNDERSTANDING (MOUs)

To strengthen linkages with national institutions/organizations, PAU signed five memoranda of understanding during 2016-17 with:

- Indian Council of Agricultural Research, New Delhi.
- Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana.
- Maharashtra State Seeds Corporation Limited, Mahabeej Bhavan, Krishi Nagar, Akola, Maharashtra
- · Khalsa College, Amritsar, Punjab.

 Bayer Crop Science Limited, Bayer House Central Avenue, Hiranandani Estate Thane (West), Maharashtra.

AWARDS AND HONOURS

- The Punjab Agricultural University was ranked 232" and was one of the only two agricultural institutes of the country, which made it to the list of top 300 world universities in the ranking done by National Taiwan University in 2017.
- As per the National Institutional Framework Ranking (NIRF) of the Ministry of Human Resource Development, Government of India, New Delhi, PAU was ranked second among the agricultural universities of India.
- The University was honoured by the Indian Society of Genetics and Plant Breeding (ISGPB) in March 2017 for having highest number of landmark varieties to its credit among all the State Agricultural Universities and ICAR Institutes.
- The University was ranked numero uno for publication of research articles and citations by Confederation of Indian Industry (CII)-Indian Citation Index in 2017.
- Two faculty members were awarded/ designated as NAAS fellows, namely Dr Kuldeep Singh, Senior Molecular Geneticist, and Dr Gulshan Mahajan, Senior Agronomist.

Best AICRIP Centre awards

- Entomology (Honey Bees and Pollinators)
- Plant Breeding and Genetics (Rice Breeding)
- Plant Breeding and Genetics (Forage)
- Plant Breeding and Genetics (Maize)

Chaudhary Devi Lal Outstanding AICRP Award

 Soil Science (Micronutrient and Pollutant elements).

Best Seed Production Centre under AICRIP

· Plant Breeding and Genetics (Maize).

Many other faculty members won 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), transgenic, etc. have been integrated into crop improvement programme for precision breeding. In addition, doubled haploid technology is being applied in wheat, maize and rice to accelerate varietal development process. The facilities at Keylong (Himachal Pradesh), Cuttack (Odisha), Hyderabad (Telangana) and Dharwad (Karnataka) are also being used to advance plant 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 technologies to reduce postharvest losses in fruits and vegetables.

The salient research achievements during the period under report are:

CROP IMPROVEMENT

Keeping in view the diversification of cropping systems, the crop improvement research has been reprioritized by laying emphasis on crops



being grown in niche areas like, groundnut in Bhunga block and peas in Chabbewal area of Hoshiarpur, and summer moong in Jagraon. Similarly, breeding oilseed crops like gobhi sarson for Majha and raya for Malwa belts are being sid on breeding for abiotic/biotic stress tolerance and improving quality of the produce, especially, in vegetables and fruits. In addition, due attention is being given to conservation of natural resources and environmental safety and a School of Organic Farming has come up on PAU Campus focusing on these aspects.

Varieties released at state and national level

The University developed/recommended 26 varieties of different crops (12 of field, two of fruit, nine of vegetable and three of ornamental crops) for cultivation in Punjab. Out of these, nine were identified/released at the national level.

Field Crops

 Unnat PBW 343 (PBW 723- Wheat): It is the first variety identified at the national level, developed by PAU through MABB (Marker Assisted Backcross Breeding). PBW 343, the most popular wheat variety for more than a decade, has been reconstituted by deploying specific genes for vellow and brown rust resistance. Its average vield is 22 q/acre. It has been released for cultivation in North Western Plains Zone (Punjab, Haryana, parts of Uttar Pradesh, Rajasthan, Uttarakhand, Himachal Pradesh, and Jammu & Kashmir).



Unnat PBW 343



PBW 1 Zn

- PBW 12n (Wheat): It is the first biofortified (high grain zinc) wheat variety developed by PAU and identified at the national level for North Western Plains Zone (Punjab, Haryana, parts of Uttar Pradesh, Rajasthan, Uttarakhand, Himachal Pradesh, and Jammu & Kashmi). It possesses on an average 40.6 ppm grain zinc concentration, which was 5.0 ppm higher than the check variety PBW 621. Its average grain yield is 21.2 q/acre.
- PR 126 (Rice): It is an early maturing variety that matures in 93 days after transplanting. This leaves a wider window for the farmers to manage paddy straw residue. It possesses long slender, clear translucent grains with high total and head rice recoveries and gives an average grain yield of 30 g/acre.
- · Punjab Basmati 4 (Rice): This basmati

variety is an improvement over the traditional Basmati 370. It is semi-dwarf (96 cm tail) and lodging tolerant, giving an average grain yield of 17.0 q /acre. It possesses extra-long, slender, non-sticky grains with excellent cooking and eating qualities. Its grains almost double upon cooking. It matures in about 116 days after

 Punjab Basmati 5 (Rice): It is an improvement of Basmati 386. It is semidwarf (112 cm tall), having an average grain yield of 15 q /are. It possesse excellent cooking and eating quality characteristics. It matures in about 107 days after transplanting. It is as good as traditional basmativarieties.

transplanting.

 CSR 30 (Rice): It is a salinity tolerant rice variety that is about 139 cm tall. Its average grain yield is 13.0 q /acre. The grains are



extra-long, slender, non-sticky and soft to eat with excellent cooking and eating qualities, it matures in about 112 days after transplanting. This variety was developed at Central Soil Salinity Research Institute, Karnal.

- PAU Bt 1 (Cotton): It is the first public sector Bt cotton variety developed by PAU. It was released at the national level in 2017.
- TMB 37 (Moongbean): It is an early maturing variety of moongbean for sowing during spring and summer season, and was developed by BARC, Mumbai. It matures in about 60 days and has medium sized grains with good culinary properties. Its average yield is 4.9 g/acre.
- PAU 881 (Pigeonpea): It is an early maturing variety having grain yield of 5.5 q/acre. It matures in about 132 days and vacates the field well in time to sow the wheat crop. It has been identified for release in North Western Plains Zone (Punjab, Haryana, Delhi, parts of Rajasthan, Uttar Pradesh and Uttarakhand).
- OL 1802 (Oats): It is a multi-cut variety of oats, released for Central Zone (Uttar Pradesh, Gujarat, Madhya Pradesh, Jharkhand, Bihar and Uttarakhand). It recorded an average green fodder yield of 224/6 g/acre.
- OL 1804 (Oats): It is a single cut variety of oats, released for North East Zone (Assam, Imphal and Odisha). It has good fodder quality traits, gives high fodder yield, and is resistant to diseases and insect pests. Its average green fodder yield is 151.5 q/acre.
- PBN 342 (Napier Bajra): It has been released for North West Zone (Punjab, Haryana and Rajasthan) and South Zone (Coimbatore and Karnataka). It recorded an average 937.0 q/ha green fodder yield

against national checks NB 21 (785.0 q/ha), CO 3 (887.0 q/ha) and PBN 233 (835.1 q/ha), showing the superiority of 19.4, 5.6 and 12.2 per cent, respectively.

Horticultural Crops

- MH-51 (Muskmelon): It is an early maturing high yielding hybrid that can be harvested after 62 days of transplanting. Its average fruit yield is 89.0 q/acre. Its fruit flesh is thick, medium juicy and flavorsome with 12% TSS. Its average fruit weight is 890g.
- PBH-5 (Brinjal): It is an early maturing hybrid of long fruit group of brinjal. Its fruits are long, medium-sized and shining purple with green calyx. Its average yield is 255 q/acre. It has been identified at the national level for cultivation in Zone IV (Bihar, Uttar Pradesh, Punjab and Delhi)
- PBHR-41 (Brinjal): This hybrid brinjal variety has round medium-large sized, shining, deep purple fruits with purple green calys. Its average yield is 260 q/acre. It has been identified at the national level for cultivation in Zone IV (Bihar, Uttar Pradesh, Punjab and Delhi).
- PBHR-42 (Brinjal): Plants of this hybrid are medium-tall, thornless with green foliage.
 Fruits are oval-round, medium-sized, shining, purple-black with green calyx. Its average yield is 251 g/acre.



PBHR-41



PBHR-42





Punjab Sona Cherry

- Punjab Sona Cherry (Tomato): It is a table purpose variety of cherry tomato possessing high carotene content (13 mg per 100 g of fresh weight) that is suitable for protected cultivation. Its fruits are oval, yellow in colour and give first picking after 112 days of transplanting. Fruits are borne in clusters of 20-25 with average fruit weight of 11g and average yield of 425 g/acre. Its TSS content is 7.5%.
- Punjab Kesar Cherry (Tomato): This variety of cherry tomato has high lycopene and carotene content i.e.1.8 mg and 13 mg per 100 g of fresh weight, respectively. It is suitable for protected cultivation. Its fruits are oval, orange in colour and give first picking after 115 days of transplanting. Fruits are borne in clusters of 18-23 with



Punjab Kesar Cherry

average fruit weight of 11g and average vield of 405 g/acre. Its TSS content is 7.6%.

- Punjab Suhawani (Okra): Its fruits are medium long, dark green, tender and five ridged. It has tolerance to yellow vein mosaic disease. Its average yield is 49 g/acre.
- Punjab Bahar (Bottle Gourd): Its fruits are nearly round, medium-sized, light green, shining and pubescent. Its average yield is 222 q/acre.
- Punjab Jhaar Karela-1 (Bitter Gourd): Its fruits are attractive green, tender, spindle shaped and suitable for cooking by chopping. It is resistant to root knot nematode disease. Its average yield is 35 g/acre.



Punjab Jhaar Karela-1



Punjab Bahar

FRUIT CROPS

- Kagzi (Boel): It is the first Boel variety released in Punjab. It has thin fruit shell and less seeds. Its average fruit weight is 1.2 kg as compared to 0.60 kg of local genotypes. It has higher pulp, lower shell percentage and 28-32% TSS (total soluble solids) with an average yield of 107 kg/tree. Its fruits mature between mid-Aprit to mid-May.
- Superior Seedless (Grapes): It is a table purpose variety whose berries are seedless, amber coloured and crisp having 17%TSS and 0.51% acidity. It has loose bunches, which are medium to large in size. Its average yield is 96 q/acre on Y trellis training system.

FLOWERS AND ORNAMENTALS

- Punjab Sunaina (Pansy): Its plants are dwarf having light green leaves, and purple and yellow colour flowers. It is an early variety and bears small sized flowers for four months. If is suitable for pot culture and bedding.
- Punjab Neelma (Pansy): Its plants are dwarf having dark green leaves and purple colour flowers. It is an early variety and bears small sized flowers for four and a half months. It is suitable for pot culture and bedding.
- Punjab Gainda No. 1 (Marigold): It is an open pollinated, heat tolerant variety with fully double, medium-sized, orange coloured flowers, suitable for flower production during summer season. Its plant height is 69 cm and it flowers in 82 days, yielding 44 q/acre, It is moderately resistant to Alternaria leaf blight.

GERMPLASM STRENGTHENING

A large number of germplasm accessions in different crops were procured from various parts of the country and abroad to strengthen the ongoing crop breeding programme. These include wheat (1530), rice (133), oilseeds (25), cotton (31), maize (200), soybean (50), mcongbean (50), urdbean (12), chickpea



(190), pigeonpea (30), pearl millet (6), sugarcane (48), sorghum (266), chilli (10), tomato (8), potato (10), cauliflower (2), binnjal (11), pea (2), cucumber (2), muskmelon (2), snap melon (5), wild melon (2), waternelon (5), pumpkin (5), onion (8), bitter gourd (3), ber (3), guava (3), mango (26), pecan-nut (3), persimmon (2), avocado (1), banana (3), dragon fruit (1), custard apple (1), jamun (2), lemon (1). Moringa oleifera (sohanjna) (12), Melia composita (burma dek) (20), Dalbergia sissoo (tahli) (10), Toona ciliata (toon) (40), chrysanthemum (2), gladiolus (2), trees (2), shrubs (2) and climbers (3).

BIOTECHNOLOGY Field Crops

The School of Agricultural Biotechnology works in close liaison with the crop breeding groups. One of the hallmarks of this venture was the deployment of in-house identified and tagging of rust resistance genes. The development of PBW 723 (Unnat PBW 343), through MABB using leaf and stripe rust resistance genes izr6-½r70, introgressed from Aegilops umbellulata and pyramided with another pair of linked genes Lr37-½r17 through marker assisted selection (MAS) at PAU, was the result of the joint efforts. These genes have been deployed inseveral bread wheat lines.

- Allele mining for Starch synthase gene was done in 20 wild and cultivated wheats. SNP based alleles from four wild progenitor species (Aegilops tauschii acc. pau14102, Aegilaps tauschii acc. pau3747, Aegilops speltoides acc. pau15081 and Triticum dicaccoides acc. pau7107) and two cultivated genotypes (Impaia and C591) were identified as candidate SNPs for testing response to heat stress.
- Allele mining for phospholipase D gene, important for rice bran oil rancidity, was done in rice wild species and promising low PLD lines were identified, which would be used in rice breeding programme. Grain



number QTL (quantitative trait loci) from O. longistaminata is being introgressed in basmati cv. Punjab Basmati 3.

 The QTLs for shoot fly resistance in make were mapped on chromosome 3, 9 and 10 and for maydis leaf blight, on chromosome 3, 8 and 9. The favorable beta-carotene alleles are being introgressed into four QPM lines viz. LM11, LM12, LM13 and LM14 using MAS technology. The QTL for waterlogging tolerance in make is being fine mapped on chromosome 8. Crosses have been initiated for transfer of drought tolerance QTLto spring make using MAS.

Horticultural Crops

- Phytophthora parasitica resistant rough lemon transgenics were developed through transformation of beta-1,3 glucanase gene from Trichoderma virdae.
- Linkage map was constructed in guava F.

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population of Allahabad Safeda x Arka Kiran and Allahabad Safeda x Purple Guava using molecular markers. New gene based SSR markers are being generated by comparative transcriptome study in six guava genotypes for linkage mapping studies. Promising markers, showing close linkage to coloured flesh in the fruit, would be used for MAS.

 In vitro shoot tip grafting of Daisy tangerine on Carrizo rootstock was accomplished.

SEED TECHNOLOGY

During the period under report, the University produced 59,629 q graded seed of field crops (breeder, foundation, certified and truthfully labelled) and 7,409.4 q seed of vegetable crops. Out of this, 1,550 q seed was produced through public-private partnership. The details are given in Table 1 and 2:

Season		Type of seed (q)				
	Breeder seed	Foundation seed	Certified seed	Truthfully labelled seed	Total (q)	
Total	7,355	13,478	23,669	15,127	59.629	

able 2: vegetable seed produced during 2016-1	getable seed produced during 20	16-17
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Season	Type of seed (q)					
	Breeder seed	Foundation seed	Certified seed	Truthfully labelled seed	Total (q)	
Potato	19.30	2,336.70	4,184.20	576.71	7116.91	
Turmeric	26.85	0.69	75.75	189.21	292.50	
Total	46.15	2,337.39	4,259.95	765.92	7.409.41	

Experiment on seed quality, health, yield and storability as affected by pre-sowing seed priming treatments in *Kabuli* chickpea was conducted. It was observed that treating seed with *Trichodermo horzianum* after Vitava and Bavistin application, as a pre-sowing seed priming treatment, improved germination and vigorindex. Fine tuning of technologies recommended or developing new technologies of crop production-protection, and processing of field crops, horticultural crops and agro-forestry is a continuous process across the departments. Similarly, recommendations on subsidiary occupations, farm mechanization, water conservation, blogas generation, food and





nutrition, and apparel and textiles were made during the period under report. A brief overview of these is given below.

CROP PRODUCTION TECHNOLOGIES

Field Crops

- Application of rice straw biochar @ 5 t/ha each to rice and wheat increased the grain yield of both the crops and saved 40 kg N.
- Application of bagasse ash and rice husk ash to wheat @ 10 t/ha saved 30 kg P,O./ha without affecting the productivity of ricewheat system.
- Spreading of 4 tonnes of rice straw mulch in one acre was recommended for saving irrigation water in Napier Bajra. Irrigating Napier Bajra at 8-10 days interval during hot and dry months was also recommended.
- Application of 12 kg S/acre (gypsum: 80 kg/acre or bentonite sulphur 13 kg/acre) in sulphur deficient soils improved the yield of gobhisarson.
- Application of Azorhizobium biofertilizer was recommended for enhancing grain yield in rice.
- Need-based N scheduling using leaf color chart (LCC) was recommended for basmati rice.
- Drip irrigation and fertigation in turmeric saved 40 per cent of irrigation water and 20 per cent of nutrients along with 25 per cent increase in crop productivity.
- Sodic water irrigations in cyclic mode, starting with canal water (CW) followed by sodic water (SW) [2CW: SW, CW: SW), sustained long-term cotton and wheat yield.
- Planting two rows of turmeric on 67.5 cm wide beds (37.5 cm bed and 30 cm furrow) with plant to plant spacing of 18 cm was recommended.
- Soil test report was made available online for easy access to farmers.

