



From Director Desk...



IARI efforts are always focused and directed towards the benefit of Indian farmers through development of promising crop varieties and new agrotechnologies. During last three months, our major research highlights include releasing of four new high yielding wheat varieties and cabbage hybrids, development of a diversified agro forestry system, biological control methods, solar based cold storage model, efficient protocol to limit acidity of the pearl flour and nutritional benefits of black rice. Besides several scientific and extension lecture series, trainings and workshops were organized on capacity building. In addition, the capacity building programme of extension personnel and farmers through training programme, field days, visits and exhibition were also organized.

I wish that the information included in newsletter would be helpful to farmers for enhancing farm productivity and profitability.

I wish to thank all the scientists, technical staffs associated with publication unit for bringing out the newsletter timely.

Dr. A.K. Singh
Director, IARI

RESEARCH

Semi-dwarf Compact Plant Types in Pigeon-pea with Bold Seed Size and Early Maturity

Pigeonpea plant types with semi-dwarf semi-erect compact plant type with bold seeds (9-10 g/100 seeds) and early maturity (around 135 days) was developed viz., PAE 17-54, PAE 17-64 and PAE 17-39. These plant types are suitable for high density planting with row to row spacing of 45 cm. As these lines mature in about 135 days so field can be vacated early for following wheat, chickpea and late sown mustard. These lines have bold seed size around 9 to 10 g/100 seeds.

Four High Yielding Wheat Varieties Identified

HI 1633

High yielding (41.7 q/ha) bread wheat variety was identified for peninsular zone comprising of Maharashtra, Karnataka and plains of Tamil Nadu for cultivation under late sown and irrigated conditions. It has high yield potential of 65.8 q/ha and wider yield stability. It is a



HI 1633

quality wheat genotype with excellent chapati and biscuit quality with high protein content (12.4%). It also has high iron (41.6 ppm) and zinc (41.1 ppm) contents.

HI 1634

High yielding (51.6 q/ha) variety was identified for late sown, irrigated conditions of central zone with yield potential of 70.6 q/ha. It possessed seedling and field resistance to all stem and leaf rust pathotypes. This bread wheat genotype is excellent in chapati and biscuit quality with high protein content.



HI 1634

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HD 3298

A bio-fortified wheat variety with high Fe content (43.1 %) and good level protein content (12.12%) was identified for North West Plain Zone under irrigated, very late sown conditions. Average yield of 39 q/ha with potential yield of 47.4 q/ha was achieved. It matures in 104 days, with a good multiple resistance to stripe rust, leaf rust, karnal bunt, powdery mildew, foliar head blight and flag smut along with tolerant to heat stress. This variety has perfect Glu score of 10 and is best suitable for chapati making.



HD 3298

Diversified Agro-Forestry Systems Enhance System Productivity and Profitability and Improve Farmer's Livelihood under Limited Irrigation Conditions

Appropriate land-use systems ensure resilience, and are crucial for livelihood security. Agro-Forestry Systems (AFS) were developed for round the year crop cultivation and generation of products for regular



Mung bean, cowpea, mustard and potato as inter crops in phalsa, moringa, karonda based system for higher carbon sequestration and enhanced system productivity and profitability



Symptoms of rose varieties: A) "Delhi Princess" showing flat stem symptom B) "Pusa Arun" showing phyllody symptom and C) Rose variety "MS Randhawa" showing flower malformation

income and employment. Diversified phalsa-mung bean-potato and moringa-mung bean-potato system were found as the most productive agro-forestry system (36.7 t/ha and 36.2 t/ha), respectively. Under limited irrigation conditions, Karonda (*Carisa* sp.)-mung bean potato system gave maximum net return of ₹ 266.8 thousand/ha with higher profitability/day (₹ 731/day/ha). Phalsa -MB-potato system was also recorded maximum water use efficiency (33.0 kg/ha-mm), whereas the density of SOC was in Phalsacowpea-mustard (9.10 Mg/ha) and moringa-mungbean -potato AFS (9.16 Mg/ha). Carbon footprint analysis revealed that maximum net C gain was in the phalsa-MB-potato system (7030 carbon equivalent kg CE/ha/year). Overall under limited irrigation conditions, a net return of ₹ 2.66 lakhs/ha with higher profitability/day (₹ 731/day) was



achieved in the karonda-MB-potato system. The integration of more agriculture and allied activities with field crops will certainly help in creating a sustainable agro-ecosystem. The integration of annual crops with fruit trees yields manifold benefits through secure production, income generation, and restoration of ecosystem services in a sustainable manner.

