



IARI NEWS



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RESEARCH

Wheat Varieties Released and Notified

HI 1605 (Pusa Ujala). A high yielding bread wheat variety HI 1605 with an average yield of >3.0 t/ha and potential yield up of 4.4 t/ha was released and notified under timely sown, restricted irrigation conditions of Peninsular Zone (PZ), by Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops. It has high levels of resistance to black and brown rust diseases, excellent *chapatti* making quality, high protein (~13%) and rich in micro-nutrients like iron (43 ppm) and zinc (35 ppm).

HI 8759 (Pusa Tejas). A *durum* wheat variety HI 8759, with an average yield of >5.7 t/ha and potential yield of 7.6 t/ha, was released and Notified for timely sown irrigated conditions of Central Zone (CZ) by Central Sub-Committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops. It has high levels of rust resistance, quality traits and dual purpose variety suitable for making *chapatti*, pasta and other traditional food products. It has high protein content (12%), and essential micro nutrients like iron (42.1 ppm) and zinc (42.8 ppm)

with high overall acceptability (7.5).

Varieties Identified

The IARI Variety Identification Committee identified one variety of gladiolus, i.e., Pusa Sindoori and one variety of chrysanthemum, i.e., Pusa Guldasta.

Pusa Sindoori. It is a selection from the open pollinated seedlings of the variety Little Fawn. The florets base colour is bright red. Two yellowish spots on base of inner tepals with red coloured rainbow type stripe on throat add novelty in colour and make it more attractive. It is a mid-season variety (105.22 days) with robust and compact spikes. The variety produces long spike (>98.77

cm), having more number of florets per spike (>18.66). This is a very good multiplier, on an average producing 2.88 corms and 47.77 cormels per corm which makes it more suitable for commercialization. It is also suitable for cut flower, bouquet preparation, and floral arrangement in different styles.

Pusa Guldasta. It is an open pollinated seedling of cv. Lalpari. Plant of this variety attains a height of 58 cm with a good spread of 50 cm. The plant is of upright growth habit, very sturdy and branches do not droop down. It bears semi double medium sized flowers (3.8 cm) with orange red ray florets and yellow disc. The inflorescence is corymb and flowers are borne at almost same height. The flowers stay for longer duration (48 days) under field conditions. This does not require pinching and staking. It is suitable for spray and pot culture purposes.



A gladiolus variety Pusa Sindoori



A chrysanthemum variety Pusa Guldasta

Profiling of Carotenoids and their Antioxidant Activities in Marigold (*Tagetes sp. L.*)

The different marigold genotypes were evaluated for total carotenoids, antioxidant activities, phenol and flavonoid contents. Among the various genotypes, selection Af/w-6 had highest total carotenoids on fresh weight basis followed by Pusa Narangi Gainda and Pusa Arpita. The selections Af/w-6 had highest antioxidant activities measured by DPPH radical scavenging activity (82.17%) and Ferrous Reducing Antioxidant Power (FRAP: 891.12 $\mu\text{mol FeSO}_4/\text{g}$ fresh weight) followed by Af/w-4 (DPPH: 81.55%; FRAP: 809.30 $\mu\text{mol FeSO}_4/\text{g}$) and Pusa Narangi Gainda (DPPH: 76.02%; FRAP: 711.39 $\mu\text{mol FeSO}_4/\text{g}$). Af/w-4 (136.17 mg GAE/g fresh weight) showed highest phenolic content followed by Af/w-6 (125.48 mg GAE/g fresh weight) and Af/w-3 (119.83 mg GAE/g fresh weight). The selection Af/w-4 showed highest total flavonoid content (65.13 mg RE/g fresh weight) followed by Selection Af/w-6 (55.17 mg RE/g fresh weight) and Af/w-3 (50.89 mg RE/g fresh weight). This has provided useful information for efficient utilization of pigments of marigold flowers for further industrial use *viz.*, carotenoid extraction, marigold powder production, food colourant, etc.

Cymbidiums: Cool Climate Beauties

Cymbidium was introduced at ICAR-Indian Agricultural Research Institute, Regional



Cymbidiums valued for cut flowers, hanging baskets and potted plants

Station, Katrain, Himachal Pradesh during 2012-13 from Sikkim which was acclimatized to induce flowering in the year 2016-17 successfully, and observations on cultivation aspects have been recorded for its popularization and future research use. Cymbidiums are suitably cultivated in Darjeeling, Sikkim, Arunachal Pradesh, Upper Shillong and temperate regions of Himachal Pradesh.

Genetic Basis of Slow Rusting Leaf Rust Resistance in Wheat Cultivar Agra local

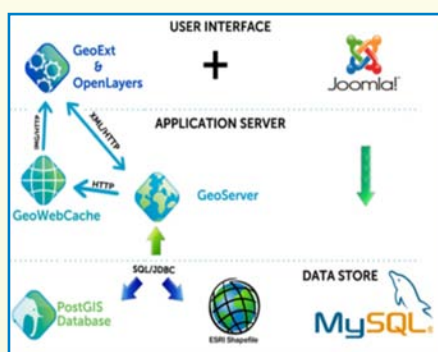
Agra Local is the bread wheat cultivar widely used in India as susceptible genotype to study patterns of inheritance of stem and leaf rusts resistance genes. However, this genotype has been showing slow rusting behavior over the years. Therefore, a genetic study was conducted to find out the genetic basis of slow rusting in Agra Local. The inheritance data clearly indicated the presence of two dominant slow rusting resistance genes. Hence, this cultivar should not be used in infectors in zones with short wheat growth period, especially in Central and Peninsular zones.