Horticultural Crops

- Paddy straw mulching in guava orchards was recommended for the management of weeds, higher fruit yield and quality. Application of 4.0 tonnes of paddy straw per acre as mulch under the tree canopy in the month of May, after the application of recommended dose of organic manure and inorganic fertilizers, reduced the weed biomass by 83 per cent as compared to the control. Fruit yield using paddy straw mulch was significantly higher as compared to that using polythene mulch, mechanical and chemical weed control.
- Two foliar sprays of potassium nitrate @ 1%, first after two weeks of full bloom and second 10 days thereafter, were recommended for improving fruit yield and quality of plum cv. Satluj Purple This increased fruit size by 18 per cent as well as fruit yield by 20 per cent.
- A nutrition garden plan suggesting plantation of 21 different types of fruit plants in an area of 1.25 kanal or 625 m² (25m x 25m) was recommended. This plan ensured nutritional security of the family and availability of fruits round the year.
- Alternate use of saline-sodic ground water with good quality canal irrigation water (1:1) and incorporation of rice straw mulch @ 6 t/ha at sowing were recommended for sustaining soil health and obtaining optimum yield of summer crop of okra in light textured soils in South-Western region of the state.
- In Boston fern, frond production was maximum under 75 per cent shade planting at a distance of 45 x 30 cm. At the time of plantation, application of farm yard manure @ 10 t/acre as basal dose, followed by N at 50 kg/acre in four equal splits at three months interval was recommended.



CROP PROTECTION TECHNOLOGIES

Field Crops

- Two releases of Trichogramma chilonis @ 1,00,000/ha, first release on 10 day old crop and second release one week after first release, were recommended for the management of maize stem borer in khorif sown maize
- Neem based biopesticides, namely Nimbecidine and Achook @ 1.0 litre per acre were recommended for the management of whitefly in cotton in initial stages.
- Ulala 50WG (flonicamid) @ 80 g/acre was recommended for the management of whitefly in cotton.
- Green chemistry insecticide, Lano 10EC (pyriproxyfen) was recommended for the management of whitefly in cotton.
- Treating of seeds with Metalaxyl 35% WS @ 6 g/kg seed was recommended for the management of sunflower downy mildew.
- New brands, namely Voltage 22-95C (spiromesifen) @ 200 ml/acre; Ruby, Ludo and Shoku (diafenthiuron 50 WP) @ 200 g/acre and Goldmit SOEC (ethion) @ 800 ml/acre were recommended for the management of whitefly. New insecticides, namely Osheen 205G (dinotefuran) @ 60 g/acre (adhoc) and isogashi 17.8 SL (imidacloprid) were recommended for the management of jassid in cotton.
- Spray of Coragen 18.5 SC (chlorantraniliprole) was recommended for the management of maize stem borer in fodder maize.
- Spray of Katsu 4% GR (cartap hydrochloride) or Shinzen 0.3% GR (fipronil) was recommended for the management of rice stem borers and leaf folder in *basmatirice*.
- Shaking of plant canopy through the use of coir/jute rope was recommended for the mechanical control of rice leaf folder.

- Spray of Delfin WG (bacterial biopesticide) @ 300 g/acre was recommended for the management of diamondback moth in cole crops.
- Spray of Atari 50 WP and Traxx 50 WP (new brand formulations of atrazine) @ 2 kg/ha was recommended for weed control in maize
- Spray of Almix 20 WP (metsulfuron methyl+chlorimuron ethyl) at 20 g/ha was recommended for the control of sedges and broadleaf weeds in direct seeded rice.
- Spray of Sokusai 50 EC (new brand formulation of pretilachlor) at 1500 ml/ha was recommended for the control of weeds in transplanted rice.
- Spray of Genki 41 SL (new brand formulation of glyphosate) at 0.7% (700 ml in 100 litres of water) was recommended for the control of weeds in non-cropped area.

Horticultural Crops

- Application of Basamid @ 40 g/sqm in irrigated nursery beds of tomato and sealing it with plastic sheet for eight days was recommended. Removing of sheet and upturning of soil thrice in a period of 10 days before sowing of tomato nursery was also recommended.
- Application of pre-emergence herbicide Stormp 30 EC (Pendimethalin) @ 1 litre or Goal 23.5 EC (oxyflorfen) @ 425 ml per acre, followed by mulching with paddy straw @ 25 q/acre, was recommended to check weedstillater stage of garlic crop.

FOOD SCIENCE AND TECHNOLOGY

- Technology for the development of naturally fermented baby corn pickle from industrial by-products was evolved. (Commercialized)
- Pre-biotic drink from finger millet and oats, double toned milk and rose based functional drink were prepared.



(Commercialized)

- Preparation of carbonated and noncarbonated sugarcane juice beverages, using a blend of juices from kinnow, aonla, lemon and ginger in specified proportions. was found to be the best. Use of preservatives was highly reduced due to presence of ascorbic acid in fruit luices, acid in lemon juice and antibacterial functionality of ginger Juice. The non carbonated juices with minimal use of preservatives were stable for three months at ambient and refrigerated conditions. The technology for thermal processing of shelf stable (six months of storage) bottled sugarcane juice has been recommended. (Commercialized)
- Two blends of juices viz, from kinnow, black carrot and pear; and another from tomato, black carrot, sugarbeet, watermelon and mint were found to be the best on the basis of sensory evaluation. These blends were developed and standardized for Punjab Agro Juices. Hoshiarour (Commercialized)
- Juice from grape fruit, known for its immense antioxidant properties, was blended with mango juice in the ratio of 50:50 to obtain a beverage. Grape fruit yielded a juice recovery of 36 per cent (TSS 8.2'Brix and acidity 1.28%). The sensory score for overall acceptability of the blend was 8.0 on a 9-point hedonic scale.
- Fruit bars, using different blends of kinnow, guava and grape juice wastes with 20 per cent sugar and 0.2 per cent citric acid, were prepared. The bar from the blend of kinnow, guava and grapes (1:1:1) with 20 per cent sugar and 0.2 per cent citric acid had maximum acceptability scores. The resultant bar was found to be rich in nurrients.

POST-HARVEST TECHNOLOGIES

- Debittering technology of citrus juices was standardized using yeast, Clavispora lusitaniae that could produce debittering enzymes, naringinase and limonin dehydrogenase, reducing limonin by 18.4 per cent and naringin by 38.96 per cent. This technology was recommended.
- The shelf life of grapefruit cv. Star Ruby can be enhanced up to 14 days under ambient storage by treating the fruits with citrashine wax.
- The foliage of Asparagus (Asparagus setaceus), Fern (Nephrolepis exaltata) and Silver Oak (Grevilla robusta) can be dehydrated by dipping in 20% glycerin solution in a well ventilated dark room for 7-8 days. The dehydrated foliage has a shelf life of more than six months.

AGRO-FORESTRY

- In poplar plantations, wheat varieties PBW 725, PBW 677 and WH 1105 should be preferred for sowing. These should be sown in the first fortnight of November to get higher productivity.
- The fertilizer dose, timing and its method of application to plantations of clonal eucalyptus during different growth years were standardized for obtaining higher productivity from plantations.
- The University produced nearly 1.30 lakh plants of different tree species mainly poplar, eucalyptus, shisham and dek for distribution to farmers during 2016-17

BEEKEEPING

 In studies conducted on stock improvement of Apis mellifera, workers were collected from 10 selected colonies (seven hygienic and three non-hygienic) for genotyping by SSR markers to study the genetic variability between the hygienic and non-hygienic colonies and also within the colonies. It was



observed that the genetic similarity was 0.47 among the colonies.

- Studies on pollination of Brassica corinata revealed that pollination by Apis mellifera resulted in significantly higher seed yield (6.80 g/ha) than pollination exclusion (5.87 g/ha), whereas open pollination gave 7.88 g/ha. Honey production potential of B. carinata was calculated to be 7.8 kg/ha.
- Pollination studies on cotton cv. RCH 650 BGII in the village Sukhladhi, district Bathinda, revealed that per cent increase in number of healthy seeds, weight of healthy seeds, weight of lint and weight of seed cotton per boll in bee pollination treatment over pollinators' exclusion was 31.0, 25.6, 8.1 and 16.7, respectively. Bee pollination treatment had significantly higher number of healthy seeds, weight of healthy seeds, weight of lint and weight of seed cotton per boll over open pollination treatment.

MUSHROOMS

- Physiological, nutritional and biochemical characterization aspects of *Pleurotus* eryngli were undertaken and successful cultivation, using locally available agriresidues showed that it could be commercially cultivated for diversification of mushroom portfolio of the state. It is an aromatic fleshy textured mushroom.
- Short method composting formula, based on wheat straw formulation and poultry manure, was standardized for the cultivation of Agoricus bisporus.
- Pleurotus florida mushroom soup powder was prepared which could be stored up to six months with no reduction of nutrients.
- Calocybe indica mushroom slices can be dried at 55°C and stored in polyethylene bags up to three months without any change in color, texture, nutrition and bacterial count.

FARM MECHANIZATION

Keeping in view the farm needs, agriculture engineers developed and modified various technologies as given below:

- A 'PAU Super Straw Management System' (SMS) was developed and recommended for paddy straw management. It is attached with combine harvester for chopping and uniform spreading of straw to improve the efficiency of Happy Seeder for wheat sowing.
- A 'PAU Straw Cutter-cum-Spreader' was recommended for chopping and simultaneous spreading of left over straw (loose and standing stubbles) after harvesting paddy with combine harvester to improve the efficiency of PAU Happy Seeder for wheat sowing.
- A tractor operated Auto Rotate Gun Type Sprayer, having auto rotating guns, was recommended for effective spray on cotton crop. The field efficiency of this sprayer is 3.0-4.0 acres per hour.
- The PAU Multipurpose High Clearance Sprayer, fitted with auto rotate gun type, boom type and drop up type nozzles, was recommended for effective spray on cotton crop of all growth stages. The field capacity of this sprayer is 5.0 acres per hour.
- A six row tractor operated Garlic Planter was developed for planting garlic cloves on beds as well as for flat surfaces.
- A tractor operated irrigation channel marker was developed and evaluated for making irrigation channels in orchards.
- An inclined Solar Cooker-cum-Drier was designed with modified cooking vessel of parallel piped shape for cooking food and drying vegetables and other crops for domestic use.
- A 56-plant capacity modified Nutrient Film Technique (NFT) was designed and





developed for growing leafy vegetables on rooftop kitchen garden. Lettuce was successfully grown in November 2016 and about 10 kg of lettuce was harvested within 40 days of transplanting.

 A prototype design of forced draft paddy straw bale combustor was developed with pilot fuel injection system and grate shaker. The system can efficiently burn paddy straw using intermittent fuel injection system for flame sustainability. Fuel gas at 340°C was obtained for heating water and room on a commercial scale. About 200 kg of paddy straw can be managed per night in winters by burning it in bale combustor.

AGRO-PROCESSING

- A naturally ventilated onion storage structure, having capacity of 1.25 tonnes, and size 1.8m × 1.2m × 1m with the provision of mechanical aeration was designed, fabricated and evaluated. Only 26 per cent loss was found after four months of storage.
- A forced circulation solar dryer was installed at Unnati Processing-cum-Marketing Cooperative Society, Talwara, for drying of amla, bitter gourd, harad, etc.
- A system for curing of kharif onion using solar energy was developed. It has a capacity to cure 200 kg of onions in one batch.

WATER CONSERVATION AND QUALITY

- An upgraded Decision Support System was developed for appropriate selection of submersible pump set and accessories such as pump horse power, PVC pipe diameter, wire diameter and wire length.
- Abandoned well can be used to recharge surplus canal water/agricultural runoff without any adverse effect on groundwater quality. The quality of groundwater improved during rainy season.

 The concentrations of N, P and K in groundwater of four districts of central Punjab viz. Fatehgarh Sahib, Patiala, Moga and Ludhiana were found within permissible limits. However, bacteriological contamination was found in some of the groundwater samples in these districts.

AGRICULTURAL ECONOMICS

The study on the Economics of Farming and the Pattern of Income and Expenditure Distribution in Puniab brought out that the average size of the operational holding was 4.0 hectares during 2015-16 as compared to 3.06 hectares during 2004-05 in the state Farmers cultivating own holdings increased from 69 per cent during 2004-05 to 77.50 per cent during 2015-16. The owned-cumtenant holdings were 25.54 per cent in 2015-16 as compared to 30 per cent in 2004-05. Pure tenancy is totally absent in the state. The study also brought out that about 38 per cent small and marginal farmers were cultivating 12 per cent area, whereas only 18 per cent large farm holders/owners were cultivating 46 per cent of the total area of the state. About 65 per cent farmers owned tractors during 2015-16 as compared to 38 per cent during 2004-05. Tractor and diesel engines were underutilized in Punjab agriculture, whereas, the capacity utilization of electric motor was maximum. The dairy enterprise was found to be more popular among marginal farmers with contribution of 32 per cent towards family income, whereas, its contribution was about 10 per cent in case of large farmers. Only 58 per cent family labour was utilized in agriculture. The study showed that about 10 per cent of the farm families were below poverty line in 2004-05 which decreased to 9 percent in 2015-16.

The socio-economic impact of adoption of

enterprises on Self-Help Group (SHG) member households was studied in Punjab by selecting districts of Ludhiana, Jalandhar and Hoshiarpur. A sample of 30 randomly selected SHGs was studied and further two members from each SHG were randomly selected. The reference year of the study was 2014. The results of the study showed that SHGs had good impact on saving. income, assets formation, employment and other social aspects of the members. But SHG member households confronted the problems of opening bank accounts, low credit delivery, high rate of interest on credit amount, marketing and competition from MNCs. Lack of training was a major impediment in the success of the SHGs.

An attempt was made to access the profitability of different crops and cropping pattern in the state of Punjab using alternative scenarios like market prices, economic prices (without subsidies) and natural resource valuation considering environmental benefits like biological nitrogen fixation and greenhouse gas costs. The results revealed that the rice-wheat cropping pattern was likely to produce the highest and more stable income as per the present set of marketing infrastructure and agricultural technological know-how. The sustainability of natural resources could be achieved only if the same platform of technology-market-government assurance for other alternative crops was provided to the farmers as in case of rice-wheat cropping system, which gave the highest and stable income. Market incentives for other crops should be explored so that farmers could move away from thirsty crops such as rice.

BIOCHEMISTRY

· Total soluble sugars, total soluble proteins,

flavonoids, vitamin C, total soluble solids and TSS-acid ratio were recorded to be maximum in fruits that were picked from 15 year old kinnow trees as compared to 10 year old and five year old trees. Kinnow mandarin trees of 15 years age gave the highest fruit yield due to the lowest fruit drop and bigger fruit size as compared to five year old trees.

- The incidence and degree of granulation was significantly higher in Dalsy mandarin fruits budded on rootstock Citrus jambhiri Lush, followed by Carrizo citrange and Valkamariana. Among the three rootstocks, maximum juice pH, flavonoids, carotenoids, α-amylase activity and minimum peroxidase activity were recorded in Citrus jambhiri Lush.
- Effect of different N and K ratios in nutrient solutions was evaluated on fruit quality of tomato crop raised under wick and drip type substrate hydroponic systems. Crop raised under wick system gave better quality in terms of fruit firmness, ascorbic acid and total soluble sugars in winter crop. Application of N and K in 1.4.3 at vegetative stage and 1.7:3.5 at reproductive stage gave the highest fruit yield (20.61 kg plant ") under wick system in winter crop.
- Deep rooted chickpea genotype ICC 4958 combated water deficit-induced oxidative stress in a better way than genotype ILC 3279 (shallow rooted) as revealed by increase in total phenols, reducing power, ferric reducing ability and capacity to scavenge 2,2-Diphenyl-1-picryl hydrazyl (DPPH) and OH free radicals. The antioxidative capacity was maximum in roots of genotype ICC 4958.

FOOD AND NUTRITION

 About 1,050 school children (11-17 years) were selected from urban and rural government schools of three regions of Puniab, namely Maiha, Doaba and Malwa using thirty-cluster multistage sampling technique. It was observed that the prevalence of anemia was the highest (97%) among the school going children. However, under-nutrition as assessed in overall physical development i.e. thin and stunted prowth was 24 and 18 per cent. respectively. Over-nutrition among Puniabi school children was found scarce, the prevalence being 11, 7 and 5 per cent in Maiha, Doaba and Malwa regions, respectively. A substantial disparity in anemia was also noted with respect to caste of the children, while only religion had significant relationship with thinness among various socio-economic factors studied. Family income and education status of parents also had a significant relationship with stunting among children.