Identification of '*Candidatus Phytoplasma australasia*' Association in Rose (*Rosa × hybrida* L.)

'*Candidatus* Phytoplasma australasia' was identified on three rose varieties, Delhi Princess, Pusa Arun and MS Randhawa causing flat stem, phyllody and flower malformation symptoms at IARI, New Delhi with disease incidence of 37.5%, 50% and 100%, respectively. Amplifications of ~1.25kb, ~480bp and ~1.3kb products were achieved using primer pair P1/P7, R16F2n/R16R2 for *16S rRNA* gene, *secAfor1/secArev3*, *secAfor2/secArev3* for *secA* gene and *rp(II)F1/rp(I)R1A*, *rp(II)F2/rp(I)R1A* for *rp* gene in nested PCR assays which confirmed the phytoplasma association in all the three symptomatic rose varieties. Pairwise sequence comparison, phylogenetic and virtual RFLP analysis of the *16S rRNA* gene sequences of phytoplasma isolates of rose varieties confirmed the

association of 16SrII-D phytoplasma subgroup in all the three rose varieties.

Bacterial Inoculants for Crop Resilience to Environmental Stress

Bacterial isolates from different habitats were characterized for salt tolerance and multiple plant growth promoting traits. Four separate treatments were formulated, with two treatments having individual bacterial strain as PGPM and the rest two having consortia of three bacterial isolates as PGPM. High yielding variety MTU1010 was selected for pot experiments and treated with individual as well as consortium of isolates. Drought was imposed for 10 days to different batch of the rice crop (variety MTU1010) at two stages of crop growth i.e., pre-flowering and flowering stages. Results indicated amelioration of drought stress with higher biomass accumulation, increased grain yield and reversal of stress indicators in plants inoculated with PGPM. The antioxidant enzyme activity of SOD, CAT, and GPOX was reduced by 24, 20.5 and 20 per cent in consortium treated plants as compared to un-inoculated control. This study suggests that the bio-formulations can be used to induce systematic tolerance to rice plants under drought stress.



Red Cabbage hybrid (KTCBH-R-7)

Promising Red Cabbage Hybrid (KTCBH-R-7)

It is a CMS based red cabbage hybrid developed by crossing KTCB-R-3A and KTCB-R-5. The hybrid has purple-green outer leaves and head is completely purple, very compact and round in shape. It matures in 70-75 days after transplanting. The average head weight and yield under station evaluation trials is 1.20 kg and 47.0 t/ha, respectively.

Assessment of Soil Microbial Responses under Elevated Ozone and Elevated Carbon Dioxide

An experiment was conducted in FAOE and FACE experimental site with chick pea (Kabuli-3022) as a test crop wherein we assessed four years of fumigation effects of EO_3 (60 ± 10 ppb) alone and in combination of ECO_2 ($550 \text{ ppm} \pm 20$ ppm) on soil microbial communities at 0–15 cm of soil depth. The activity of β -glucosidase was suppressed under EO_3 exposure. Similar response was found in xylanase and β -D-cellobiosidase activities. The enhanced O_3 alone and in combination with CO_2 altered the diversity of major microbial sub groups belongs to Gram-positive, Gram-negative and unspecific bacterial species). Apart from this fungal: bacterial (f/b) PLFA biomass

ratio was also found decreased in EO_3 treatment. The highest f/b ratio was recorded in ECO_2 followed by ECO_2+EO_3 . The experimental finding indicates that EO_3 alone and in combination with elevated CO_2 even at moderate levels for comparatively moderate period of exposure duration may cause changes in the microbial community and thus also can influence the soil nature and fertility.

Third Party Validation of Pusa SPG1118 Hydrogel in Barley

A trial on SPG 1118 hydrogel AICRP (wheat and barley) was conducted under programme at Agra, Durgapura and Hisar, under rainfed and irrigated conditions for two years. Use of product @ 2.5 Kg/ha at Agra and Durgapura established significant water saving (60%) under irrigated condition and yield advantage (17.5%) under rainfed conditions. The results of hydrogel with one irrigation and control with three irrigations were recorded at par and therefore net saving of two irrigations was achieved to produce the same level of yield.