Web Based Decision Support System to Identify Best Sowing Date

A web based Decision Support system (DSS) using crop simulation model InfoCrop wheat was developed to identify best sowing date of a specific wheat cultivar. This was created using Visual Studio Express, SQL Server, NET framework 4.0 and hosted at <http://InfoCrop.iari.res.in>. This web-based DSS has separate modules for input variable, management conditions, and decision output. The users after registration without any payment, have the right to insert, edit or update and delete data within their private domains. Based on the information about the cultivar, location, soil, weather and management conditions, specified by the user, the DSS runs the InfoCrop wheat model and identifies the best sowing date as a function of yield output. The decision provided by the DSS was verified for the various wheat growing regions of India and observed to be significantly correlated well with the observed results. The goodness of fitting was performed by comparing the observed and simulated best sowing date for a particular location. In DSS calibration, the relative RMSE values fell within the good 10–15% range, percent BIAS (PBIAS) ranged between 11.6% and 7.6%.

Design and Development of ICAR Geportal

A new project was initiated by ICAR for digitizing all the data



Schematic diagram of geoportals design

generated in ICAR institutes and create a standardized repository for access through public web portal KRISHI (www.krishi.icar.gov.in). The Coordinating Committee for Project Information (CCPI) in the Division of Agricultural Physics was given the main responsibility to design, develop and maintain the ICAR Geoportals (geoportals.icar.gov.in). The project proposal and work plan for geoportals component of KRISHI was prepared. The first beta version of the Geoportals was designed, and developed using Open-Source technologies of Geoserver, PostGIS, GeoExt, OpenLayers and Joomla. The portal has been hosted at ICAR Data Centre in IASRI. The Metadata formats were finalized for different spatial layers and ported many ICAR spatial data layers to the Geoportals.

Discrimination of Rice Genotypes Using Field Spectroradiometry

Spectral observations of 14 rice genotypes grown in the experimental field were taken using field portable spectroradiometer in the spectral range of 350 to 2500 nm. The pre-processed collected reflectance spectra were statistically analyzed

using one-way analysis of variance (ANOVA) to find significantly sensitive wavelengths for discrimination. Classification and regression tree analysis (CART) technique was implemented on selected wavelengths to select most sensitive wavebands for discrimination of genotypes. The spectral separability between each pair of rice genotypes at the selected wavebands was quantified using Jeffries-Matusita (JM) distance. JM distance analysis of 91 pairs of 14 genotypes revealed spectral separability of all the pairs. The performance of selected sensitive wavebands was also evaluated by using quadratic discriminant analysis and overall accuracy found was 98%. The sensitive bands were found to be distributed over entire region of spectral range 350 to 2500 nm. The variation in biophysical and biochemical attributes of genotypes has been captured through differential spectral reflectance at selected wavebands which could make the discrimination possible.

Thermal Image Detection of Early Moisture Stress in Plants

When plants are exposed to moisture stress, they mount a hypersensitive response, characterized by cell death or leaf rolling. In wheat cultivars, such a process occurs spontaneously. In this study, different cultivars of wheat were exposed to moisture stress (IW:CPE ratio of 1.0, 0.8, 0.6 and 0.4) conditions, an increase in surface temperature was thermographically observed, co-localized with the leaf rolling and senescence, before any visual cell death

symptoms became apparent. In this study with ten different wheat cultivars, thermography permitted to visualize the evolution of cell death both earlier and with higher contrast, compared to visual-spectrum imaging. The thermal response to the moisture stress was characterized by a pre-symptomatic appearance of increase in temperature at the surface of leaf (on an average 8h before pinpoint leaf senescence were visible). The changes in the thermal effect were rapid, when compared to visual symptoms. A temperature increase of 0.4 °C was measured at the leaf surface. Maximum changes in the thermal effect were reached after 2 days, whereas the development of visual symptoms to pinpoint leaf senescence needed on an average 7 days to result in leaf rolling and senescence. Thus thermography enabled pre-symptomatic detection of resistance responses in plants could find applications in early stress monitoring and screening for resistance.