- Effect of a developed nutrition-education package on lifestyle modifications of urban hypertensive patients (45-60 years) was studied. Sedentary lifestyle and stress at home were found to be the contributing factors towards hypertension among the subjects. It was also observed that 95 per cent male and 96.7 per cent female subjects had never consulted any dietician before. The nutrition-education package had a positive and highly significant impact on the improvement of knowledge, awareness and practices of the subjects.
- Five quinoa (Chenopodium quinoa) based gluten free bakery products were prepared by supplementing quinoa flour at 5, 10 and 15 per cent with rice and oat flour. Quinoa based gluten free bakery products, namely cookies, cakes, muffins, pies and farts were found to be highly acceptable at 10 per cent level of supplementation of quinoa flour



with rice and oat flour with an overall acceptability scores of 7.46, 7.54, 7.32, 7.78 and 7.56, respectively on a 9-point hedonic scale. The products had increased nutrient content in terms of protein and fibre. Calcium, iron, magnesium and zinc content in the products ranged from 13.5-34.84 mg, 1.34-1.73 mg, 12.22-33.41 mg and 0.13, 0.54 mg/100g, respectively. The amino acid content of the products i.e. tryptophan, methionine and lysine was in the range of 52.75-100.23 mg, 79.13-209.93 mg and 96.71-435.88 mg/100 g protein, respectively.

APPARELS AND TEXTILES

- Essential oils, namely Citronella, Eucalyptus and Rosemary, having mosquito repellent properties, were optimized to finish cotton fabric with microcapsules. The effect of application of these oils in different concentrations was studied on selected textile properties such as strength, bending length and whiteness index. The results showed that microcapsules of 10 per cent core materials i.e. essential oil using gum acacia as sheath and essential oil as core were suitable for application on textile products. Full sleeve shirts, socks, wrist bands, pillow covers and handkerchiefs were prepared from treated fabric and given to respondents for wear trials. More than 90 per cent of respondents reported that they had less mosquito bites upon using the treated products. The microencapsulation method showed good mosquito repellent activity up to 30 washes, whereas the direct application method showed that the repellent activity decreased after 10 washes.
- Cotton waste and hemp fibres were blended in three proportions (65:35, 50:50 and 35:65) to develop yarns. The yarns prepared



in different proportions were tested to check the mechanical and physical properties. The yarn blended using 65:35 cotton waste and hemp fibre was adjudged as the best, as it had greater strength (18:75 lbf) and moisture regain (4:21%). The yarn was dyed with reactive dyes and used to develop hand woven rugs. The weaving of rugs from blended yarn can be promoted as an enterprise, from which a weaver can earn 11-23 percent as profit.

TECHNOLOGIES COMMERCIALIZED

The PAU offered non-exclusive rights to the licensees for the commercialization of vegetable hybrids and agricultural technologies, developed by it. Memoranda of Agreements were inked with:

· VNR Seeds Private Limited, Raipur,

Chhattisgarh, for seed production of brinjal hybrid PBHR-42, and pumpkin hybrids PPH-1 and PPH-2.

- RR Seeds Agri-Tech (P) Limited, Hassan, Karnataka, for seed production of chilli hybrid CH-27.
- Sampuran Agri-ventures Private Limited, Chandigarh, for Consortium biofertilizer.
- Sri Om Sai Sugar and Allied Products Private Limited, Khanapur, Belgaum, Karnataka, for bottling of sugarcane juice.
- PI Foundation Trust, Gurugram, Haryana, for manufacturing of Lucky Seed Drill.
- Ms Bandana Chhetri, Budha Theh, Amritsar, Punjab, for mushroom processing.
- Mr Iqbal Singh, Tarn Taran, Punjab, for formulation of kaddu chutney.



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 2016-17, the University offered 10 Undergraduate programmes, 44 Master's programmes, 29 Doctorate programmes and two Diploma programmes as per following details.

Programme	Number of seats		Number of students admitted	Number of students passed out
Class/programme	General & Reserved/ Additional	ICAR		
UNDERGRADUATE			1	
B.Sc. Agri. (Hons) 4-year	85	15	100	124
B.Sc. Agri. (Hons) 6-year at Regional Campus* (Gurdaspur & Bathinda)	126	-	126	62*
B.Tech. Agril. Engg. 4-year	72	11	83	94
B.Sc. (Hons) Home Science 4-year	52	8	30	39
B.Sc. (Hons) Nutrition & Dietetics 4-year	61		61	51
B.Sc. Biotech. (Hons) 4-year	53	9	62	50
B.Tech. Food Tech. 4-year	57	9	62	61
B.Sc. (Hons) Fashion Designing 4- year	60	~	27	29
B.Sc. Interior Design 4-year	60	-	24	-
POSTGRADUATE				
M.Sc. Agriculture	141	33	174	
M.Sc. Home Science	48	10	3,4	285 all M.Sc./
M.Sc. Basic Sciences	115	25	107	M.Tech.
S-year Integrated M.Sc. (Hons)	80	-	80	programmes
M.Tech.	51	6	37	

Programme	Number of seats		Number of students admitted	Number of students passed out		
Class/programme	General & Reserved/ Additional	ICAR				
MBA	50	-	39	36		
MBA (Agribusiness)	30	7	12	10		
Ph.D	137	12	124	109		
DIPLOMA						
Diploma course in Hybrid Seed Production Technology	40		14	3		
2-year Diploma in Agriculture	30		30			

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

EXAMINATION CELL

The Examination Cell under Controller of Examinations conducted entrance tests for admitting meritorious students to various academic programmes of PAU. Besides, it conducted competitive exams, recruitment tests and Higher Standard Departmental Examination. Details are given below:

ACADEMICS

 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. (Hons) Community Science 4-year, B.Sc. (Hons) Nutrition & Dietetics 4-year and 5-year Integrated M.Sc. (Hons) programmes was conducted during June 2017 for which 4,380 candidates applied.

- Entrance test for admission to B.Sc. Agri. (Hons) 6-year programme was conducted during June 2017 for which 933 candidates applied.
- Seventeen Masters' Entrance Tests (MET) for admission to M.Sc./ MBA/ MBA (AB)/ MJ/ M.Tech. programmes were conducted during June-July 2017 for which 1,301 candidates applied.
- Admission to 29 Ph.D programmes was done during November-December 2016 through entrance test.



Students appearing for Common Entrance Test at PAU



Competitive Exam/ Recruitment Tests conducted by/through PAU

- One centre for conduct of Civil Services (Preliminary) Examination of Union Public Service Commission on August 7, 2016 was created on PAU campus.
- Written test for recruitment to the posts of Network-cum-Programme Assistant, Office Assistant and Operator (Audio Visual Aids) In August 2016.
- Test for recruitment to various posts under ATMA Scheme of Punjab Government from December 2016 to January 2017. These posts included Gender Coordinator, Project Director, Deputy Project Director, Block Technology Manager, Assistant Technology Manager, Accountant-cum-Clerk, Computer Programmer/Computer Operator, Deputy Director Agriculture Extension Management, Deputy Director Human Resource Development, Deputy Director Information Technology, Deputy Director Information Technology, Deputy Director Harvest Handling/Technology.
- Shorthand Dictation Test in English for recruitment to the post of Stenographer (Grade-III) in April 2017 for 97 candidates.
- Written test for recruitment to the posts of Assistants at Krishi Vigyan Kendras and Assistants at Krishi Vigyan Kendras [SC and BC category] in April 2017 for 379 candidates Also conducted computer test for the candidates who qualified in the written test in May 2017.
- Test for recruitment to the post of Clerk on compassionate grounds in April 2017.
- Written test for recruitment to the posts of Tractor Driver, Boiler Operator and Laboratory Assistant (Refrigeration) in April 2017.

Higher Standard Departmental Examination

 Conducted six papers of Higher Standard Departmental Examination for PAU employees during November 2016 and April 2017.

NEW COURSES

The course curricula of the undergraduate programmes namely B.Sc. Agri. (Hons) 4-year, B.Sc. Biotech. (Hons) 4-Year, B.Tech. Food Tech. 4-year, B.Tech. Agril. Engg. 4-year, B.Sc. (Hons) Community Science 4-year, B.Sc. (Hons) Nutrition & Dietetics 4-year and B.Sc. (Hons) Fashion Designing 4-year were revised in accordance with the recommendations of the 5[°] Dean's Committee of ICAR.

STUDENTS' ACADEMIC ACCOMPLISHMENTS College of Agriculture

- Mehak Gupta (L-2012-A-30-D) was conferred with "Jawaharlal Nehru Best Thesis Award 2016" by Indian Council of Agricultural Research, New Delhi.
- Gaganjyot (L-2010-A-17-D) bagged the "Best Ph,D Thesis Award" during the National Symposium on "Agrochemicals Research and Education in India: Appraisal and Road Map for Future," organized by Society of Pesticide Science, India, at Indian Council of Agricultual Research, New Delhi. from November 15-17, 2016.
- Bhupinder Singh (L-2014-A-2-M) bagged Dr Gurbaksh Singh Gill Medal from PAU for scoring highest overall credit point average in M.Sc. Agronomy.
- Two students, namely Simmapreet Kaur (L-2016-A-50-M) and Shivali Pathania (L-2014-A-11-0) were selected for zonal level competition of "ANVESHAN-2017," organized by Association of Indian Universities, New Delhi, at Chitkara Universities, New Delhi, at Chitkara
- Prasun Karmakar (L-2014-A-44-M) received the "Third Best Thesis Award" during the National Symposium on "Impact of Climate Change, Biodiversity and Good Plant Protection Practices for Crop Productivity," organized by Association for the



Advancement in Plant Protection at Bidhan Chandra Krishi Viswavidyalaya (BCKV), Kalyani, West Bengal, from December 22-23, 2016. He also got the "Best Poster Presentation Award" during the 12" National Symposum on "Biotic Stress Management Strategies: Challenges and Environmental Harmonizati," held at Uttar Banga Krishi Viswavidyalaya, West Bengal, from February 17-19, 2017.

 Haramrit Kaur (L-2015-A-157-M) bagged the "Best Poster Award" during the XXIX Annual National Conference of Environmental Science Academy on "Food Security Issues and Environmental Challenges for Indian Agriculture in the Next Decades," held at Panjab University, Chandigarh, from November 19-20, 2016.

College of Agricultural Engineering and Technology

 Baljeet Kaur (L-2012-AE-09-BIV) was awarded Gold Medal by PAU for meritorious performance in academics.

College of Basic Sciences and Humanities

- Manpreet Kaur (L-2016-85-238-M) was selected Summer Fellow by Indian Academy of Sciences, Bangalore.
- Ravneet Kaur (L-2013-BS-57-D) received stipend under Women Scientist Scheme, Department of Science and Technology (DST), New Delhi.

College of Home Science

- Pushpa Dhami (L-2013-HSc-98-D) attended an international short training course on "Linking Emergency Aid to Food and Nutnition Security" at Wageningen Centre for Development Innovation, The Netherlands, from November 28 to December 9, 2016.
- Two Ph.D students, Pragya (L-2013-HSc-97-D) and Karmjeet Kaur (L-2013-HSc-95-D) were invited to present research papers at International Conference on "Strategies to Improve Nutrition Quality and Combat

Hidden Hunger," organized by University of Hohenheim, Stuttgart, Germany, from March 20-22, 2017, Pragya was awarded Foreign Travel Grant by Council of Scientific and Industrial Research for attending this conference

 Three students, namely Pushpa Dhami (L-2013-HSc-98-D), Neha Pathak (L-2014-HSc-98-D) and Shweta Priyadarshini (L-2014-HSc-122-D) attended "Manna Centre Programme for Food Safety and Security Summer Institute 2017 Policy and Nutrition Track" at Tei Aviv University, Tel Aviv, Israel, from June 28 to July 28, 2017. They were awarded Planning and Budgeting Committee scholarship.

SCHOLARSHIPS AND FINANCIAL ASSISTANCE College of Agriculture

- Four students received ICAR National Talent Scholarship, five ICAR - Senior Research Fellowship and four ICAR - Junior Research Fellowship. As many as 13 students qualified ICAR - National Eligibility Test.
- Twelve students got Dr Gurdev Singh Khush Scholarship and 24 University Merit Fellowship.
- One student each was awarded Shri Bal Krishan Vaid Scholarship and Mrs Jaswant Kaur Bindra Scholarship.

College of Agricultural Engineering and Technology

- Four students got ICAR National Talent Scholarship, one ICAR - Senior Research Fellowship and two ICAR - Junior Research Fellowship A total of 11 students qualified ICAR - National Eligibility Test.
- Two students were awarded Council of Scientific and Industrial Research (CSIR) Senior Research Fellowship,
- Twenty students got University Merit Fellowship.
- One student each received Innovation in Science Pursuit for Inspired Research





Fellowship (DST) and Maulana Azad National Fellowship for Minority Students (UGC).

College of Basic Sciences and Humanities

- Eleven students were awarded ICAR -National Talent Scholarship, three ICAR -Senior Research Fellowship, five ICAR -Junior Research Fellowship and seven UGC -Junior Research Fellowship. One student qualified ICAR - National Eligibility Test and six qualified Agricultural Research Service (ARS) - National Eligibility Test.
- Eight students got Innovation in Science Pursuit for Inspired Research Fellowship (DST), nine Rajiv Gandhi National Fellowship (UGC), 11 Maulana Azad National Fellowship for Minority Students (UGC) and two Indian Council of Social Science Research (ICSSR) Doctoral Fellowship.
- Six students received Dr Gurdev Singh Khush Scholarship and 33 University Merit Fellowship.
- One student each got Council of Scientific and Industrial Research (CSIR) - Senior Research Fellowship, National Fellowship for Higher Education for ST Students and PSEB Scholarship.
- Two students received Piara Singh Parmar Memorial Society Scholarship and two CBSE Scholarship.

College of Home Science

- Seven students were awarded ICAR Senior Research Fellowship, 10 ICAR - Junior Research Fellowship and 11 UGC - Junior Research Fellowship. Three students qualified Agricultural Research Service (ARS) - National Eligibility Test.
- Four students received Innovation in Science Pursuit for Inspired Research Fellowship (DST) and five University Merit Fellowship.
- One student each got ICAR National Talent Scholarship and National Fellowship for

OBC/SRF.

STUDENTS' WELFARE ACTIVITIES Important Sports Achievements Inter-Varsity Tournaments

The teams of PAU 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), Kabaddi (M), Table Tennis (M&W) and Cycling (M&W). Harsangeet Singh Maan (CoHS) was declared Best Cyclist while Abhijeet Singh Grewal (CoA) was declared Best Hockey Player Shahbaj Singh Bhullar (CoA) and Khushmanpreet Hanhra (CoA) were declared Best Swimmers in men and women category, respectively.

Annual Athletic Meet

The 51[°] Annual Athletic Meet of PAU for the session 2016-17 was held at PAU Athletic Track on April 5-6, 2017. Hardeep Singh (CoA) and Harmandeep Singh (CoBSc&H) were declared Best Athletes in men category while Mehakpreet Kaur Randhawa was declared Best Athlete in women category.

University Colour/Merit Certificates

The PAU Sports and Youth Activities Council in its 53rd meeting held on August 31, 2016 awarded 37 Merit Certificates, 13 University Colour and 2 Roll of Honour to the outstanding sportspersons/artists of PAU for their proficiency in sports, games, cultural and literary events for the session 2015-16. The students were awarded these honours during the 51^o Annual Athletic Meet of the University.



Sports Coaching Camps

The Annual National Sports Organization (NSO) coaching camp was organized at PAU for the session 2016-17. Before the participation of PAU teams in the North Zone/All India Inter-Varsity/Inter-Agricultural University Tournaments, a coaching camp of 15-20 days duration in respective games was organized in the University. As many as 240 trainees enrolled under NSO programme including officials attended the camp. Lakhwinder Singh (CoA) and Sandeep Kaur (CoA) were declared Best Campers in men and women category, respectively.



Students attending National Sports Organization (NSO) coaching camp at PAU.

Sports Scholarships

The Sports Scholarship Committee in its meeting held on March 3, 2017 approved 10 sports scholarships of the value of Rs 350/- per month in four major and six minor games for the academic session 2016-17 to the outstanding sportspersons for their proficiency in sports and games.

Outstanding Players

- The Punjab Agricultural University was declared overall champion in the Team Games (M) during the 17" All India Inter-Agricultural Universities Sports and Games Meet, organized by CCS Haryana Agricultural University, Hisar, from March 25-29, 2017. The University team won two Gold Medals and three Silver Medals in the Team Games (M&W).
 - The Basketball (M) team won Gold

Medal. The team comprised students, namely Aalamdeep Singh (CoA), Gurjeet Singh (CoA), Karan Brar (CoA), Harpreet Singh (CoA), Pukhraj Singh Brar (CoA), Xaran Bawa (CoA), Jagdeep Singh Riar (CoA), Angadjeet Singh (CoA) and Hardeep Singh (CoA).

- The Basketball (W) team also won Gold Medal. The team comprised students, namely Harmeen Kaur (CoHSc), Ravneet (CoHSc), Arpana (CoHSc), Manpreet Kaur (CoHSc), Dilpreet Kaur (CoA), Rajveer Kaur (CoA) and Arsshpreet Kaur Saran (CoBSc&H).
- The Badminton (M) team won Silver Medal. The team comprised students, namely Guranjan Singh Matharoo (CoAE&T), Chanpreet Singh (CoA), Alok





Gupta (CoAE&T) and Rajesh C.R. (CoBSc&H).