Mapping of Water and Soil of IARI Farm for Pesticide Residues

A multi residue LC-MS/MS method for simultaneous trace level



Validation of SPG1118 Pusa Hydrogel in barley at Agra centre

quantification of 140 pesticides was developed and used for assessment of pesticide residue status of IARI soil farm and irrigation water chlorpyrifos, cyphenothrin, hexaconazole, and tebuconazole were detected in both soil and water samples from different fields of Institute farm. Pesticides residues (10 to 35) in the range of 0.02 to 1.37 µg/L in tube well water with cumulative pesticide load of upto 4.63 µg/L have been detected. Soil samples have been found to contain residues of 3-8 pesticides in the concentration range of 0.01 to 0.55 mg/Kg with cumulative load of pesticide contamination in soils upto 0.85 mg/Kg.

Pusa-Farm SunFridge-A Stand-alone grid less, Batteryless, Solar-refrigerated Evaporatively-cooled Structure for Storage of Perishables

Pusa-Farm SunFridge (Pusa-FSF) – a grid less, battery less stand-alone green-energy (solar-refrigerated) cold structure has been designed and developed and installed in Picholiya village in Ajmer, Rajasthan. This on-farm cold store is of 2 tones capacity and does not need a grid or batteries. It is

cooled by combined effect of evaporative cooling and solar refrigeration in the day, and a “water battery” (thermal storage) during the night. The innovative design features are a spilt evaporator coil, water battery for night time cooling and a control system which can match the demand of the refrigeration system with the available sunlight successfully. The structure of size 3x3x3 m, uses 14 solar panels in series-parallel circuit, to power the refrigeration capacity. The structure has low cost styrofoam panels insulation with mesh-fabric walls, and keeps the structure cold by evaporative cooling through wetted fabric and solar refrigeration. The structure starts cooling automatically in the morning with the sunshine and shuts off in the evening with sunset and goes into standby mode when there are clouds, to start again when sky gets cleared. Pusa-FSF can achieve daytime temperatures as low as ~5-10 °C and night time temperatures below 14 °C, when the daily ambient maximum temperature reaches approximately 45 °C. This innovative green cold store is being used by farming community for

storing fruits and vegetables like tomatoes, cauliflower, coriander, potatoes, flowers; processed produce like tomato puree and animal products like eggs..

PUSA Touch-free Hand Sanitizer Machine

PUSA touch-free hand sanitizer was developed for dispensing the sanitizer without touching the unit for safety measures against Covid-19 at Division of Agricultural Engineering, ICAR-IARI, New Delhi. This is useful for sanitizing hands using liquid/gel sanitizer without touching the dispenser. It is foot operated mechanical arrangement with PVC pipes for pressing the tip of dispenser bottle (capacity 500 ml) to discharge sanitizer over the hands. A total of 53 of units of PUSA Touch-free hand sanitizer were manufactured and supplied in different divisions/Units of ICAR-IARI, New Delhi at unit price of ₹ 1800.



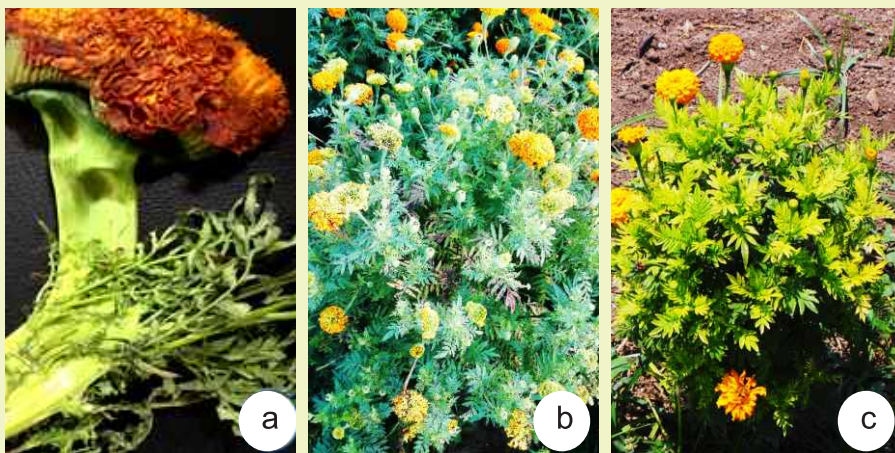
Pusa-Farm SunFridge - a gridless, batteryless cold store running successfully in village Picholiya, Ajmer, Rajasthan