Screening of Wheat Germplasm for Thermotolerance Using RuBisCO activase Activity

RuBisCOactivase uses the energy from ATP hydrolysis to remove tight binding inhibitors from Rubisco, thus playing a key role in regulating photosynthesis in plants. Under stress condition, it plays dual roles, primarily modulate the activity of RuBisCO and simultaneously protect the nascent proteins also. Seventy three different lines of wheat were screened for RuBisCO activase

activity assay at grain- filling stage by radioactive labelling method. Sodium carbonate labelled with ^{14}C was used for the activity assay. Among the lines selected for the study, Raj 3765, WR 544, HD 2781, Halna, and HI 1531 were best performer under heat stress. Putative RuBisCoactivase (Rca) gene of 1402 bp was further, identified through *de novo* transcriptomic approach and was cloned in maintenance vector. The gene was further cloned in pMALC5x expression vector for heterologous expression in BL21-DE3 strain of *E. coli*. The recombinant Rca protein of ~47 kDa was purified and subjected to site directed mutagenesis by substituting alanine with asparagine. Mutant Rca protein showed high activity up to the heat stress of 42°C for 1 h as compared to control. Mutant Rca was observed to increase the renaturation of RuBisCo under HS, as evident from the activity assay of RuBisCO. Immunoblot analysis showed increase in the accumulation of Rca protein in contrasting wheat cultivars under HS. There is a need to exploit the diversity in the thermal stability and activity of Rca, as reported in other species, for augmenting the carbon assimilatory process under HS. Thermo-stable Rca will pave the way for the development of 'Climate-smart' wheat.

Crop Diversification for Increased Profitability under Drip Irrigation System

A field study was conducted to evaluate the effect of crop diversification on the resource use efficiency, productivity and

profitability under drip irrigation. Four cropping sequences, viz., bottle gourd (Pusa Naveen)-vegetable onion (Pusa Ridhi); baby corn (G 5414)-spinach (Pusa All Green); okra (Arka)-garden pea (Pusa Pragati); and bottle gourd (Pusa Naveen)- sarson saag (Pusa Sarson Saag) were grown with the recommended package of practices. All *kharif* season crops were grown under rainfed condition, while *rabi* crops (vegetable onion, spinach, garden pea and sarson saag) were under drip irrigation. Among all the cropping systems, baby corn-spinach cropping sequence resulted in highest net returns (₹ 2, 37,555/ha) followed by bottle gourd- green vegetable onion (₹ 2, 09,971/ha). The highest B:C ratio(2.25) and income/day(₹ 1170) also obtained with baby corn-spinach cropping sequence.

EDUCATION

55th Convocation

The 55th Convocation of the Post Graduate School of the Indian

Agricultural Research Institute (IARI) was held on February 9, 2017 with Hon'ble Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh as the Chief Guest. Dr. T. Mohapatra, Secretary, DARE & Director General, ICAR presided over the function. The Chief Guest presented the degrees, medals and awards to the students and faculty. In his convocation address, the Chief Guest highlighted the Government priorities in field of agricultural research and farmers welfare. Dr. Ravinder Kaur, Director (Acting) presented her report on the significant research achievements of the Institute during 2016, while Dr. R.K. Jain, Dean & Joint Director (Education) presented his report on the significant research achievements of the students and human resource development related activities of the Institute during 2016. The Chief Guest also released seven publications and 18 varieties of different crops.

During this Convocation, 231 candidates (112 M.Sc., 8 M.Tech.



A Ph. D. student receiving her degree from Hon'ble Union Minister of Agriculture and Farmers Welfare, Shri Radha Mohan Singh at the convocation

and 111 Ph.D.) including 13 (7 M.Sc., 1 M.Tech. and 5 Ph.D.) international students were awarded degrees. One student each in M.Sc. (Ms. Priyanka Upreti, Agricultural Economics) and Ph.D. (Ms. Hema Baliwada, Agricultural Extension) were awarded the Best Student of the Year Awards. Five students each in M.Sc. and Ph.D. received IARI Merit Medals. Five faculty members of the Institute, namely, Dr. R. R. Sharma, Principal Scientist, Post Harvest Technology; Dr. T.K. Das, Principal Scientist, Agronomy; Dr. Adarsh Kumar, Principal Scientist, Agricultural Engineering; Dr. R.R. Burman, Senior Scientist, Agricultural Extension; and Dr. V.S. Raju Dantuluri, Senior Scientist, Floriculture and Landscape Architecture received the Best Teacher Award-2016 for their achievements in academics. The XVII Hari Krishna Shastri Memorial Award for the year 2016 was awarded to Dr. B.S. Dwivedi, Head, Division of Soil Science and Agricultural Chemistry, IARI, New Delhi for his outstanding research contribution in the field of "Soil Science and Agricultural Chemistry". The XXIV Hooker Award for biennium 2014-15 was awarded to Dr. Gouranga Kar, Principal Scientist, Indian Institute of Water Management, Bhubaneswar for his outstanding research contribution in the area of "Water Management".

47th Lal Bahadur Shastri Memorial Lecture

47th Lal Bahadur Shastri Memorial Lecture was delivered by Dr. Jitendra Singh, Hon'ble



Dr. Jitendra Singh, Hon'ble Minister of State (Independent Charge) for Development of NER and MOS for PMO delivering 47th Lal Bahadur Shastri Memorial Lecture

Minister of State (Independent Charge) for Development of NER and MOS for PMO, Govt. of India on February 9, 2017 at Dr. B.P. Pal Auditorium, IARI. Shri Parshottam Rupala, Hon'ble Minister of State, Ministry of Agriculture and Farmers Welfare, Govt. of India presided over the function.