- The Volleyball (M) team won Silver Medal. The team comprised students, namely Milapdeep Singh (CoA), Amanpreet Singh (CoA), Shehbaz Singh (CoA), Jatinder Singh (CoAE&T), B. Sundharalingam (CoHSc), Rajwinder Singh (CoA), Sukhjinder Singh (CoA) and Jagmanjot Singh (CoA).
- Tejinder Pal Singh (CoA) got first position in Shot Put and Discus Throw.
- Harmandeep Singh (CoBSc&H) secured first position in High Jump and 110m Hurdles.
- Mehakpreet Kaur Randhawa (CoA) got second position in 400M, 800M and 1500M races.
- Beant Singh (CoA) represented India at Astan Power Lifting Championship, held in Indonesia from May 1-5, 2017. He also won fourth position in the Federation Cup and participated in the National Power Lifting Championship, held in Jammu from March 20-27, 2017.
- Nimrat Kaur Sekhon (CoA) participated in the 60^m National Shooting Championship, held at Pune from December 12-26, 2016.
- Manveer Singh (CoA) and Harmanjot Singh (CoA) participated in the Senior Nehru Hockey Cup, held in New Delhi from November 14-23, 2016.
- Davinder Singh (CoA) got second position in the Punjab State Senior Power Lifting Championship, held at Ludhiana from July 8-9, 2017.

National Service Scheme Activities

- Asish Kumar Padhy, an NSS volunteer, got "Dr Dalip Singh Deep Memorial Award 2015-16" and "Swami Vivekananda Youth Award 2016-17."
- The NSS volunteers of PAU organized special donation drives for the collection of old

clothes, shoes, stationery, school bags, old books, blankets, toys, etc. and the same were distributed among the needy in adopted slums.

- Blood donation camps were organized during Kisan Melas in September 2016 and March 2017 under the supervision of the team of doctors from Dayanand Medical College and Hospital, Ludhiana and Raghunath Hospital, Ludhiana Another blood donation camp was organized in association with Guru Gobind Singh Study Circle and Bhai Ghanaiya Ji Mission Sewa Society, Punjab, on November 18, 2016. A total of 526 units of blood were collected at these camps.
- A workshop on "Digital India" was held under the aegis of the Ministry of Electronics and Information Technology, Government of India, on October 4, 2016.
- Twenty one-day regular activity camps were organized by each NSS Unit as per the themes given by the Ministry of Youth Affairs and Sports, Government of India.
- A seven-day workshop on "Personality Development" was conducted in collaboration with the University Counseling and Placement Guidance Cell from December 18-24, 2016. Apart from this, a series of lectures-cum-workshops were arranged on building self-confidence, leadership qualities, stress management. self-evaluation, etc.
- The volunteers also participated in campus beautification, playground cleanliness, village health care camps, yoga camps, etc. In addition, signature campaigns for National Anthem called by Prime Minister of India; and campaigns on road safety and traffic rules were organized.
- Ten NSS volunteers participated in the 7 Conclave of Bhartiya Chhatra Sansad, held at Pune from January 17-19, 2017.



Cultural Activities

 Independence Day and Republic Day were celebrated on August 15, 2016 and January 26, 2017, respectively. A large number of students, faculty and staff of the University participated in the celebrations.



Independence Day and Republic Day celebrations at PAU.

- A workshop on "Bhangra and Giddha" was organized from September 1-20, 2016. The students of PAU learnt techniques of both the folk dances.
- The PAU Inter-College Youth Festival was organized from November 3-11, 2016.

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



Dr Baldev Singh Dhillon, Vice Chancellor, PAU, inaugurating the Inter College Youth Festival at PAU. Students of PAU performing bhangra and giddha during the youth fest.





- A PAU contingent of 40 members participated in the 32⁻¹ Inter-University North Zone Youth Festival 2016-17, organized by Chhatrapati Shahu Ji Maharaj University, Kanpur, from January 2-6, 2017. The students won Silver Medal in the cultural procession; and Bronze Medals in skit, cartooning and light vocal solo.
- The University students represented North India at the 32th Inter-University National Youth Festival 2016-17, organized by Shivaji University, Kolhapur, from February 10-14, 2017. The students won Silver Medal in cartooning and Bronze Medal in light vocal solo.
- A PAU contingent of 27 members participated in the 17" All India Inter-Agricultural Universities Youth Festival, organized by Indian Council of Agricultural Research, New Delhi, at Rajasthan University of Veterinary and Animal Sciences, Bikaner, Rajasthan, from February

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22-25, 2017. The PAU won the overall trophy by clinching Gold Medal in debate; Silver Medals in elocution and one-act play; Bronze Medals in group mime, rangoli and collage; and fourth position in patriotic group song and spot painting.

- A PAU contingent participated in the Punjab State Inter-University Youth Festival, organized by Directorate of Youth Services, Punjab, in Chandigarh on March 27-28, 2017. The University students won Gold Medal in collage making and chikku making; Silver Medal in bhangra, giddha, one-act play, clay modeling, cartooning, traditional dress, gudian patole and embroidery; and Bronze Medals in folk song, pranda, pakhi, kroshiao and pirhi making (traditional art shaft of Punjab).
- A 30-member PAU contingent participated in Hiking and Trekking tour to Solan, Himachal Pradesh, from June 20 to July 26, 2017.



EXTENSION

The University undertakes the transfer of improved agricultural technologies among the farmers and extension functionaries through 15 Farm Advisory Service Centres (FASCs) and 18 Krishi Vigyan Kendras (KVKs) located at different district headquarters in Punjab and various departments; Agricultural Technology Information Centre (ATIC); and Advanced Centre of Training at Kairon Kisan Ghar (KKG) on the main campus. These Centres transfer the technologies through various extension modes like Kisan Melas, field days, workshops, adaptive research trials, on farm trials, demonstrations, trainings (short, vocational and in-service), exhibitions, campaigns, technical guidance, PAU Doots, TV/radio talks, Kison Club/committee meetings 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 dissemination of improved knowledge among 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 2016 and March 2017 at the main campus of PAU, Ludhiana; KVK Rouni (Patiala); KVK Nag Kalan (Amritsar); Regional Research Station (RRS) Faridkot; RRS Ballowal Saunkhri, RRS Bathinda and RRS Gurdaspur. The theme of the mela in September 2016 was "PAU farm recommendations, a blessing for crops; with scientific farming, farmers reach the top (PAU kheti sifarshan, faslari layi vardan; vigyanak kheti naal hi, safal hon kisan)," The theme of the mela in March 2017 was "Sow PAU seeds, adopt subsidiary occupations, do efficient marketing, maintain farm records (PAU de beej bijo, sahayak dhandey apnao; mandikaran suchiha karo, lekha-jokha lao)." A large number of farmers from Punjab and adjoining states participated in these melos. Field demonstrations and elaborate exhibitions on improved varieties, production-protection technologies, beekeeping, mushroom cultivation, nutritional gardening, protected cultivation, etc. were organized for the farmers. The seeds of improved varieties of crops, fodders and vegetables; saplings of vegetable, fruit and ornamental 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 arranged.



Rush of farmers at PAU Kisan Mela (Ludhiana) in September 2016.
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Awards to Progressive Farmers

The progressive farmers from various parts of Punjab are honoured during the PAU *Kisan Melas* for their outstanding contributions to agriculture, horticulture and allied enterprises. During PAU *Kisan Mela* on September 23, 2016, three progressive farmers and one woman farmer were honoured. S. Rajmohan Singh Kaleka (Patiala), S. Amarjit Singh (Jalandhar), Mr Chetan Verma (Gurdaspur) and Smt Vinod Kumari (Hoshiarpur) were conferred with Sardar Dalip Singh Dhaliwal Memorial Award, Parwasi Bharti Award, Sardar Surjit Singh Dhillon Award and Sardarni Jagbir Kaur Grewal Memorial Innovative Woman Farmer Award, respectively, During PAU Kisan Melo on March 25, 2017, 5. Jagtar Singh Brar (Bathinda) was awarded "Chief Minister Award" for excellence in agriculture while S. Vinder Singh Gioli (Sangrur) and S. Rajinder Singh Dhaliwal (Ludhiana) were conferred with "Chief Minister Award" for excellence in horticulture. S. Aparpal Singh (Bathinda) was awarded "Sardarni Parkash Kaur Sra Memorial Award." S. Paramjit Singh, (Ludhiana); S. Hardeep Singh (Patiala) and S. Narinder Singh (Hoshiarpur) were honoured with "CRI Pumps Award." for adopting improved farm mechanization, water management techniques and organic farming, respectively.



Sh V.P. Singh Badnore, Governor of Punjab, inaugurating Kisan Mela at PAU in September 2016 (left). Progressive farmers honoured during mela posing for a group photo (right).

FIELD DAYS

The University holds field days in order to popularize improved technologies and practices among farmers. In all, 230 field days were organized in different villages to promote direct seeded rice technique, mechanical transplanting of paddy, use of biofertilizers, mat-type nursery raising, use of Happy Seeder, crop residue management, integrated pest management in parmal/ basmati rice, PAU fruit fly traps, cultivation of pulses (soybean, gram, etc.) and maize, 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 research system. A total of 713 ARTs were conducted at different locations to evaluate new crop varieties, and production and protection technologies. Some of the important ARTs are given as under:

- Evaluation of new varieties of parmal rice, basmati, wheat, sugarcane, mustard, oats, berseem and rajmash.
- · Testing of plant protection technologies



including new weedicides (288), insecticides (27) and fungicides (97).

Based on these trials, 65 recommendations were made, out of which, 22 were of new varieties (10 field crops, 7 vegetables, 2 fruit crops and 3 flowers), 16 of production technologies, 23 of plant protection technologies and 4 of farm machinery.

ON FARM TRIALS

On Farm Trials (OFTs) are conducted to test a new technology/idea under farmer's field conditions along with PAU recommended practice and farmer's own practice. As many as 165 OFTs were conducted by KVK scientists. The salient findings of some of the important OFTs are listed below:

- Nitrogen management in cotton: No considerable yield differences in seed cotton yield among different does of N assessed i.e. 87.5 kg N ha⁺ (farmer's practice), 150 kg N ha⁺ (recommended) and 115 kg N ha⁺ (intervention) were recorded.
- Stemborer and leaf folder management in paddy: In paddy, Katasu (cartap hydrochloride 4%G) proved superior as compared to Padan 4G (recommended) for controlling stem borer and leaf folder. It is also safer for natural enemies like spiders.
- Evaluation of sowing methods of wheat: Results showed that the zero tillage sowing accounted for the highest yield of 49.25 q/ha followed by roto drill (47,50 q/ha) and conventional (45,50 g/ha).
- Sulphur management in gobhi sarson (variety GSC-7): Application of DAP @ 125 kg/ha along with two sprays of Sulphur SOWG at 70 and 100 days after sowing improved the productivity of gobhi sarson (21.80 q/ha) as compared to farmer's practice (19.75 q/ha) but it was inferior to the recommended technology i.e. SSP or gypsum (22.51 q/ha).
- Raising of bitter gourd: Raising bitter gourd

on multitler wining gave higher yield (300 q/acre) followed by raising on bamboo and mould iron wires (243 q/acre) and as per recommended (flat sowing) practice (80 q/acre)

- Planting methods and spacing for garlic: Quality parameters i.e. bulb diameter and clove size were better in ridge sowing than in flat sowing. However, yield was higher incase of flat sowing.
- Seed rate in pea: Highest green pod yield and returns were obtained when 137.5 kg seed/ha was used as compared to 112.5 kg/ha (recommended) and 200 kg/ha seed (farmer's practice)
- Nursery raising of marigold: Marigold nursery sowing in soilless media gave higher yield and net returns over nursery raising insoil medium.
- Storage of pulses: Use of Parada Ayurvedic tablets for small scale storage of pulses gave better results as compared to use of ash layer and mustard oil (recommended practices).
- Preparation of garlic pickle: Garlic pickle prepared with synthetic vinegar was better in taste and flavor than grape's vinegar and golgol juice.
- Zero energy cool chamber for storage of lemon: Storage of lemon in zero energy cool chamber improved its shelf life by 10-12 days over open room storage. At room temperature, lemon had a shelf life of 10-12 days, whereas, in zero energy cool chamber, it was extended to 20-25 days.
- Urea management in litchi: Urea application of 1600 g/plant (recommended dose) along with additional dose of 1000 g/plant after harvesting of litchi gave 77.35 kg/plant yield as compared to 73.66 kg/plant in recommended practice of 1600 g urea/plant (in February and April).
- Ration management for cross bred cows: Total Mixed Ration (TMR) improved the



milk production and reproduction performance of cross bred cows with the best utility of all feed ingredients over conventional feeding methods.

- Feed management in buffaloes/cows: Feeding basal diet along with bypass fat (@ 15 g/kg milk) increased the milk yield by 9.3 per cent as compared to green fodder and concentrate mixture. Similarly, in cross bred cows, supplementation with bypass fat @ 200 g/day showed 13 per cent increase in milk yield and 5 per cent increase in milk to
- Reduction in age at first calving in heifers: Heifers fed balanced diet along with protein and energy rich sources like uromin lick (300 g/day for one month) resulted in reducing the age at first calving.
- Milking management practices of dairy animals: Full hand milking method of dairy animals along with hygienic milking practices resulted in better milk production with zero incidence of mastilis.
- Removal of stain: Commercial stain removal (Vanish) was found most efficient followed by borax solution and salt or lemon juice, respectively, for removing fresh and old ink stain.
- Prevention of colour bleaching of turbans/cotton fabric: Commercial dye fixer prevented colour bleaching of turbans/cotton fabric efficiently followed by dipping of cloth into white vinegar solution or salted water solution.
- Drying of mushroom for safe storage: Blanching mushroom cuts in 1% KMS (potassium metabisulfite) or 0.5% KMS+0.25% ascorbic acid followed by drying at 45°c gave better color stability over unblanched mushroom.

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. A total of 3,568 front line demonstrations (FLDs) were conducted on Improved varieties of oilseed crops (groundnut, sesame, gobhi sarson, toria, raya and sunflower), pulses (summer moong, main season moong, mash, soybean, gram and lentil), parmal rice, basmati rice, cotton (American and desi), maize and maize fodder. Field demonstrations were also conducted on resource conservation technologies such as nitrogen management in paddy using leaf colour chart; skip of P application in rice, cotton and maize after wheat grown with recommended dose of P; seed and nursery treatment for control of foot rot in basmati; irrigation of paddy receding after drainage of ponded water; green manuring before rice cultivation; paddy straw management by using Baler, Straw Management System (SMS) and Chopper; use of Happy Seeder for wheat sowing; use of Rice Transplanter; management. of maize borer using Trichoderma harzianum; use of biofertilizer: use of fertilizer on soil test basis; weed control in maize and direct seeded rice; and management of stem borer/leaf folder in parmal rice and basmati rice.

Besides, demonstrations were given on mixed cropping of sorson and toria, intercropping of gohi sorson in sugarcane, nutrition gardening of summer and winter vegetable crops, use of Paddy Straw Chopper, use of Baler-Cum-Knotter, seed treatment of wheat, turmenc cultivation, low tunnel technology for vegetable crops, orchard protection in summers, use of hydrogel in wheat/potato/ pea. bulb set technique in kharif onion production, cultivation of rainy season tomato and broccoli, fungicidal management of foot. rot/gummosis in citrus, and use of cobalt chloride for control of parawilt in cotton.

In addition to field demonstrations, method demonstrations were conducted on important practices. In all, 1,227 method demonstrations were conducted on the collection of soil and water samples, seed treatment, *Rhizobium* inoculation in sugarcane/berseem/gram/ peas/lentil, spray techniques of agrochemicals, identification of weed flora, nursery raising of vegetables, different aspects of cooking and home management, and animal sciences. Method demonstrations were also given on subsidiary occupations (beekeeping, mushroom cultivation etc.) to promote adoption of these occupations by farmers, specially, small farmers.

BIOCONTROL

Sugarcane

 Large scale demonstrations were conducted on the effectiveness of *Trichogramma chilonis* (biocontrol based IPM technology) against stalk borer and early shoot borer, and *T. japonicum* against top borer. The demonstrations were carried out by PAU as well as six sugar mills of Punjab in an area of 10,516 acres. More than 50 per cent of incidence was observed to be reduced.

Maize

- Large scale demonstrations were given on the use of *T*. chilonis in farmers' fields. The demonstrations were conducted in an area of 355 acres across the state. The reduction in incidence over control was 52.51 and 69.24 per cent in blocontrol and chemical control, respectively.
- Experiments were also conducted in maize to check the efficacy of double release of *T*. *chilonis* @ 1,00,000 per ha (first on 10 day old crop and second one week after). A total of 32 trials were done at farmers' fields in an area of 71 acres. There was significantly less dead heart incidence (4,27%) as compared to single release (5.44%) and untreated control (10.52% incidence).