PUSA touch-free hand sanitizer machine

Association of 16SrII-C and 16SrI-B Subgroups of Phytoplasma with Mexican and French Marigold Species

Symptoms of witches' broom, phyllody, flat stem, little leaf, leaf yellowing and stunting were observed in Mexican and French marigold species at IARI, New



Phytoplasma symptoms on marigold: a): flat stem; b): phyllody; c): little leaf and yellowing

Delhi, Bishalgadh area of Sipahijala district, Tripura, University campus, Gorakhpur and Directorate of Floricultural Research Campus, Pune. Amplicons of ~1.2 kb were consistently amplified in all the Mexican and French symptomatic marigold samples using universal phytoplasma specific nested primer pairs P1/P7 and R16F2n/R2. Pair wise sequence comparison, phylogeny and virtual RFLP analysis of *16S rRNA* gene sequences confirmed the identification and taxonomic assignment of marigold phytoplasma strains into 16SrII-C subgroups from Delhi (in Mexican sp.) and 16SrI-B subgroup from Tripura (in Mexican and French sp.), Uttar Pradesh (in Mexican sp.) and Maharashtra (in Mexican sp.). Similar results were further established and validated by amplifying phytoplasma specific multilocus candidate genes in all the symptomatic Mexican and French marigold isolates by utilizing specific primers of *secA*, *rp*, *secY* and *tuf* genes.

Biobeds for Disposal of Pesticide Rinsate/left over Pesticide and Waste Generated during Spray Operation

Biomixture (a mixture of soil, straw/biomass and compost) is an

integral component of biobed, which works on the principal of pesticide retention and degradation. Degradation of azoxystrobin and imidacloprid in laboratory established biobeds was studied. Imidacloprid was completely degraded in both the biobeds, while 81.5 and 68.1% azoxystrobin



Biobed setup

degradation was observed in the RS+C and CC+C biomixtures, respectively. The RS+C biobed was better than the CC+C in degrading azoxystrobin and was attributed to its higher MBC content.

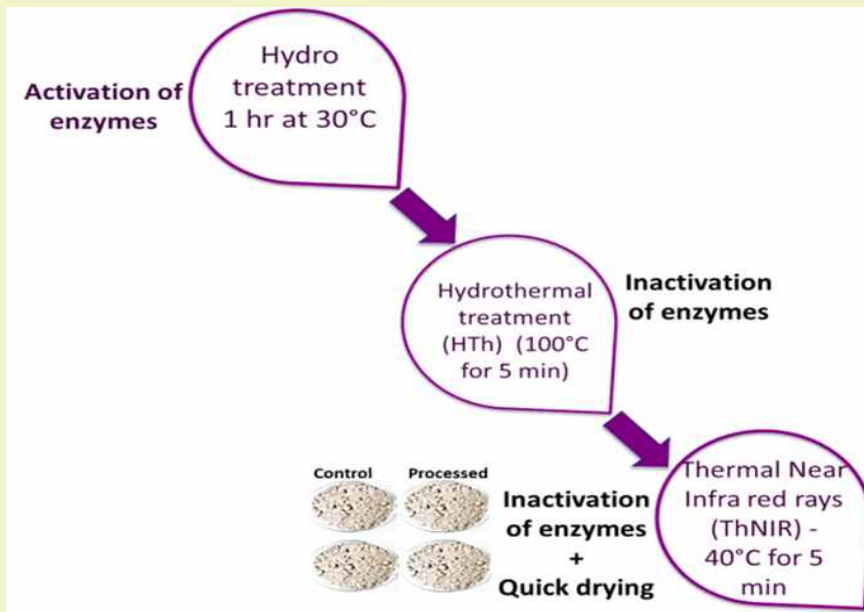
An Efficient Hydrothermal Treatment to Limit the Rancidity Development in Pearl-millet Flour