Valedictory Function of M.Sc. Agronomy Students (2nd Batch) of ANASTU

The Valedictory function of the Capacity Building Course for the Second Batch of M.Sc. Agronomy Students of ANASTU, Kandahar, Afghanistan was organized in the Auditorium of the Division of Plant Pathology on March 20, 2017. Dr. T. Mohapatra, Secretary, DARE and DG, ICAR was the Chief Guest on this occasion. Shri M. Subbarayudu, Joint Secretary (MEA), Dr. J.S. Sandhu, DDG (Crop Science), ICAR and Director, IARI, Dr. R.K. Jain, Dean & Joint Director (Education), Prof. Anupam Varma, Advisor, ANASTU and Dr. Rashmi Agarwal, Head, Division of Plant Pathology also graced the occasion.

On this occasion, 19 M.Sc. Agronomy students were awarded their hard earned Transcripts in respect of 10 courses taught to these students during their stay at IARI from July 21, 2016 to March 20, 2017.

Seminar on Science and Technology

The Institute organized a seminar on "Science and Technology for Specially Abled Persons" on the occasion of National Science Day, on February 28, 2017. Eminent invited speakers were: Dr Mathew Varghese, Head, Orthopaedic Department, St. Stephen's Hospital, Delhi; Dr. Patanjali Dev Nayar and Dr Gaurav Gupta, WHO, New Delhi; and Mr Nikaram Upadhyay, Head, Assistive Technology Department, Indian Spinal Injuries Centre, New Delhi. The lectures addressed the issues related to magnitude and scientific solutions to enhance productivity of specially abled persons. Dr. K.V. Prabhu, Joint Director (Research) chaired the event, organized by Dr. Indramani,



Seminar on "Science and Technology for Specially Abled Persons" organized by the Division of Agricultural Engineering

Head, Division of Agricultural Engineering.

EXTENSION

Krishi Unnati Mela – 2017

The three-day *Krishi Unnati Mela* – 2017 was organized from March 15 to 17, 2017 at the campus of IARI, New Delhi jointly by ICAR and Ministry of Agriculture & Farmers Welfare. The *mela* was inaugurated by Hon'ble Minister of Agriculture and Farmers' Welfare, Shri Radha Mohan Singh on March 15, 2017. Hon'ble Minister of State for Agriculture and Farmers Welfare, Shri Sudarshan Bhagat, Dr. Trilochan Mohapatra, Secretary, DARE and DG, ICAR; Shri

Devendra Choudhary, Secretary, DAHF; Shri Chhabilendra Roul, Secretary, ICAR & Additional Secretary, DARE; Shri S.K. Singh, Additional Secretary, DARE & FA, ICAR; Shri U.K. Singh, Additional Secretary, DAC; Dr. Ashok M. R. Dalwai, Additional Secretary DAC & FW, Ministry of Agriculture also graced the occasion.

Hon'ble Minister of Agriculture and Farmers' Welfare conferred *Pt. Deen Dyal Upadhyay Krishi Vigyan Protsahan Puraskar* for the outstanding works of KVKs, one award at national level and 11 zonal awards. He also released publications, viz, *Krishi Ayam: Jigyasa Avam Samadhan*, Farm Calendar and *Prasardoot*. He also released two bilingual (Hindi and English) portals developed by IARI, New Delhi and NIAIM, Mau, which will facilitate an easy access to quality knowledge by the end users. Besides, eighteen extension leaflets and folders on salient technologies were also published in Hindi

The mega event, that celebrated the great contribution of Indian farmers to agriculture, witnessed the participation of 342 public and private exhibitors. Exhibition of improved technologies on agriculture, horticulture, animal husbandry, dairy, fisheries, farm machinery and equipments, etc. including live demonstrations at the Pusa farms were major highlights of the *mela*. Display and sale of seeds of high yielding varieties and plants of different crops, fruits and vegetables were another attraction of the event. Fifty innovative farmers and entrepreneurs also displayed and sold their products. Farmers' interactive sessions were also organized in which experts and scientists provided advance technological knowledge in simple way along with details of the various government schemes launched for the benefit of the farmers.

On March 17, there was an exclusive session on Innovation at Farmers' Fields, wherein the innovations devised and modified by the farmers were highlighted by the farmers themselves. The chief guest of the session, Hon'ble Minister of State for Agriculture & Farmers Welfare & Parliamentary Affairs, Shri S. S. Ahluwalia appreciated their work and also released the book published on their achievements. In his address, he highlighted the need of bringing out vernacular publications of alphabets on farm machineries and technologies so that farmers in rural areas could easily identify the equipment and technologies and put them in use. He also released a



Hon'ble Minister of Agriculture and Farmers' Welfare, Sh. Radha Mohan Singh inaugurating *Krishi Unnati Mela* – 2017 at IARI



Hon'ble Minister of State for Agriculture & Farmers Welfare & Panchayati Raj, Shri Parshottam Rupala felicitating a farmer at *Krishi Unnati Mela* – 2017

Mobile App developed by National Research Centre on Banana.