Rice

· Large scale demonstrations were given on



biocontrol based integrated pest management (six releases of *T. chilonis* and *T. japonicum* each @ 1,00,000/ha) in organic bosmati rice (variety Pusa 1121). The demonstrations were carried out at Nabha (Patiala), Samrala (Ludhiana) and Kheri (Sangrur) over an area of 165 acres. The incidence of white ears was significantly lower in biocontrol field (3.38%) as against untreated control (6.93%), resulting in a reduction of 51.23 per cent

Cotton

 Field evaluation of biopesticides for the management of whitefly in Bt cotton revealed significantly lower population with chemical treatments (spiromesifen 240 St @ 500 m/ha and diafenthiuron 50 WP @ 500 g/ha) followed by application of botanical (neem baan 1% @ 1250 and 1500 ml/ha) and biopesticides [Leconicillium leconii 2% AS and Metarhizlum anisopliae 1% WP @ 1200 ml/ha). The results revealed that though the population of whitefly was higher in case of biopesticide application as compared to chemical, yet there was no reduction in seed cotton yield, thereby, reducing the chemical pesticide use.

CAMPAIGNS

Cotton

 The biocontrol based integrated pest management (BIPM) practices involving cultivation of Bt cotton crop showed significantly lower whitefly population than untreated control. The predator population was significantly more in BIPM (1.36/plant) as compared to chemical control (0.39/plant) and untreated control (0.98/ plant). Seed cotton yield in BIPM (22.80 q/ha) was at par with chemical control (23.70 q/ha) and significantly better than untreated control (21.30 q/ha).

High Yielding Varieties

Campaigns before Robi and Kharif seasons



were organized to urge farmers to use recommended varieties of different crops. The area under varieties developed and recommended by PAU has increased to 62 per cent in rice and almost 96.9 per cent in wheat and 69 per cent in sugarcane.

SPECIAL CAMPAIGNS

Whitefly management in cotton: A special campaign on the management of whitefly in cotton was initiated from February 2017 onwards by adopting integrated pest management strategy. Under this strategy, whitefly population was critically monitored and managed on host plants (like potato, cucurbits, okra, etc.) as well as on weeds. The cotton growers were advised about the recommended Bt cotton varieties, timely sowing, nutrient management, clean cultivation and application of suitable pesticide as per the requirement. To educate the farmers, 500 scouts were engaged by the Department of Agriculture, Punjab, Extensive trainings were provided by PAU to these scouts for effective monitoring of the pest population as well as guiding the farmers. In this direction, nine district, 105 block and 5,280 village level training camps were organized. Under the Chairmanship of PAU Vice Chancellor, six meetings of Interstate Consultative and Monitoring Committee for Whitefly were held at Bathinda and Abohar.

Management of yellow rust of wheat: Yellow rust of wheat was successfully managed by integrated approach including timely monitoring in Himachal Pradesh and submontaneous areas of Punjab, advising farmers to not cultivate susceptible varieties, avoid early sowing in October and make need based application of fungicides. The initial foci of infection were identified in time and managed with the application of fungicides. Later on, farmers were regularly advised on the basis of prediction of weather conditions. Average severity remained very low and was unable to cause yield losses. Farmers were also advised in time regarding management of Karnal bunt, based on the weather prediction.

Paddy straw management: Campaigns on paddy straw management were organized in various parts of Punjab, to create awarenwss among the farmers on the ill effects of paddy starw burning on human health and environment. Various options for management of paddy starw before sowing of wheat like use of combines with attachment of PAU Straw Management System, happy seeder, paddy straw baler, mulcher, paddy straw cutter and chopper were demonstartaed at farmers fields.Besides this, the interventions proposed by PAU were also demonstrated at two adopted villages which were declared as zero burning villages.

Agro-processing complexes: Seven agroprocessing complexes were established in various districts of Punjab with the technical guidance of the Department of Processing and Food Engineering, PAU. About 200 farmers were motivated and guided regarding establishment of agro-processing complexes.

Biogos plants: Ten large capacity fixed dome type biogas plants, having capacity from 100m¹/day to 350m²/day based on cattle dung/poultry droppings, were installed and commissioned at different locations in Punjab.

SKILL DEVELOPMENT

A total of 486 farm women and rural youth participated in 14 capacity building training programmes and 11 awareness campaigns to improve their entrepreneural skills. One of the trainees was motivated to make paper bags and sell these in the local market. An awareness campaign on "Swacch Pokhiwada" was also planned, under which various activities like dusthin making competition for school children and best kitchen competition for rural homemakers were organized.



TRAININGS AND EXHIBITIONS

Trainings

The KVKs and Advanced Centre of Training at PAU organized 1,464 training programmes (1,039 short, 253 vocational, 123 in-service and 49 sponsored) for the farmers, farm women and extension functionaries to enhance their knowledge for increasing agricultural productivity and farm income. Vocational trainings were given on precision farming, hybrid seed production, protected cultivation of vegetables, pruning trimming of fruit plants, mushroom cultivation, apiculture, value addition of agricultural produce (preparation of pickles/murabbas/ketchup and other recipes), tie and dye, stitching and embroidery, poultry, dairying, piggery, goatry etc. in all, 19,747 farmers, 8,358 farm women and 2,691 extension personnel benefited from these trainings.



Formers and rural women attending training courses at PAU.

Exhibitions

Exhibitions are arranged during Kison Melos, training camps, field days, scientific advisory committee meetings, special days, etc. to create awareness among farmers about new and improved technologies and practices. During the period under report, 782 exhibitions were put up where important production, protection and resource conservation technologies; live and preserved plant specimens; farm machinery; models of various important technologies including drip irrigation, integrated farming system, vermicompost and kitchen gardening; processing equipment and farm literature were displayed. WORKSHOPS

Workshops are regularly organized by PAU in which University scientists and extension officers of line departments discuss the results of latest technologies, developed by PAU, and finalize the Package of Practices for the farmers. 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, four workshops were organized: Research and Extension Specialists' Workshop for Rabi Crops (August 16-17, 2016); Research and Extension Specialists' Workshop for Fruits, Mushroom, Agro-forestry along with Postharvest Management, Farm Power and Machinery, Food Technology and Agricultural Economics (December 21-22, 2016); Research and Extension Specialists' Workshop for Kharif Crops (February 27-28, 2017); and Research and Extension Specialists' Workshop for Vegetables, Floriculture and Sericulture along with Post-harvest Management, Farm Power Machinery, Food Technology and Agricultural Economics (May 31-June 1, 2017). A total of 1,842 scientists and extension functionaries from the State Departments of Agriculture and Horticulture participated in these workshops.



Dr Baldev Singh Dhillon, Vice Chancellor, PAU, seeing seeds of various crop varieties during "Research and Extension Specialists' Workshop for Rabi Crops" at PAU.

FARMERS' ORGANIZATIONS

The meetings of various farmers' organizations were organized to share the latest technological advancements in various disciplines. Ten monthly training camps were organized for the members of PAU Kisan Club in which 6,971 farmers and 598 farm women participated. Besides, 10 monthly training camps were held for the members of Progressive Beekeepers Association in which 516 farmers participated. Four training camps were organized for the members of Seed Producers and Nursery Growers Association, benefitting 216 farmers. Two meetings of the Tree Growers Association were held in which 75 growers participated.

INFORMATION AND COMMUNICATION (ICT) TOOLS

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. The PAU doots are being sent 2-3 messages per week regarding various agricultural practices through e-mail. During the period under report, 319 PAU doots were enrolled and 96 messages were sent to them. In all, 5,109 PAU doots have been enrolled so far.

Weather Based Agro-advisory SMS: As many as 2,40,300 farmers were enrolled for weather based agro-advisory.

Farmer Portal: The University started a 'Farmer Portal' which has been put on the PAU website (www.pau.edu) for the benefit of the stakeholders.

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 All India Radio (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 1,046 press releases (529 in English and 517 in Punjabi). It also sent 170 articles (25 in English and 145 in Punjabi), authored by PAU scientists, for publication in vernacular newspapers and



magazines. The Centre provided TV coverage to different events and produced 12 Kisan Melo reports for telecast from Doordarshan. It coordinated with Doordarshan Kendra, Jalandhar for 248 TV talks and AIR, Jalandhar for 333 radio talks of PAU scientists. A total of 65 PAU scientists delivered TV/radio talks. 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 the top quality. The combined circulation of these magazines was 2,07,700 during 2016-17. 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 44 new/revised farm publications (20 in English and 24 in Punjabi). These included Package of Practices for Rabi and Khorif Crops (in English and Punjabi), Reviving Agricultural Growth in Puniab. Kinnow, Nutrient Composition of Puniabi Recipes, Citrus Cultivation, Safal Kisan Punjab De, Jaivik Kheti, Tractor Di Varton Te Sambhal, Ravayati Punjabi Pakwan, Punjab Vich Alooaan Di Kashat, etc.



Farmers purchasing PAU farm publications during Kisan Melo

HUMAN RESOURCE, FINANCE AND INFRASTRUCTURE DEVELOPMENT

NEW APPOINTMENTS, PROMOTIONS AND RETIREMENTS

New appointments

During the period under report, following new

appointments were made. Besides, 22 Assistant Professors & equivalent and two Associate Professors & equivalent were directly recruited.

Name	Appointed as	Date of appointment
Dr S.S. Kukal	Dean, College of Agriculture	30.05.2017
Dr (Mrs) Jatinder Kaur Gulati	Dean, College of Home Science	30.05.2017
Dr Navtej Singh Bains	Director of Research	30.05.2017
Dr R.S. Sidhu	Registrar	30.05.2017
Dr (Mrs) Jagdish Kaur	Additional Director Communication (CC&IL)	13.07.2016
Dr Jatinderjit Kaur Gill	Head, Department of Family Resource Management	03.10.2016
Dr Manjeet Singh	Head, Department of Farm Machinery and Power Engineering	24.11.2016
Dr (Mrs) Poonam A. Sachdev	Head, Department of Food Science and Technology	.01.04.2017
Dr Harpinder Singh Grewal	Head, Department of Floriculture and Landscaping	30.05.2017
Dr O.P. Choudhary	Head, Department of Soil Science	01.06.2017
Dr (Mrs) Parveen Chhuneja	Director, School of Agricultural Biotechnology	19.09.2016 (AN)

Promotions and retirements

During the period under report, 16 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; seven 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; three 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 six 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 24 teachers retired/resigned from the University service.

Faculty strength

Category	Sanctioned posts	Posts in position
State	1,056	483
ICAR	184	180
KVK.	119	104
Others	23	20
Total	1,382	787



AWARDS, DISTINCTIONS AND RECOGNITIONS

 As per the National Institutional Framework Ranking (NIRF) of the Ministry of Human Resource Development, Government of India, New Delhi, PAU was ranked second among the agricultural universities of India.



A plaque presented to PAU by the Union Ministry of Human Resource Development for ranking 40th in the India Rankings 2017.

- The Punjab Agricultural University was ranked 232^{std} and was one of the only two agricultural institutes of the country, which made it to the list of top 300 world universities in the ranking done by National Taiwan University in 2017.
- The University was honoured by the Indian Society of Genetics and Plant Breeding (ISGPB) in March 2017 for having highest number of landmark varieties to its credit among all the State Agricultural Universities and ICAR Institutes.



Dr Baldev Singh Dhillon, PAU VC (first from left), receiving a certificate from Dr R. S. Paroda, Former Director General of ICAR (fourth from left) during an award giving ceremony, organised by ISG&PR.



- The University was ranked numero uno for publication of research articles and citations by Confederation of Indian Industry (CI)-Indian Citation Index in 2017.
- Two faculty members were awarded/ designated as NAAS fellows, namely Dr Kuldeep Singh Senior Molecular Geneticist and Dr Gulshan Mahajan, Senior Agronomist.

College of Agriculture

- Drs Pardeep K. Chhuneja, Jaspal Singh, Harminder Kaur Deosi and Amit Choudhary (Entomology) were conferred with the "Best AICRP Centre (on Honey Bees and Pollinators) Award 2016" by ICAR.
- Drs J.S. Manchanda, S.S. Dhaliwal and M.P.S. Khurana (Soil Science) received "Chaudhary Devi Lal Outstanding AICRP Award 2016" from ICAR for micronutrient and pollutant elements scheme.
- Drs G.S. Mangat, Ranvir Gill, Rupinder Kaur, Renu Khanna and Navjot Kaur (Plant Breeding and Genetics) received the "Best All India Coordinated Rice Improvement Project (AICRIP) Centre Award 2017" from ICAR.
- Drs U.S. Tiwana, Rahul Kapoor, Meenakshi Goyal and Ashlesha (Plant Breeding and Genetics) got the "Best All India Coordinated Research Project (AICRP) Centre (on Forage) Award 2017" from ICAR
- The Maize Section got the "Best Centre Award 2017" from the Indian Institute of Maize Research, ICAR.
- Dr A.S. Dhatt (Vegetable Science) was selected Fellow of Horticultural Society of India in 2015. He also bagged the "Best Poster Award" from the society during the "7" Indian Horticulture Congress," held at Indian Agricultural Research Institute, New Delhi, on November 15-16, 2016.
- · Dr P.S. Sandhu (Plant Breeding and

Genetics) was selected Fellow of the Society for Rapeseed-Mustard Research, Bharatpur, in 2017.

- Dr Ramanna Koulagi (Plant Breeding and Genetics) received "Professor D.J. Raski Academic Merit Award 2016" from Nematological Society of India, Indian Agricultural Research Institute, New Delhi.
- Dr T.S. Thind (Plant Pathology) got "Y.L. Nene Outstanding Plant Pathology Teacher Award 2016" from Indian Society of Mycology and Plant Pathology, Udaipur.
- Dr U.S. Tiwana (Plant Breeding and Genetics) got "Fellow Award 2017" from the Range Management Society, Jhansi.
- Appreciation Certificates were awarded by the University to Dr M S. Bhullar (Agronomy) for outstanding research on the development of weed management technologies for field and horticultural crops; Dr Narinder Singh (Plant Pathology) for outstanding research on Trichoderma (bioagents); and Dr S.K. lindal (Vegetable Science) for, outstanding research on vegetable breeding.
- Dr Navprem Singh (Fruit Science) got an "Appreciation Certificate" from ICAR-National Research Centre on Litchi in 2017 for commitment to furtherance of litchi research in Punjab.
- Dr S.K. Jindal (Vegetable Science) bagged the "Best Poster Award" during the international Conference on "Agricultural Sciences and Food Technologies for Sustainable Productivity and Nutritional Security," organized by Association of Agricultural Technology in Southeast Asia, Thailand and Society for Applied Biotechnology, India, at University of Agricultural Sciences, Bengaluru, from August 25-27, 2016.
- Drs RIS Gill, Baljit Singh and Navneet Kaur



(Forestry and Natural Resources) bagged the "Best Poster Award" during the National Symposium on "Agro-forestry for Environmental Challenges, Sustainable Land Use and Biodiversity Conservation Options," held at Central Agro-forestry Research Institute, Jhansi, from December 3-5, 2016.

- Dr Sapna Thakur (Forestry and Natural Resources) received the "Best Poster Award" during the National Symposium on "Agro-forestry for Environmental Challenges, Sustainable Land Use and Biodiversity Conservation Options," held at Central Agro-forestry Research Institute, Jhansi, from December 3-5, 2016.
- Drs K.S. Sangha and P.S. Shera (Entomology) got the "Best Oral Presentation Award" and "Best Poster Presentation Award," respectively, during the 5" National Conference on "Biological Control: Integrating Recent Advances in Pest and Disease Management," organized by Society for Biocontrol Advancement/ICAR-National Burerau of Agricultural Insect Resources, Bengaluru, from February 9-11, 2017.
- Drs Meenakshi Goyal and U.S. Tiwana (Plant Breeding and Genetics) received the "Best Research Paper Award" during the National Symposium on "New Directions in Managing Forage Resources and Livestock Productivity in 21" Centruy: Challenges and Opprotunities," held at Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior, on March 3-4, 2017.
- Drs J.S. Chawla and Jawala Jindal (Plant Breeding and Genetics) won the "Best Oral Presentation Award" during the National Conference on "Perspective of Challenges and Options in Maize Production and Utilization," held at Dr. Raiendra, Prasad

Central Agriculture University, Pusa, Samastipur, Bihar, on March 3-4, 2017.

College of Agricultural Engineering and Technology

- Dr G.S. Manes (Farm Machinery and Power Engineering) as a member was awarded "Dr G.S. Khush Team Award 2016-17" by Dr Gurdev Singh Khush Foundation for Advancement of Agricultural Sciences, PAU.
- Dr N.K. Khullar (Civil Engineering) was conferred with the "Best Teacher Award 2017" by the Indian Society for Technical Education.

College of Basic Sciences and Humanities

 Dr G.S. Kocher (Microbiology) received an "Appreciation Certificate" from PAU in 2017 for his contributions to wine and vinegar production.

College of Home Science

 Ms Rohini Jain and Dr Neerja Singla (Food and Nutrition) won the "Best Poster Award" during the National Conference on "Innovative Processing Technologies for Food and Nutritional Security," held at Central Institute of Post-Harvest Engineering and Technology, Ludhiana, on September 29-30, 2016.