The valedictory function was held in the gracious presence of Hon'ble Minister of State for Agriculture & Farmers Welfare & Panchayati Raj, Shri Parshottam Rupala as the chief guest. He bestowed upon IARI Fellow Farmer Award on 5 farmers and innovative farmer awards on 39 farmers. Awards for the best display of stalls were given away to the participating institutions, farmers and organisations by Shri S.K.Pattnaik, Secretary, DAC and Farmer Welfare, Dr. Trilochan Mohapatra, Secretary, DARE and DG, ICAR, Dr. J.S. Sandhu, Deputy Director General (Crop Science), ICAR and Director, IARI.

Pusa Horticulture Show-2017

The Division of Floriculture and Landscaping in collaboration with Delhi-Agri-Horticultural Society organized a Pusa Horticulture Show on February 18, 2017 at research farm of the Division of Floriculture and Landscaping. The chief guest,



Pusa Horticulture Show-2017

Dr. J.S. Sandhu, DDG, Crop Science, ICAR inaugurated the show and Dr. Ravinder Kaur, Director (Acting), IARI also graced the event. An exhibition displaying IARI released varieties of flowers, vegetables and fruits, array of different seasonal flowers and value added products were arranged by the different divisions of IARI. A large number of farmers from Delhi and NCR regions visited the field and got exposed to different technologies on cultivation of flowers including value addition of the flowers.

Bougainvillea Festival-2017

The Division of Floriculture and Landscaping in collaboration with Bougainvillea Society of India



Bougainvillea Festival-2017

organized a Bougainvillea Festival during March 24-25, 2017 at Budha Jayanti Park (CPWD), Ridge Road, New Delhi. The show was inaugurated by the Chief Guest, Dr. J.S. Sandhu, DDG (Crop Science), ICAR. A large number of exhibitors from Delhi and NCR regions participated in the show and displayed their exhibits and products. During the show, a new variety 'Changi Airport' was registered with International Cultivar Registration Authority for Bougainvillea, IARI, New Delhi.

Participation in Agricultural Exhibitions/Melas

- ❖ *National Krishi Mela* at IGKV, Raipur from January 27 to 31, 2017. The *mela* was jointly organized by ICAR and State Govt., Chhattisgarh.
- ❖ *Gramodaya Mela* at Deendayal Research Institute, Chitrakoot (February 24-27, 2017).
- ❖ *Kisan Mela* organized by Young Farmers Association, Rakhra, Patiala on March 19, 2017.

Field Days

Cauliflower Field Day. It was organized at ICAR-IARI Regional Station, Katrain on February 22, 2017 to show-case the available technologies in snowball cauliflower to increase the income

of the farmers. The developed breeding materials including cytoplasmic male sterile (CMS) and doubled haploid (DHs) lines were kept for exhibition for their potential use in cauliflower hybrid breeding programme. Representatives from different private vegetable seed companies and around 40 local farmers participated in this occasion.

Field Day on mustard under cluster FLD programme. Three field days on "Mustard Crop" were organized in Bhorakalan, Langra and Khanpur villages on February 13, 14 and 18, 2017, respectively. In these programmes 63, 58 & 45 farmers participated. The farmers were carried to the demonstration plots in which mustard variety RB 50 was sown.

Vegetable Field Day. ZTM&BPD Unit organized a field day on February 15, 2017 to showcase and commercialize the promising vegetable varieties and hybrids developed by IARI. The program was attended by breeders and marketing specialists of several seed companies.

Field Day on INM in wheat under on farm trials. Field day was organized on "Integrated Nutrient Management in Wheat Crop" in Langra village on March 4, 2017. In this programme, 36 farmers were present. The farmers visited the trial of wheat crop in which soil test based fertilizer with organic manures and bio fertilizer (Azotobactor and PSB) was used and performance of the crop was better as compared to other field in which only chemical fertilizer was used.

Field Day on IWM in wheat under on farm trials. Field day was organized on "Integrated Weed Management in Wheat Crop" in Jataula village on March 14, 2017. In this programme, 35 farmers were present. The farmers visited the trial of wheat crop in which Carfentrazone and Sulfosalfuran @ 45 g/ha were used and it was observed that the field was weed free and performance of the crop was better as compared to other field.

Wheat Day. Wheat day was organized at ICAR-IARI, Regional station, Indore on March 4, 2017 on the theme "Scientific Wheat Cultivation Practices for Better Future". More than 300 farmers, staff from MP agriculture department, representatives from private seed production companies, farmers seed cooperatives, state seed certification officials and *Kirshi Vigyan Kendras'*, ATMA and NGOs participated in the programme.

Honey Day. Honey day was organized in Pataudi village on February 17, 2017 in which the farmers were advised to adopt beekeeping so that they may be engaged in self employment. The importance of beekeeping in increasing crop production through pollination was also explained to the 62 participants. During the *gosthi*, discussion was held regarding the various problems of beekeeping.

Wheat Field Day. IARI Regional Station, Indore organized a field day in Makodia village for demonstrating improved new varieties and crop production technology. A total of 28 frontline

demonstrations on 11 new wheat varieties of wheat in an area of 13.5 ha were conducted in five adopted villages, which includes newly released varieties, viz., HI 1605 and HI 8759.

CAPACITY BUILDING

Trainings

The Division of Agronomy organized two training programmes on: i) "Recent Innovations in Organic Farming" from January 2 to 9, 2017 (25 participants); and ii) "Good Agricultural Practices (GAPs) for Enhancing Resource-use-efficiency and Farm Productivity" from February 14 to 27, 2017 (25 participants).

The Division of Agricultural Engineering organized a training programme on "Precision Agriculture Technologies" for technical staff of ICAR from January 16 to 21, 2017. Twenty participants from different ICAR institutes across seven states of the country participated in the training programme. Information about different precision agriculture machines and equipment and hands-on training on their operation, care and maintenance was imparted to the trainees.

The Division of Agricultural Extension organised Farmer-Scientist Interface on "Bio-Fortification of Food Crops for Nutritional Security" on January 31, 2017 at *Kirshi Vigyan Kendra*, Sonipat, Haryana. Scientists from KVK, Sonipat emphasized the need for cultivating Nutri rich crops and varieties and consuming it on



Farmers interacting with the scientists and raising questions regarding biofortified crops

regular basis for the healthy function of the human body. The Division of Agricultural Extension also organized three off-campus training courses of two-day each on “Entrepreneurial Motivation and Technological Options for Agri-enterprises Uptake” in three project villages, viz., Manjhawali and Fatehpur Biloch in Faridabad and Swamika in Hathin block of Palwal district during February 27-28, March 3-4 and March 9-10, 2017 for 250 farmers.

The *Krishi Vigyan Kendra*, Shikohpur organized four vocational trainings on: i) “Dairy Farming” under *Pradhan Mantri Krishi Kaushal Vikas Yojna* from February 1 to March 8, 2017 in which 20 rural youth from different villages of Gurgaon, Mewat and Hisar districts participated; ii) “Floriculturist- Protected Cultivation” under *Pradhan Mantri Krishi Kaushal Vikas Yojna* from February 1 to March 8, 2017 in which 20 rural youth from different villages of Gurgaon, district participated; iii) “Motor Winding” from February 6 to 15, 2017 in which 10 rural youth from Gurgaon and Palwal districts participated; and iv) “Value Addition of Seasonal Fruits and Vegetables” from February 13 to 18, 2017 in which 34 rural women of Shikohpur,



Training on “Motor Winding”

Chandu and Sakatpur villages participated.

The *Krishi Vigyan Kendra*, Shikohpur also organized four training programmes under ARYA Project on: i) “Protected Cultivation” from February 13 to 16, 2017; ii) “Goat Farming” from February 13 to 16, 2017; iii) “Value Addition” from February 13 to 18, 2017; and iv) “Mushroom Production” from February 20 to 27, 2017. Seventy four rural youths from Gurgaon district participated in these training programmes. A training was also organized for Air Force personnel on “Floriculture and Landscaping” from March 6 to 9, 2017. In this training programme, 11 air force personnel learnt about cut flower production technology and landscaping.

Indian Institute of Remote Sensing, Dehradun and the Division of Agricultural Physics conducted 19th outreach training program on “Remote Sensing and GIS Application in Carbon Forestry”, from February 16 to March 10, 2017. Forty one participants took part in this training programme.

IARI Regional Station, Indore organized a two-day training program on “Recording of Data in Coordinated Wheat Trials and Nurseries” from March 1 to 2, 2017

to train new scientists and technical staff who joined All India Coordinated Wheat and Barley Research Program recently. A total of 19 trainees have attended the training program.

Centre for Agricultural Technology Assessment and Transfer conducted a two-day training programme on “Improved Agricultural Practices for Higher Productivity and Income” from March 2 to 3, 2017 sponsored by Jan Kalyan Sanstha, Meerut, UP(30 farmers attended the training programme); a five-day training on “Improved Agricultural Practices for Higher Productivity and Income” sponsored by ATMA Nagaur, Rajasthan from March 21 to 25, 2017(30 farmers attended the training programme); and five training programmes of five-day each at Alipur village in Delhi on “*Jaiwik, Prakritik evam Go-Adharit Arthvyvashtha* sponsored by Agricultural Education Divison, ICAR under *Pandit Deen Dyal Upadhyay Unnat Krishi Shiksha Yojna*” (each training was imparted to 30 farmers).

The Division of Biochemistry conducted a training under Centre for Advanced Faculty Training on “Advance Omics-techniques and Tools for Crop Improvement” from March 8 to 28, 2017. Twenty one trainees from different states participated in the training.

MISCELLANEOUS

New External Funded Projects Launched

- ❖ “Functional validation of yield related genes” funded by DBT.