NATIONAL AND INTERNATIONAL LINKAGES

Memoranda of Understanding (MoUs) signed During the period under report, PAU signed five MoUs with various national institutions/ organizations:

- Bayer Crop Science Limited, Bayer House Central Avenue, Hiranandani Estate Thane (West), Maharashtra, on July 27, 2016 to promote research, extension and exchange of information and technology in the areas ofmutual concern.
- Indian Council of Agricultural Research, New Delhi, on September 22, 2016 for scientific and technical cooperation in the implementation of the project of Krishi



Vigyan Kendra at Pathankot.

- Khalsa College, Amritsar, Punjab, on November 25, 2016 for the seed production of berseem BL 42.
- Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana, on January 6, 2017 to promote and accelerate programmes of academic and research cooperation in the areas of mutual concern.
- Maharashtra State Seeds Corporation Limited, Mahabeej Bhavan, Krishi Nagar,

Akola, Maharashtra, on May 22, 2017 to organize seed production programme on maize hybrid PMH-1.

Eminent Visitors

 Sh Giriraj Singh, Union Minister of State for Micro, Small and Medium Enterprises (MSME), India, visited PAU on October 17, 2016 to interact with the officials of the University and oversee the arrangements for the visit of the Prime Minister, Sh Narendra Modi on October 18, 2016.



Dr Baldev Singh Dhillon, Vice Chancellor, PAU and Dr P.K. Khanna, Former Registrar, PAU, honouring Sh Giriraj Singh, Union Minister of State for Micro, Small and Medium Enterprises (MSME), India.

- A two-member delegation comprising Dr Bikram Gill from Kansas State University, Manhattan, Kansas, and Dr K.S. Gill from Washington State University, Pullman, Washington, USA, visited PAU on November 15, 2016 to discuss sustainable agriculture.
- A delegation of Colorado Agri Leaders, USA, visited PAU on December 5, 2016 to study University's agricultural interests.
- Sh Arjun Ram Meghwal, Union Minister of State for Water Resources, River Development and Ganga Rejuvenation; and Parliamentary Affairs, India, visited PAU on December 22, 2016 to inaugurate an Integrated Beekeeping Development Centre (IBDC). Sh Vijay Sampla, Union Minister of State for Social Justice and Empowerment, India, also graced the occasion.



Sh Arjun Ram Meghwal, Union Minister of State for Water Resources, River Development and Ganga Rejuvenation; and Parliamentary Affairs, India, inaugurating Integrated Beekeeping Development Centre at PAU.

- A delegation of Washington Agro-forestry Group, USA, visited PAU on January 12, 2017 to learn about University's role in Green Revolution.
- A delegation of scientists from the University of Agricultural Sciences, Bengaluru, visited PAU on January 18, 2017 to discuss the ways to maximize farm income and sustain agriculture.

India, visited PAU on January 25, 2017 to enhance University's online recognition.

 A delegation from the University of Cambridge, United Kingdom, visited PAU on February 17, 2017 to deliberate on the scope of partnership. The visiting team comprised Dr Leszek Borysiewicz, Vice Chancellor, and scientists of the Cambridge University.



· A two-member delegation from Wikipedia,

Delegation from University of Cambridge, United Kingdom, at PAU.



 An Afghan delegation visited PAU on March 6, 2017 to gain knowledge about seed production, methodology, standards, etc.



Dr Baldev Singh Dhillon, PAU VC, interacting with Afghan delegation.

- A delegation of officers from Colorado State University, Fort Collins, Colorado, USA, visited PAU on March 17, 2017 to study agricultural advancements made in the region.
- A delegation of Australian farmers visited PAU on March 17, 2017 to have an overview of research and extension programmes.
- Experts from Yezin Agricultural Varsity, Myanmar, visited PAU on April 15, 2017 to explore collaborative areas.
- Dr Claire Newstead, International Manager, Nottingham Trent University, United Kingdom, visited PAU on April 24, 2017 to explore opportunities for joint venture.
- Professor Gabriela Soto Laveaga from Harvard University, Cambridge, Massachusetts, USA, visited PAU on May 18, 2017 to study history of Green Revolution.
- A delegation of Nuffield scholars from Australia visited PAU on May 19, 2017 to know research interests of the University.
- A delegation from the Ministry of Education, Bhutan, visited PAU on May 24, 2017 to discuss future avenues for Bhutanese students at PAU.

Trainings and visits abroad

Dr Neelam Grewal visited Asian Productivity Organization, Jakarta, Indonesia, to attend a conference on "Raising Productivity in Higher Education" from August 29 to September 1, 2016.

- Dr Vikas Indal (Entomology) visited Kansas State University, Manhattan, Kansas, USA, from July 18, 2016 to July 17, 2017 as a part of his research project entitled "Characterization of G-protein coupled receptor in insects," for which he got Raman Post-Doctoral Fellowship from UGC (CoA)
- Dr Ruma Devi (Vegetable Science) visited University of Missouri, Columbia, USA, to attend a training programme on the "Development of Doubled Haploids in Cauliflower: Single Step Approach to Attain Homozygosity" from August 10, 2016 to August 9, 2017. (CoA)
- Dr Sandeep Singh (Entomology) visited Putrajaya, Malaysia, to organize the first Symposium of Tephritid Workers of Asia, Australia and Oceania (from August 12-16, 2016) as a member of an International Steering Committee of Tephritid Workers of Asia, Australia and Oceania (TAAO) on Fruit Flies. He also delivered an invited lecture and organized an International Fruit Fly Photography Contest as Organizing Secretary-cum-Chief Judge during the Symposium at University Putra Malaysia.



Putrajaya, Malaysia, on August 18, 2016. (CoA)

- Dr Varinderpal Singh (Soil Science) visited University of Cambridge, United Kingdom; National Institute of Agricultural Botany, United Kingdom; and Rothamsted Research Station, United Kingdom; to deliberate on Cambridge-India Network for Translational Research in Nitrogen (CINTRIN) Project from October 17 to November 1, 2016. (CoA)
- Dr Jaspal Kaur (Plant Breeding and Genetics) visited Nepal Agricultural Research Council (NARC), Nepal, for surveillance and monitoring of wheat rusts from February 22 to March 1, 2017. (CoA)
- Dr Prashant Mohanpuria (Plant Breeding and Genetics) visited Tokushima University 2-1 Minammijosanima Tokushima City, Japan, to attend a training programme on "Genome Editing Technologies" from March 1to August 31, 2017. (CoA)
- Dr Jagieet Singh Lore (Plant Breeding and Genetics) visited International Rice Research Institute, Philippines, to discuss collaborative research project on "Bacterial Blight of Rice" from March 15 to April 5, 2017. (CoA)
- Dr Inderjit Yadav (School of Agricultural Biotechnology) visited John Innes Centre

IMPORTANT EVENTS ORGANISED AT PAU College of Agriculture (JiC), Norwich, United Kingdom, to attend a training programme on "Renseq Technique for Candidate Gene Identification Belonging to NB-LRR Family" from April 30 to June 26, 2017. (CoA)

- Dr Manjeet Singh (Farm Machinery and Power Engineering) visited Korean Society for Agricultural Machinery, South Korea, to attend an International Symposium on "Globalization Strategies of Agricultural Machinery for International Market" from November 1 - 4, 2016. (CoAE&T)
- Dr Vishal Bector (Training Unit) visited Practical Training Centre, Barneveld, The Netherlands, to attend a short course on "Training and Extension" from June 12 – July 7, 2017. He was also awarded Netherlands Fellowship by the Ministry of Development and Cooperation, The Netherlands, for attending this course. (CoAE&T)
- Dr Neena Singla (Zoology) visited Xilinhaote, Inner Mongolia, China, to attend the "5" International Symposium on Integrative Zoology" from July 25-29, 2016. (CoBSc&H)
- Dr Kiranjot Sidhu (Extension Education and Communication "anagement) visited Taipei, Republic of China, to attend a workshop on "E-Business Modeling for Women Entrepreneurs" from June 18-23, 2016.(CoHSc)

Event and Date	Organizing/Sponsoring Agency
Training course on "Mass Production of Trichogramma spp. for Use in Biological Control Programmes" (July 12 and August 10- 12, 2016)	Biocontrol Section, Department of Entomology, PAU
Training programme on "Innovative Breeding Techniques for Development of Climate Smart Crop Varieties" (August 23 to September 12, 2016)	Department of Plant Breeding and Genetics, PAU, under the aegis of Centre for Advanced Faculty Training

-Training course on "Making Handmade Paper From Lantana camara Biomass" (October 17- 21, 2016) - Training course on "Use of Bush Cutter, Root Puller, Transporter, Charcoal Production Technology and In situ Moisture Conservation" (November 29, 2016; January 31, 2017 and March 3, 2017)	Department of Forestry and Natural Resources, PAU, in collaboration with Department of Science and Technology. Government of India
"Basic Beekeeping Training Courses" for scheduled castes at villages Gondwal (October 24-28, 2016), Baraich (November 7-11, 2016), Maherna (May 23-27, 2017) and Andloo (June 12-16, 2017)	Department of Entomology, PAU, under the auspices of <i>Rashtriya Krishi Vikas</i> Yojna
Training course on "Soil, Air and Water Pollution and Mitigation Strategies" (November 2-22, 2016)	Department of Soil Science, PAU, in association with Indian Council of Agricultural Research, New Delhi, under the aegis of Centre of Advanced Faculty Training
Advance training course on "Beekeeping" (February 6-9, 2017)	Directorate of Extension Education in association with Department of Entomology, PAU
Brain storming workshop on "Identification of Student Competencies in Higher Agricultural Education" (February 8, 2017)	Department of Extension Education, PAU, under ICAR Extra Mural Project
Training the Trainers Programme (March 6-8, 2017)	Department of Entomology, PAU, under the auspices of Agriculture Skill Council of India (ASCI)
"Bioinformatics Surgery" (March 21-24, 2017)	Punjab Agricultural University, Ludhiana, in collaboration with John Innes Centre, United Kingdom
National Group Meet of "All India Coordinated Research Project on Pearl Millet–Kharif 2017" (April 28-29, 2017)	Punjab Agricultural University, Ludhiana, in association with Indian Council of Agricultural Research. New Delhi
"Basic Beekeeping Training Course" for HSTC (May 2-4, 2017)	Department of Entomology, PAU, with the support of National Horticulture Mission
Refresher course on "Apiculture" for Gujarat personnel (May 8-12, 2017)	Department of Entomology, PAU
Summer school on "Technological Advances for Enhancing Productivity of Horticultural Crops" (June 7-27, 2017)	Indian Council of Agricultural Research, New Delhi



College of Agricultural Engineering and Technology

Event and Date	Organizing/Sponsoring Agency
- Orientation workshop on "MATLAB	School of Electrical Engineering and
Software" (August 8, 2016) - Construction-cum-Maintenance Training Course (August 8-31, 2016) - Turnkey Workers/Self Employed Workers Training Courses (November 18 to December 7, 2016; December 19-28, 2016; and March 8- 17. 2017)	Department of Civil Engineering, PAU and sponsored by Ministry of New and Renewable Energy, New Delhi, under the scheme "Regional Biogas Development and Training Centre (CSS-60)"
 In-house training programme T1 on "Agricultural Engineering" (August 19-20, 2016) In-house training programme T2 on "Agricultural Engineering" (March 10-May 26, 2017) 	Training Unit, College of Agricultural Engineering and Technology, PAU
 Workshop on "Study Opportunities in Foreign Institutions" (August 24, 2016) Workshop on "Personality Development" under SMART series (November 16-17, 2016) Training course on "Personal Grooming" (January 18, 2017) Workshop on "Campus to Corporate" (January 21, 2017) Training course on "Building Self-esteem and Self-confidence" (January 25, 2017) Training course on "Leadership Skills" (February 8, 2017) Training course on "Leadership Skills" (February 8, 2017) Training course on "Analyzing Strengths and Weaknesses" (February 22, 2017) Group visit of students and faculty from Kelappaji College of Agricultural Engineering and Technology, Kerala Agricultural University, Tavanur, to PAU as a part of All India Educational Tour (April 3, 2017) 	Training Unit and Placement, College of Agricultural Engineering and Technology, PAU
Winter school on advance training programme on "Resource Conservation and Paddy Residue Management" (October 4–25, 2016)	Department of Farm Machinery and Power Engineering, PAU, and Indian Council of Agricultural Research, New Delhi
Training programme under Jal Kranti Abhiyan (October 21, 2016)	Sponsored by Central Ground Water Board in association with Department of Soil and Water Engineering, PAU

	No. 1
Training course on "Agro-processing and Value Addition" (December 12-14, 2016) Training course on "Setting-up of Agro-based Industries" (February 7-9, 2017) Training course on "Agro-processing Technologies" (April 20, 2017)	Training Unit, Department of Processing and Food Engineering in collaboration with Directorate of Extension Education, PAU
COAE&T Alumni Meet – Moments 2016 (December 17-18, 2016)	Alumni Association, College of Agricultural Engineering and Technology, PAU
Training course on "Machinery and its Safety for Different Farming Operations" (January 6, 2017)	Training Unit, Department of Farm Machinery and Power Engineering in collaboration with Directorate of Extension Education, PAU
Training programme on "Decision Support System for Selection of Pumping Units and Irrigation Scheduling" (January 21, 2017)	Punjab Agricultural University, Ludhiana
Training course on "Adjustments and Optimization of Combine Harvesters : Comprehensive Straw Management Begins With Harvest" (April 25, 2017)	Department of Farm Machinery and Power Engineering, PAU, and DEULA-Nienburg, Germany
Faculty development programme on "Networking Simulation (MANET, WSN and IOT) using NetSim Software" (May 11, 2017)	School of Electrical Engineering and Information Technology, PAU, in collaboration with DELLSOFT
Seminar-cum-group discussion on "Subsurface Drip Irrigation" (May 15, 2017)	Department of Soil and Water Engineering, PAU, and Borlaug Institute for South Asia (BISA)
Talk on "Improving Sustainability at the Food- Energy Water Nexus in Changing World" by Dr Mark Johnson, Associate Professor, University of British Columbia and Canada Research Chair, Institute for Resources, Environment and Sustainability, Vancouver (May 26, 2017)	Indian Society of Agricultural Engineers – Punjab Chapter

College of Basic Sciences and Humanities

Event and Date	Organizing/Sponsoring Agency	
Dr S.S. Guraya Memorial Seminar on "Recent Advances in Reproduction" (October 12, 2016)	Zoological Society, PAU	
Workshop on "Policy Dissemination" (November 10, 2016)	National Centre for Agricultural Economics and Policy Research (NCAP), New Delhi	
National Seminar on "Doubling Indian Farmers' Income by 2022 : Opportunities and Challenges" (April 7, 2017)	Society of Economics and Development, PAU	



College of Home Science

Event and Date	Organizing/Sponsoring Agency		
Contentation course on "Effective Teaching, Research and Extension" (October 30 to November 7, 2016) -Lecture on "Video Technology" by Dr Nishi Sethi, Director, Training, CCS Haryana Agricultural University, Hisar, Haryana (March 8, 2017) -Lecture on "Women Empowerment" by Dr Lali Yaday, Ex-Professor and Head, CCS Haryana Agricultural University, Hisar, Haryana (March 9, 2017)	Department of Extension Education and Communication Management, PAU		
-Lecture on "Diabetes and Renal Nutrition" by Dr Nancy Sahni, Chief Dietitian, PGIMR, Chandigarh (February 23, 2017) -Workshop on "Innovative Bakery Products" (March 11-12, 2017) -Workshop on "Glazed Icing and Chocolate Making" (March 16-17, 2017) -Workshop on "Nutritious Biscuits" (April 3, 2017) -Workshop on "Nutritious Puddings" (April 27, 2017)	Department of Food and Nutrition, PAU		
Workshop on "Rethinking Social and Emotional Development" (April 11-12, 2017)	Department of Human Development and Family Studies, PAU		

PAU Science Club

Event and Date	Organizing/Sponsoring Agency
Orientation programme for the fresh postgraduate students of PAU (September 7, 2016)	PAU Science Club

FINANCES

The Board of Management in its 280° meeting held on March 29, 2017 approved the budget estimates of Punjab Agricultural University for the year 2017-18 amounting to Rs 599,13.42 lakh. The details of these schemes, budget allocation for research, teaching, extension and for the administrative and miscellaneous activities are as under:-



*includes Rs 7,16.71 lakh for strengthening and development of PAU and Rs 52.00 lakh for strengthening of Library services.

As compared to the Budget Estimates amounting to Rs 570,60.68 lakh for the year 2016-17 approved by the Board of Management in its 276" meeting held on March 28, 2016, the actual grants received during the financial year 2016-17 were Rs 423,92.60 lakh. The University raised Rs 75,39.63 lakh through tuition fee and other sources/services.

Allocation of funds for various activities

Budget Allocation	2017-18 As per Budget Estimates		2016-17 As per Actual Grant received	
	Amount (Rs in lakh)	Allocation (%)	Amount (Rs in lakh)	Allocation (%)
Research	323,42.66	54.0	232,50.84	54.8
Teaching	137,17.68	22.9	90,19.36	21.3
Extension	77,90.23	13.0	56,36.07	13.3
General administration and others	60,62.85	10.1	44,86.33	10.6
Total	599,13.42	100	423,92.60	100

During the year 2016-17, actual allocation was 54.8 % on Research, 21.3% on Teaching, 13.3 % on Extension and 10.6% on General Administration & others.