- Amount: ₹ 40.83 lakhs for 3 years. Principal Investigator: Dr. Viswanathan Chinusamy, Head, Division of Plant Physiology.
- ❖ “Improving chickpea adaptation to environment challenges in Australia and India” funded by DBT. Amount: ₹ 38.54 lakhs for 3 years. Principal Investigator: Dr. Chellapilla Bharadwaj, Principal Scientist, Division of Genetics.
 - ❖ “Studies on role on endophytes in variation of acaricidal properties of two acaricide producing plant species NBA22/F1 and NBA18.D1 from North Eastern States” funded by DBT. Amount: ₹ 16.14 lakhs for 3 years. Principal Investigator: Dr. K. Swarnalakshmi, Senior Scientist, Division of Microbiology.
 - ❖ “Studies on mass rearing of the edible insects and their nutritional value as alternative source of food security in Nagaland of the North East Region” funded by DBT. Amount: ₹ 17.91 lakhs for 3 years. Principal Investigator: Dr. Mukesh K. Dhillon, Sr. Scientist, Division of Entomology.
 - ❖ “Development and popularization of round the year cultivation technologies of high value exotic vegetables in Kullu Valley of Himachal Pradesh” funded by NHB. Amount: ₹ 16.00 lakhs for 3 years. Principal Investigator: Dr. Sandeep Kumar, Scientist, IARI Regional Station, Katrain.
 - ❖ “Assessing stocks and stabilization mechanisms of soil carbon as affected by land use and management practices in the north-western Indo-Gangetic Plains” funded by DST. Amount: ₹ 38.28 lakhs for 3 years. Principal Investigator: Dr. Shрила Das, Scientist, Division of Soil Science and Agricultural Chemistry.
 - ❖ “Application of Glycolipid bio-surfactant for general welfare of economically important crops with special reference to management of phytopathogenic fungi” funded by DBT. Amount: ₹ 17.09 lakhs for 3 years. Principal Investigator: Dr. Robin Gogoi, Principal Scientist, Division of Plant Pathology.
 - ❖ “Deploying biotechnology based decision making tools in postharvest grain pest management to enhance food security and market access” funded by DBT. Amount: ₹ 94.08 lakhs for 3 years. Principal Investigator: Dr. Chitra Srivastava, Head, Division of Entomology.
 - ❖ “A nutrition led extension model of Community Agri-Nutri Security Centres (CANSCs) for nutrition security of women” funded by DST. Amount: ₹ 32.56 lakhs for 3 years. Principal Investigator: Dr. V. Sangeetha, Scientist, Division of Agricultural Extension.
 - ❖ “Unraveling the bacterial blight pathogenesis based on rice RNAs as induced by virulent and less-virulent strains of *Xanthomonas oryzae* pv. *Oryzae* in presence or absence of functional T3SS” funded by DBT. Amount: ₹ 33.15 lakhs for 3 years. Principal Investigator: Dr. K.K. Mondal, Principal Scientist, Division of Plant Pathology.
 - ❖ “Molecular characterization of resistance to insecticides and fumigants in stored project insects in North Eastern Regions” funded by DBT. Amount: ₹ 47.75 lakhs for 3 years. Principal Investigator: Dr. Chitra Srivastava, Head, Division of Entomology.
 - ❖ “Molecular characterization Marker assisted pyramiding of neck blast resistance genes in *Basmati* rice” funded by SERB, DST. Amount: ₹ 49.98 lakhs for 3 years. Principal Investigator: Dr. Ranjith Kumar Ellur, Scientist, Division of Genetics.
 - ❖ “Characterization, mapping and transcriptome analysis of seed protein, β -carotene and mineral contents in chickpea (*Cicer arietinum* L.)” funded by NASF. Amount: ₹ 25.57 lakhs for 3 years. Principal Investigator: Dr. Venkatraman, Principal Scientist, Division of Genetics.
 - ❖ “Transgenic over expression of phosphate dehydrogenase: A comprehensive strategy to enhance phosphorus use efficiency with integrated weed and disease management for sustainable agriculture” funded by NASF. Amount: ₹ 61.41 lakhs for 3 years. Principal Investigator: Dr. A. Kumar, Principal Scientist, Division of Plant Pathology.
 - ❖ “Population diversity of banana streak virus (BSV) and