ESTATE ORGANIZATION

The Estate Organization looks after the construction and maintenance of the University buildings. A total of 16 projects were completed by the Engineering Unit during the period under report. (Annexure I)

INTERNATIONAL VISITS

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

Name Event and Organizing Agency **Date and Place** 4th International Conference on "Plant July 14-15, 2016 Drs G.S. Mangat and Jagjeet Singh Lore (Plant Genomics" by OMICS, International Brisbane, Australia Breeding and Genetics) **Conference** Series "International Conference of Institute of July 16-19, 2016 Dr A. Kalia (Soil Science) Food Technologists (IFT-2016)" Chicago, USA "India-Mauritius Global Partnership July 24-27, 2016 Dr C.S. Aulakh (Agronomy) Conference" by India- Mauritius Trade Balaclava, Mauritius and Cultural Friendship Forum "XXV International Congress of September 25-30, 2016 Dr Vikas Jindal Entomology" by Entomological Society of Orlando, USA (Entomology) America

International participation



	"10th Arthropod Genomics Symposium" by Eck Institute for Global Health	June 8-11, 2017 University of Notre Dame, USA
Dr Jagjeet Singh Lore (Plant Breeding and Genetics)	Training on "Genomics and Molecular Diagnostics" and 5th International Conference on "Bacterial Blight of Rice" by International Rice Research Institute (IRRI), Philippines	October 14-20, 2016 IRRI, Philippines
Dr Ruma Devi (Vegetable Science)	8th Annual Agro-forestry Symposium on "Enhancing Health, Conservation and Livelihoods: Medicinal Plants in Agro- forestry" by Bond Life Science Centre, University of Missouri, Columbia, USA	January 26, 2017 University of Missouri, Columbia, USA
	"1st Annual MU DuPont Pioneer Plant Science Symposium" by Bond Life Science Centre, University of Missouri, Columbia, USA	February 2, 2017 University of Missouri, Columbia, USA
	34th Annual Interdisciplinary Plant Group Symposium on "Root Biology" by University of Missouri, Columbia, USA	June 7-9, 2017 University of Missouri, Columbia, USA
	Local Auxin Meeting by Tyson Research Centre, Washington University, St Louis, Missouri, USA	June 12, 2017 Washington University, St Louis, Missouri, USA
Dr Beant Singh (Plant Breeding and Genetics)	Monogram by University of Bristol, United Kingdom	April 4-6, 2017 University of Bristol, United Kingdom

National participation

Name of the College	No. of faculty members participated
College of Agriculture	150
College of Agricultural Engineering and Technology	40
College of Basic Sciences and Humanities	45
College of Home Science	24

NEW EQUIPMENTS ACQUIRED (above Rs 2.0 lakh)

College of Agriculture

F-viewant/instrumant	Cost (in lakh)	Utility
Equipment/instrument	2.10	For research
Deep Freezer	2.40	
Refrigerator Centrifuge	11.50	
Thermal Cycler	9.45	
Thermocycler	4.85	For use in molecular diagnosis of honey bee diseases
Digital Bee Counters	25.00	For use in recording activity of honey
Dee toragers at colony entrance	14.90	For enzyme, calcium etc. assay
Tissue Homogeniser	4.25	For homogenizing tissue for DNA/RNA/Protein extractions
Ice Making Machine	2.00	
Electrophoresis System Power	3.27	
Auto Clave	2.97	
Real Time PCR machine	9.25	
Canopy Analyzer	6.00	For research
Chlorophyll Meter	2.50	
GENO Grinder	15.00	
Green house in Cuttak PAU	14.00	
Automatic Rapid Fibre Analysis System (out of SFS Scheme 01(B)	2.00	For easy and fast analysis of food fibres
Four Automatic Weather Stations particular location automatically	20.00	For recording weather data of a
pH/EC/ORP Meter determination of pH, EC and ORP	2.15	Portable and multi-parameters for
Gas Chromatograph	3.76	For analyzing greenhouse gases
Total	157.35	

College of Agricultural Engineering and Technology

Equipment/instrument	Cost (in lakh)	Utility
Safe Trolley	3.42	For training/demonstration
Trolley Type Tray Dryer	2.95	Agro-processing complex developed
Oil Expeller Plant	2.70	under Consortia Research Project on
Turmeric Processing Boiler	3.70	Agriculture
Turmeric Processing/Grading Unit	2.90	
Pectin Extraction Plant	4.95	Developed under All India
Automatic Kjeldhel Apparatus	4.90	Coordinated Research Project on
		Post-Harvest Engineering and
		Technology



Flue Gas Analyzer	4.65	To measure percentage of various gases in flue gas of paddy straw bale combustor or in any other furnaces/engine
Solar Thermal Training System	3.30	For conducting undergraduate practical
Total	33.47	

College of Basic Sciences and Humanities

Instrument/equipment	Cost (in lakh)	Utility
Hypropalam Portable Analyzer Hp-23-AW-A	2.45	For research of M.Sc./Ph.D students
Refrigerated Centrifuge	2.86	
Total	5.31	

College of Home Science

Instrument/equipment	Cost (in lakh)	Utility
Lypholyzer	3.47	For analysis by Department of Food and Nutrition
Total	3.47	



Two Food Testing Laboratories, established in the Food Industry Business Incubation Centre, PAU.



NEW LABORATORIES AND INFRASTRUCTURE CREATED AND UPDATED

- Two Food Testing Laboratories were established in the Food Industry Business Incubation Centre.
- Three new laboratories including Bee Disease Diagnostics Laboratory, Queen Bee Rearing Laboratory and Bee Husbandry Laboratory were established by the College

of Agriculture.

- The SOLID WORKS software was upgraded to version 2016-17 by the Department of Mechanical Engineering in the Computer Aided Design (CAD) Laboratory.
- A Fee Collection Portal was started for the online payment of the semester registration fee of the students.

M. S. RANDHAWA

Mohinder Singh Randhawa Library caters to the informational needs of the academia of PAU by keeping pace with the 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 3,749 members which include PAU students and staff, in addition, 14,319 books were issued to the library members during this period.

Documents procured and subscribed

During this period, the library procured 2,778 books, 334 theses and 376 Compact Discs (CDs). At present, the library is subscribing to 58 print journals (national and international), 12 online journals and 11 online databases including 137 e-books. Thus, the total collection of library as on June 30, 2017 stands at 4,01,464.

Digitization

The library got 7,056 theses documents digitized which have been uploaded in PAU theses database and are accessible from the library web page.

Online services

The library is providing online access to scholarly material through various online databases namely Consortium for e-Resources in Agriculture (CeRA) for journal articles, Krishikosh, Krishiprabha and PAU Theses for theses submitted in PAU as well as other State Agricultural Universities and ICAR institutes.



Mylibrary, CRCnetBASE, EBSCO NetLibrary, Koganpage and Pearson Thinktank Library provide access to e-books, whereas ISO standards provide access to various standards on food products. Indiastat.com is accessed for statistical information on agriculture and allied areas.

New software purchased

To monitor the quality of research, an antiplagiarism software TURNITIN costing Rs 4,25,332/- was renewed for the University. In order to provide remote access to subscribed eresources of the library to PAU faculty placed at different Regional Stations, *Krishi Vigyan Kedras* and Farm Advisory Service Centres, a software Cyberoam 300i firewall costing Rs 1,95,229/- was procured. As per ICAR directions, open source library management software KOHA was implemented in the library under e-Granth project to facilitate interconnectivity of agricultural university libraries across the country.

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 eresources like e-journals, e-books, e-theses, estandards etc. are accessible campus wide from the web page. Only Indiastat.com database is accessible within the library.

Library usage

Books – 2,14,627; Theses – 37,295; Bound periodicals – 30,060; Current periodicals – 24,205; Abstracts and Indexes – 7,307; Newspapers – 2,503; Reference books – 19,290; Textbooks – 9,915 and Rare books – 2,716.

IMPACT

RESEARCH AND EXTENSION

- Special campaigns for cultivation of recommended varieties resulted in enhanced area under improved rice varieties from 54.6 per cent in 2015 to 67.9 per cent in 2016 and of wheat varieties from 92.1 per cent during 2014-15 to 96.9 per cent during 2016-17.
- Unnat PBW 343 is the first wheat variety developed through marker assisted selection and to be released at the national level PRW 1 Zn is another first in terms of being one of the two wheat varieties released simultaneously for higher Zn concentration in the grain in the country. ITC is cultivating PBW 550 on a large area in eastern states for flour production due to its better chapatti making quality. Unnat PBW 550, with enhanced resistance to rusts, is likely to perform better in disease prone areas. PBW 1 Zn with enhanced content of this crucial trace mineral would be beneficial for mental development of growing children. Adoption of these varieties, released for irrigated timely sown conditions of North Western Plains Zone, having higher grain yield and resistance to vellow and brown rusts, would enhance the productivity and profitability of wheat farmers.
- Cultivation of improved disease resistant varieties, surveillance and monitoring of yellow rust in wheat and timely advisory to farmers regarding its management resulted in attaining wheat productivity of 50.46 q/ha during 2016-17.
- Intensive campaigns on whitefly management in cotton belt resulted in

bumper cotton crop and a record productivity of 756 kg lint/ha during 2016. In addition, the adoption of integrated pest management strategy saved pesticides to the tune of Rs 54.0 crore in the cotton belt, accruing abenefit of Rs 2,156 per hectare.

- Campaigns on paddy straw management resulted in declaring five villages (one each in Amritsar, Bathinda, Patiala, Roopnagar and Sangrur districts) as zero burning villages.
- Salient characteristics including early maturity, high yield, genetic resistance against bacterial blight and good grain quality will make the rice variety PR 126 beneficial for the farmers, traders and the consumers. On account of its short duration, it is suitable for multiple cropping systems and helps in saving water.
- The new spring/summer mungbean variety TMB 37 has medium sized grains and good culinary properties. Due to its short duration, maturing in 60 days, it would be an effective option for the farmers to get an additional crop.
- Due to special focus on diversified farming, during 2016-17 the area under vegetables increased to 2.44 lakh hectares while that of fruit crops increased to 0.82 lakh hectares. Area under guar also increased in Mansa during this period.
- The release of new cherry tomato varieties namely. Punjab Sona Cherry and Punjab Kesar Cherry, during the period under report provided the farmers an option to grow yellow and orange colored cherry tomato, which is a novel and high valued commodity. These fetch a premium price in the market



due to their sweetness and acceptable size, to be used for salad purposes. These varieties: received an overwhelming response from the commerceal growers and are also being cultivated by the urban consumers in their kitchen gardens.

- New brinjal hybrids PBHR-41 and PBHR-42, due to their attractive shape, size, shining, deep purple fruits, will cater to the need of the consumers, especially, for *bhartha* making and give higher returns to the farmers.
- The long group brinjal hybrid PBH-5 gives higher early and total yield as compared to the previously released variety. Hence, it is more profitable to the farmers.
- Punjab *lhaar* Karela I, a bitter gourd variety, has attractive green, tender, spindle shaped fruits that are suitable for cooking by chopping. It has resistance against root knot nematode disease.
- Punjab Bahar, a variety of bottle gourd, has round, medium sized, shining green, pubescent, tender fruits. It gives high yield and higher returns to the farmers.
- Punjab Suhawani, an okra variety, has dark green, tender, five ridged fruits. It is tolerant to yellow vein mosaic virus (VVMV) disease, thereby, reducing losses by this disease and improving profitability of the farmers.
- The recommended production technologies would help in increasing area under fruit cultivation and ensure better returns from the orchards. The nutrition garden will provide year round availability of fresh fruits for nutritional security.
- Demonstrations on 'PAU Fruit Fly Traps' at Fatehgarh Sahib district reduced damage by more than 70 per cent, thereby, resulting in 25 per cent higher yield. The farmers can get additional returns of about Rs 25,000 per acre.
- The University produced 59,629 quintals seed of field crops, 3.61 lakh nursery fruit

plants and 1.30 lakh plants of different tree species for distribution to farmers during 2016-17.

PUBLICATIONS

 The University scientists published nearly 700 publications which include research papers, books, book chapters, manuals, etc.

EDUCATION

The high standards of academics and research, upheld by PAU, were recognized in various rankings:

- In the international ranking by National Taiwan. University (2016), Punjab Agricultural University was one of the only two agricultural institutes of the country which made it to the list of top 300 world universities.
- The Punjab Agricultural University was placed second among the agricultural universities of India and first among the universities of Punjab in the National Institutional Framework Ranking (NIRF) 2017.
- The University was honoured by the Indian Society of Genetics and Plant Breeding (ISGPB) in February 2017 for having highest number of landmark varieties to its credit among all the State Agricultural Universities and ICAR Institutes.
- Two faculty members, namely, Dr Kuldeep Singh, Senior Molecular Geneticist and Dr Gulshan Mahajan, Senior Agronomist, were designated as NAAS fellows.
- Five All India Coordinated Best Centre Awards were bagged by the teams of Rice, Forages, Maize team (Plant Breeding and Genetics), Honey Bee and Pollinators (Entomology) and Micronutrient and Pollutants (Soil Science).
- One student of PAU was conferred with ICAR Jawaharlal Nehru Post Doctoral Thesis Award.
- A total of 28 students cleared ICAR/ARS (NET); 19 students were awarded ICAR

National Talent Scholarship, 16 ICAR (SRF), 22 ICAR (IRF), seven UGC (IRF) and one student got CSIR (SRF). A number of students bagged Maulana Azad UGC Fellowship, Innovation in Science Pursuit for Inspired Research Fellowship from Department of Science and Technology, Rajiv Gandhi National Fellowship from UGC and University Merit scholarship. Students also participated in International conferences and training programmes.

 Two Centre for Advanced Faculty Training (CAFT) programmes were conducted in the Department of Plant Breeding and Genetics and Soil Science. One winter school on "Resource Conservation and Paddy Residue Management" was conducted by the Department of Farm Machinery and Power Engineering. Besides, short trainings on bioinformatics, biocontrol, beekeeping, charcoal production technology and management of biomass of Lantana comaro were also organized.

SKILL DEVELOPMENT

· The skill development trainings in

subsidiary occupations motivated the farmers, farm women and the rural youth to adopt these occupations. Under this, various trainings were conducted like, Training of Trainers; Agro processing and value addition; Setting up of agro based industry; Turnkey workers/self employed workers training course and Constructioncum-maintenance training course (Civil Engineering); Innovative bakery products etc. As per a survey by Krishi Vigyan Kendra, Amritsar, the adoption rate of subsidiary occupations was 52.5 per cent for preparation of decorative material at household level, 40.0 per cent for protected cultivation of vegetables, 30.7 per cent for beekeeping, 28.6 per cent for fabric value addition, 19.4 per cent for preservation of fruits and vegetables, and 17.7 per cent for candle making. In another survey by Krishi Vigyan Kendra, Sangrur, the adoption rate was 56.3 per cent for mushroom cultivation, 48.1 per cent for poultry farming, 42.7 per cent for beekeeping and 42.7 per cent for dairy farming.