- understanding the mechanism of resistance to BSV in diploid seedy banana of North East India” funded by NASF. Amount: ₹ 40.25 lakhs for 3 years. Principal Investigator: Dr. V.K. Baranwal, Professor, Division of Plant Pathology.
- ❖ “Chemical, structural and functional characterization of identified anti-tick lead phytochemicals and optimization of delivery matrix for effective application of natural formulation for the control of acaricide resistant ticks” funded by NASF. Amount: ₹ 36.56 lakhs for 3 years. Principal Investigator: Dr. Rajesh Kumar, Principal Scientist, Division of Agricultural Chemicals.
 - ❖ “Phenomics of moisture deficit stress tolerance and nitrogen use efficiency in rice and wheat” funded by NASF. Amount: ₹ 433.07 lakhs for 3 years. Principal Investigator: Dr. C. Viswanathan, Head, Division of Plant Physiology.
 - ❖ “Epigenetic regulation of host-pathogen genetics in leaf rust resistance in wheat” funded by NASF. Amount: ₹ 94.79 lakhs for 3 years. Principal Investigator: Dr. Neelu Jain, Senior Scientist, Division of Genetics.
 - ❖ “Lactic acid bacteria based bio refineries for converting agro and food based biomass into PLA and high value-added products” funded by NASF. Amount: ₹ 36.36 lakhs for 3 year. Principal Investigator: Dr. Lata, Principal Scientist, Division of Microbiology.
 - ❖ “Creating a fully characterized genetic resource pipeline for mustard improvement programme in India” funded by NASF. Amount: ₹ 34.32 lakhs for 3 years. Principal Investigator: Dr. D.K. Yadava, Principal Scientist, Division of Genetics.
 - ❖ “Nano-based detection of organophosphate pesticides using metal-organic framework conjugates” funded by NASF. Amount: ₹ 26.73 lakhs for 3 years. Principal Investigator: Dr. Irani Mukherjee, Principal Scientist, Division of Agricultural Chemicals.
 - ❖ “Energy efficient polyhouse and aeroponic system for mini tuber production of tissue cultured potato” funded by NASF. Amount: ₹ 35.08 lakhs for 3 years. Principal Investigator: Dr. Murtaza Hasan, Principal Scientist, CPCT.
 - ❖ “Improving Water Management, Agricultural Food and Food Security in Drought Prone Areas” funded by USIEF with DWFL. Amount: US\$115,080 for 3 years. Principal Investigator: Dr. Ravinder Kaur, Principal Scientist, Water Technology Centre.
 - ❖ “Strengthening Agri-nutri linkage for enhancing nutritional security and empowering farm women in India: leveraging agriculture for nutrition” funded by UNDP. Amount: ₹ 98.14 lakhs for 2 years. Principal Investigator: Dr. Satyapriya, Senior Scientist, Division of Agricultural Extension.
 - ❖ “All India Coordinated Research Project on Ergonomics & Safety in Agriculture (ESA)” funded by ICAR. Amount: ₹ 33.60 lakhs. Principal Investigator: Dr. Adarsh Kumar, Principal Scientist, Division of Agricultural Engineering.
- ### Patents Filed
- ❖ An Apparatus for *in vivo* mass production of entomopathogenic nematode
 - ❖ A semi-synthetic diet for mass rearing five species of genus *Bactrocera* (Insecta: Diptera: Tephritidae) of agricultural and quarantine significance
- ### Patent Granted
- ❖ Improvement in/or relating to synthesis of O-alkyl derivatives of oxime ethers of piperonal as potential fungicides
- ### Copyright Filed
- ❖ Design of Micro Irrigation System (DOMS)
- ### Technology Commercialized
- ❖ Entomopathogenic Nematode-based *Galleria* Cadaver technology for Insect Pest Management has been licensed to Ajay BioTech (India) Limited, Maharashtra generating a revenue of ₹5 lakhs.
- ### Corporate Membership
- In this quarter, six (6) new members were registered and eleven (11) corporate memberships were renewed, generating a revenue of ₹73,000/-

Arise Workshop

ZTM&BPD Unit organized a panel discussion on “Current Funding Opportunities for Start-ups” on March 1, 2017 for familiarizing the incubatees with the funding ecosystem in government. During the discussion the participants were briefed about capital funding, marketing strategy & financial planning for the startups.

Honours/Awards

- ❖ Dr. P. Krishnan, Head, Division of Agricultural Physics received the Excellence in Image Analysis Award conferred on ICAR-Indian Agricultural Research Institute from ESRI-India at the Leela Ambience Convention Hotel, Delhi, during the conference on “Is GIS: Enabling Transformation”.
- ❖ Dr. K.K. Bandyopadhyay, Principal Scientist, Division of Agricultural Physics was awarded with Dr. K.G. Tejwani Award of Indian Association of Soil and Water Conservationists for the biennium 2014-15 for Natural Resource Management
- ❖ Dr. Debashis Chakraborty, Senior Scientist, Division of Agricultural Physics has been selected for the ICAR National Fellow Award for the research project entitled “Regional Root Zone Soil Moisture Mapping from Near-Surface Measurements for Supporting Agro-

Advisories in Rainfed Agriculture” for a tenure of five years.

- ❖ Dr. Y.S. Shivay, Professor, Division of Agronomy was selected for the Fellowship of NAAS.
- ❖ Dr. T.K. Das, Principal Scientist, Division of Agronomy received IARI best teacher award during 2017.
- ❖ Dr. Anchal Dass, Senior Scientist, Division of Agronomy was awarded Fellow of Indian Society of Agronomy.
- ❖ Dr. Anil K. Choudhary, Senior Scientist, Division of Agronomy was awarded

Young Agronomist Award of Indian Society of Agronomy and also received the best oral presentation award from SADHNA Society and ICAR-CCARI, Goa in the National Conference at Goa.

- ❖ Dr. G.A. Rajanna, Scientist, Division of Agronomy received the best poster presentation award from Indian Society of Agronomy in the 4th International Agronomy Congress at New Delhi.
- ❖ Dr. S.S. Rathore, Principal Scientist, Division Agronomy received the best oral presentation award from SRMR at 3rd NBC, IARI, New Delhi.

Visitors from Abroad

During the period January-March, 2017, three delegations one each from Norway, Iran and Colorado visited the Institute. Norwegian delegation was led by H.E. Mr. Jon Georg Dale, Minister of Agriculture; and Iranian delegation was led by H.E. Dr. Eskandar Zand, Deputy Minister of Agriculture, Iran.



Norwegian delegation interacting with IARI team

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