ADMINISTRATION

BOARD OF MANAGEMENT

Sr.No	Name and	Period
	Designation	
Hono	orary Chairman	
Sh Ka	ptan Singh Solanki	01.07.2016 to 21.08.2016
Hon	ble Governor, Punjab and Chancellor	
Sh V.I	P. Singh Badnore	22.08.2016 to 30.06.2017
Hon'	ble Governor, Punjab and Chancellor	
Work	king Chairman	18
Dr Ba	Idev Singh Dhillon	01.07.2016 to 30.06.2017
Vice	Chancellor	
Mem	bers	
1	Sh Sarvesh Kaushal, IAS	01.07.2016 to 15.03.2017
	Chief Secretary to Govt. of Punjab	
	Chandigarh	
	Sh Karan Avtar Singh, IAS	16.03.2017 to 30.06.2017
	Chief Secretary to Govt. of Punjab	
	Chandigarh	-
2	Sh N.S. Kalsi , IAS	01.07.2016 to 15.03.2017
	Addl. Chief Secretary (Development)	
	to Govt. of Punjab	1
	Department of Agriculture, Chandigarh	
	Sh Satish Chandra , IAS	16.03.2017 to 30.06.2017
	Addl. Chief Secretary (Development) to	
	Govt. of Punjab	
	Department of Agriculture, Chandigarh	
3	Sh D.P. Reddy, IAS	01.07.2016 to 02.04.2017
	Addl. Chief Secretary (Finance) to Govt. of Punjab	
	Department of Finance, Chandigarh	
	Sh Anirudh Tewari, IAS	03.04.2017 to 30.06.2017
	Principal Secretary to Govt. of Punjab	
-	Department of Finance, Chandigarh	
4	Sh Jasbir Singh Bains	01.07.2016 to 30.06.2017
	Director of Agriculture, Punjab	
	Kheti Bhawan (Near Dara Studio)	
	Phase – VI, Mohali	

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Sr.No.	Name and	Period
	Designation	201510 20 05 2017
5	Dr.R.K. Gupta, Director, Central Institute of Post-Harvest Engineering and Technology (CIPHET), PAU Campus, Ludhiana	01.07.2016 to 30.06.2017
6	Dr G.S. Nanda H. No.1142, Sector 71 Mohali-160 071	01.07.2016 to 30.06.2017
7	Dr S.S. Gosal Former Director of Research, PAU Opposite State Bank of India ATM, Sugandh Vihar, Pakhowal Road, Ludhiana	01.07.2016 to 30.07.2017
8	Sh Kulwant Singh Ahluwalia Village – Chhauni Kalan, P.O. Ram Colony Distt. Hoshiarour	01.07.2016 to 30.06.2017
9	Sh Hardev Singh Riar Flat No. 314, Punjab Mandi Board Colony Sector 66, Mohali	01.07.2016 to 18.06.2017
10	Dr A. R. Sharma Chairman and Managing Director, Ricela Group of Companies Saron Road, Dhuri, Distt. Sangrur	01.07.2016 to 30.06.2017
Secret	ary	
	Dr P.K. Khanna Registrar	01.07.2016 to 28.02.2017
	Dr R.S. Sidhu Registrar	01.03.2017* to 29.05.2017
		30.05.2017 to 30.06.2017

* Additional Charge

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ACADEMIC COUNCIL

Designation	Name	
Vice Chancellor	Dr Baldev Singh Dhillon	
Dean, Postgraduate Studies	Dr (Mrs) Neelam Grewal	
Dean, College of Agriculture	Dr Harvinder Singh Dhaliwal	
	Dr S.S. Kukal	
Dean, College of Agricultural	Dr Jaskaran Singh Mahal	
Engineering and Technology		
Dean, College of Basic	Dr (Mrs) Gurinder Kaur Sangha	
Sciences and Humanities		
Dean, College of Home Science	Dr (Mrs) Gurinder Kaur Sangha	
	Dr (Mrs) Jatinder Kaur Gulati	
Director of Research	Dr Navtej Singh Bains	
Director of Extension Education	Dr R.S. Sidhu	
	Dr Ashok Kumar	
Head, Department of	Dr (Mrs) Parampal Sahota	
Microbiology		
Head, Department of Food	Dr (Mrs) Amarjeet Kaur	
Science and Technology		
Head, Department of Fruit	Dr MIS Gill	
Science		
Head, Department of Farm	Dr G.S. Manes	
Machinery and Power		
Engineering		
Head, Department of Processing	Dr A.K. Singh	
and Food Engineering		
Registrar, Secretary	Dr P.K. Khanna	
	Dr R.S. Sidhu	

IMPORTANT DECISIONS OF THE BOARD OF MANAGEMENT

During the period under report, the Board of Management held four meetings (278" to 281"). The important decisions taken by the Board are as under:

Amendment in Statutes

 The Board ratified the amendment in Clause 7(1) of Chapter VI of PAU statutes.

C-2/279

 The Board approved the substitution of Clause 4(2) (iii) of Chapter IV of PAU

C-2/281

Concession to Staff

- The Board approved the enhancement of honorarium of Wardens and Assistant.
 Wardens of PAU from Rs 800/- p.m. and Rs 600/- p.m. to Rs 1,200/- p.m. and Rs 900/p.m., respectively.
 B-2/279
- The Board approved to implement the rerevision of the pay scales of the Draftsman Cadre w.e.f. from 01.01.2017. B-1/280

Budget

- The Board approved the creation and inclusion of the new Revolving Fund Scheme entitled "Research Station at Dyal Bhadang, Ajnala, Amritsar, RF-8 (PC-3104)" in the University Budget for the year 2016-17. B-1/278
- The Board approved the creation and inclusion of the new Revolving Fund Scheme entitled "University Seed Farm, Usman, Tarn Taran RF-9 (PC-3105)" in the University Budget for the year 2016-17.

8-2/278

Other Decisions

· The Board approved the creation of two

posts of programmer in the pay band of Rs 15,600-39,100 + Grade Pay Rs 5,400/- to strengthen the School of Electrical Engineering and Information Technology. B-3/278

- The Board approved the creation of one post of Plant Manager and one post of Production Manager in the pay band of Rs 15,600-39,100 + Grade Pay Rs 6,600/- and Rs 15,600-39,100 + Grade Pay Rs 5,400/respectively. B-4/278
- The Board approved the allotment of space (measuring 100m³) near gate No.3 adjacent to 66 KV power station to Punjab Pollution Control Board (PPCB) for setting-up of 'Continuous Ambient Air Quality Monitoring Station (CAAQMS).' C-2/278
- The Board approved the creation and inclusion of the new scheme entitled "Self Financing Scheme for Diploma in Agrochemicals in College of Agriculture SFS-6 (PC-3041)" in the Budget Estimates 2016-17. B-1/279
- The Board approved the exchange of 02 acre-04 kanal-14 maria (2.587 acres) of land between Punjab Small Industries Export Corporation Limited and PAU at University Seed Farm, Nabha. C-1/279
- The Board opproved the allotment of 418 square metre (19m*22m) area near communication building to Prasar Bharati,



All India Radio, New Delhi, on lease of 30 years @ Re 1/- per annum for constructing office-cum-studio building and allotment of 687 square metre area near swimming pool for erecting transmission tower and hall. C-4/280 The Board decided to nominate Dr G.S. Nanda as non-official member of the Finance Committee for another period of one year. C-1/281



IMPORTANT DECISIONS OF THE ACADEMIC COUNCIL

During the period under report, 13 meetings (373^{°°} to 385^{°°}) of the Academic Council were held. The important decisions taken by the Academic Council are as under /-

- Approved rules/regulations for the institution of a medal in the name of Dr H.S. Toor for M.Sc. students in the Department Oof Zoology. Item No.C-2/373^{et}
- Approved rules/regulations for the institution of an award in the name of Sardarni Parkash Kaur Sra for outstanding innovation and progressive farmer/farmer lady. Item 5/374th
- Approved rules for G.S. Khush Foundation Financial Aid for undergraduate students belonging to low income/families.

Item 12/379"

- Approved rules for the institution of Baba Ganga Singh Memorial Innovation Award. Item 13/379"
- Approved that Gold Medal awarded in various undergraduate programmes of the University would be named as PAU Gold Medal. Group Discussion/379"
- Approved rules/regulations for the institution of Dr H.S. Garcha Memorial Medal to be awarded to the all round best doctoral student of the College of Basic Sciences and Humanities.

Item C-4/382"

- Approved rules/regulations for the institution of PAU Gold Medal for the students of B.Sc (Hons) Interior Design 4year programme. C-5/382^{eff}
- Approved the establishment of the 'School

of Organic Farming' with the provision of faculty which will be constituent of the College of Agriculture.

C-7/382

- Approved rules/regulations for the institution of an Alumni Cash Award for excellence in research in Chemistry/ Biochemistry. C-8/382⁻⁴
- Approved rules/regulations for the institution of an Alumni Gold Medal for excellence in academics in Chemistry/ Biochemistry. C-9/382^{eff}
- Approved rules/regulations for the institution of a medal in the name of Dr Rippen Gill Jassal to the all round best graduate student of B.Sc. (Hons) Home Science/ Community Science 4-year programme. C-10/382"
- Decided to increase the reservation quota for the backward classes from 5 per cent to 10 per cent for admission purpose from the academic session 2017-18. C-3/383"
- Approved/decided to rename B.Sc. (Hons) Agriculture 6-year degree programme as B.Sc. (Hons) Agriculture 6-year (2+4) degree programme. Item 6/383"
- Approved rules/regulations for the institution of Piara Singh Parmar Memorial Sports Medal and Piara Singh Parmar Memorial Students Aid Fund.

C-1/384"


ANNEXURE I

Important projects undertaken by the Estate Organization and the Engineering Unit:

Projects	Cost (Rs in lakh)
Construction of office-cum-lab building at Krishi Vigyon Kendro, Mansa	59.07
Construction of administrative building and training hostel at Krishi Vigyon Kendro, Nag Kalan, Amritsar	41.93
Construction of shed-cum-store at Regional Research Station, Bathinda	33.85
Repair of damaged boundary wall of the University at PAU, Ludhiana	27.52
Construction of processing hall, construction of threshing floor and repair of	27.18
existing threshing floor, construction of toilet and repair/renovation of the office of Director at the University Seed Farm, Ladhowal, Ludhiana	
Repair and renovation of toilets in Hostel No. 4 at PAU, Ludhiana	26.50
Electrification work at Thapar Hall building including provision of 300 KVA transformer at PALL Ludhiana	26.29
Installation of CCTV cameras (Phase-I)	25.00
Purchase and installation of CCTV cameras at PAU, Ludhiana (Phase-II)	27.20
Started construction of an International Hostel	24.69
Construction of six residential quarters at Krishi Vigyon Kendro, Kheri, Sangrur	16.15
Repair and renovation of Hostel No. 7 at PAU, Ludhiana	12.83
Laving of concrete road at Fruit Research Station, Gangian	12.55
Installation of gravel packed tubewell (25 HP) submersible pump set and	11.33
Installation of gravel packed tubewell size 16" x 8" and construction of tubewell	11.12
Construction of threshing floor and six residential quarters at New Krishi Vigyan	10.82
Kendra, Uppal Jagir, Noormanai, Jalanunat	394.03

*Apart from this, a total of Rs 1.20 crore was spent on the construction of an International Hostel.

ANNEXURE II

PUBLICATIONS

The University scientists published nearly 700 publications which included research papers, books, book chapters, manuals, etc. Details are given below:

COLLEGE OF AGRICULTURE

Research Papers in Indian and Foreign Journals

- Aggarwal N, Sharma S and Jalali S K (2016). On-farm impact of biocontrol technology against rice stem borer, Scircophaga incertulas (Walker) and rice leaf folder Chaphalocrocis medinalis (Guenee) in aromatic rice. Entomologia Generalis 36: 137-148. (NAAS rating 6.07)
- Aggarwal P and Kaur S (2017). Technology development for the preparation, concentration and utilization
 of rose extract in different valuable products and by products with retention of color and flavor. The
 Pharma Innvol 6: 189-193. (NAAS rating 5.03)
- Ali S, Singh B and Sharma S (2016). Development of high-quality weaning food based on maize and chickpea by twin-screw extrusion process for low-income populations. J Food Process Eng DOI: 10.1111/jfpe.12500. (NAAS rating 6.75)
- Ali S, Singh B and Sharma S (2016). Response surface analysis and extrusion process optimisation of maize-mungbeon-based instant weaning food. Int/ J Food Sci Technol 51: 2301-2312. (NAAS rating 7.50)
- Anand A and Kaur M (2017). Perceived impact of the stakeholders regarding agricultural subsidies in Punjab. Ind J Eco and Dev 13: 680-686. (NAAS rating 4.32)
- Arora S, Singh N, Kaur S, Bains N S, Uauy C, Poland J and Chhuneja P (2017). Genome-wide association study of grain architecture in wild wheat Aegilops touschii. Front Pl Sci 8: 886. (NAAS rating 10.49)
- Astha, Sekhon P S and Kumar P (2017). Elicitation of SAR in muskmelon lines against downy mildew caused by Pseudoperonoisporo cubensis. PI Dis Res 32: 22-30. (NAAS rating 4,58)
- Aulakh C 5, Kaur P, Walia S 5, Gill R 5, Sharma S and Buttar G 5 (2016). Productivity and quality of bosmoti rice (Oryzo sotivo) in relation to nitrogen management. Ind J Agron 61: 467-473. (NAAS rating 5.46)
- 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 annuum L). Pl Breeding 135:531-535. (NAAS rating 7.50)
- Awlachew ZT, Kaur S, Singh R, Bains N Sand Chhuneja P (2016). Transfer and mapping of heat tolerance component traits of Aegilops speltoides in tetraploid wheat *Triticum durum*. Molec Breeding 36: 78-115. (NAAS rating 8.11)
- Azeezahmed S K, Dubey R K, Kukal S S and Sethi V P (2016). Effect of different nitrogen-potassium concentrations on growth and flowering of chrysanthemum in a drip hydroponic system. J Pl Nutr 39: 1891-1898. (NAAS rating 6.53)
- Bala R, Sharma A, Kashyap L, Rana B, Bains N S and Sharma I (2016). Molecular mapping of QTLs for Karnal bunt resistance in six near isogenic (NILs) populations of bread wheat. Ind Phytopoth 69: 242-246. (NAAS rating 5.90)
- Balouria S, Mittal R K, Sood V K and Bindra S (2016). Combining ability studies for seed yield and its component traits in urdbean [Vignamungo (L) Hepper]. Res on Crops 17: 729-734. (NAAS rating 4.75)
- Bansal M, Kaur S, Dhaliwal H, Bariana H, Chhuneja P and Bansal U (2015). Mapping of Aeglops umbelluloto - derived leaf rust and stripe loci in wheat. Pl Pathol 66: 38-44. (NAAS rating 7.12)



Bansal M, Sharma M, Kanwar P and Goyal A (2017). Recent advances in proteomics of cereals. Biotechnol and Genetic Engg Rev DOI:10.1080/02648725.2016. [NAAS rating 7.91]

- 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 condido) in mustard (Brossico junceo) crops. J. Phytopoth 164: 404-411. (NAAS rating 6.95)
- Baswal A K, Rattanpal H S and Sidhu G S (2016). Varietal assessment and variability studies in grapefruit (*Citrus paradisi* Mac. Fadyen) genotypes in subtropical zones of Punjab, India. *The Bioscan* 11: 1369-1371. (NAAS rating 5.26)
- Baswal A K, Rattanpal H S, Sidhu G S and Uppal G S (2016). Genetic diversity analysis in sweet orange (*Citrus sinensis* Obseck) genotypes on the basis of morphological and physico-chemical traits. *Ind J Ecol* 43:529-532. (NAAS rating 4.96)
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- Bhavyasree R K, Singh S and Singh I (2017). Advanced back cross strategy for alien introgression for productivity. enhancing traits in chickpea (*Cicer arietinum L.*). Legume Res (LR 3746) DOI:10.18805/frv0i0.7847. (NAAS rating 6.15)
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- Bons H K, Gill K S and Sarabha J S (2016). Evaluation and comparative performance of six loguat (Eriobotrya japonica Lindl.) varieties under Punjab conditions. J App Nat Sci 8: 1831-1834. [NAAS rating 4.84]
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- + Deosi H K and Chhuneja P K (2017). Preferred site of oviposition by Varroa destructor Anderson and Trueman in Apis mellifera Linnaeus worker brood. J Exp Zool India 20: 123-127. (NAAS rating 5.51)
- Deosi H K and Chhuneja P K (2017) Some morphometric effects of Varroa destructor Anderson and Trueman on Apis mellifero Linnaeus adult workers. J Exp Zool India 20: 151-152. (NAAS rating 5.51)
- Deosi H K and Chhuneja P K (2017). Vorroa destructor Anderson and Trueman in Apis mellifera Linnaeus colonies - development of mite. J Exp Zool India 20: 67-70. (NAAS rating 5,51)
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- Dhall R K and Singh P (2016). Post-harvest ripering and quality of tomato (Solonum lycopersicum L.) during cold storage. Veg Sci 43: 50-57. (NAAS rating 4.98)
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- Dhillon H S, Dhillon T S and Devi R (2016) Quality characterization in carrot (Doucds coroto L.) germplasm. Ind / Ecol 43: 330-332. (NAAS rating 4.96)
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- Dhkal M, Hunjan M S, Kaur H and Kaur R (2016). Biochemical basis of bacterial leaf streak resistance in maize. Ind Phytopath 69: 373-380. (NAAS rating 5.90)
- 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. Ind J Ecol 43: 375-377. (NAAS rating 4.96)
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- Gabbi D K, Bajwa U and Goraya R K (2017). Physicochemical, melting and sensory properties of Ice cream incorporating processed ginger (*Zingiber officinale*). Int J Dary Tech DOI: 10.1111/1471-0307.12430. (NAAS rating 6.91)
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- Gill M 5, Bran J S, Gill P P S and Khehra S (2017). Performance of Daisy Mandarin on three different rootstocks under sub-tropics of North Western India. Eco, Env and Cons 23: 177-183. (NAAS rating 4.89)
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- Gupta N and Thind S K (2016). Performance of advanced wheat genotypes under rainfed environment of Punjab. Ecol. Env and Cons 22: 5467-5476. (NAAS rating 4.89)
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- Itoo A A, Sharma A, Zehra S B and Kang S S (2016). Potential reservoirs of whitefly transmitted begomovirus causing chilli leaf curl disease in Punjab. Appl Biol Res 18: 270-276. (NAAS rating 5.07)
- Jain T, Grover K and Kaur G (2016). Effect of processing on nutrients and fatty acid composition of garden cress (Lepidium sativum) seeds. Food Chem 213: 806-812. (NAAS rating 10.05)



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NOTES





ACTIVITIES AT PAU

Chrysanthemum show at PAU.



Students of College of Agriculture, PAU, lift averall trophy during the Inter-College Youth Festival



Alumni of College of Agricultural Engineering and Technology at PAU.













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