Pearl millet is considered as a highly nutritious food crop having enormous health benefits. Despite being nutrient rich, use of pearl millet is limited due to rancidity and

off-odor development in the flour during storage. Higher lipid content (5 to 6%) with highly active rancidity causing enzymes (lipase, lipoxygenase, peroxidase and polyphenol oxidase) causes hydrolysis of lipids to free fatty acids and its peroxide derivatives leading to rancid flour, which hinders the commercialization of pearl millet and its products. We optimized an efficient processing technology – called "hydro treatment (HT)-hydro thermal (HTh) and thermal near infrared rays (ThNIR)" successive treatments and filed patent (Patent Application No. 202011037363 August 31, 2020. This method is not only effective in reducing rancidity but is also an economically feasible option due to less energy input. The optimized processing method was applied to pearl millet variety (Dhanshakti) and the treated flour was stored up to 90 days at room temperature (RT). Our results revealed that the optimized processing method is highly efficient in reducing rancidity from 90 to 97.72% at 60 days of storage and 66 to 68% at 90 days' storage of treated flour at RT. Thus innovated successive hydrothermal treatment would be a highly efficient technology to limit the rancidity of flour even after long storage at RT. This technology thus can enable to pave the way forward to generate consumer demand for pearl millet through value added processed foods.

Quality Matrix Based on Matrix Components and Anti-oxidants Reveals the Potential of *Chak-Hao* (Black Rice) as a Nutritional Supplement

In the current trend of increased health consciousness in response to increased incidence of lifestyle disorders, functional foods, and

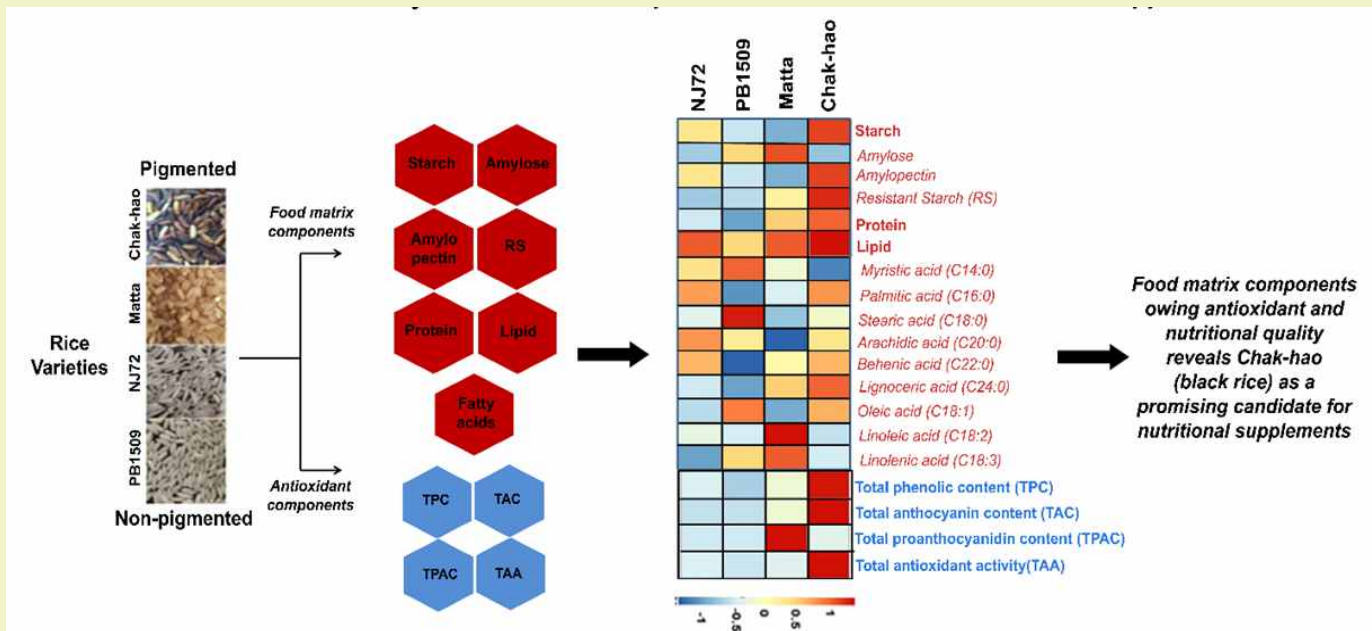


Schematic steps of successive hydrothermal treatment "hydro treatment (HT)-hydro thermal (HTh) and thermal near infrared rays (ThNIR)"

nutritional supplements got immense societal acceptance globally. Traditional niche rice varieties even though being treasure troves of nutritional and nutraceutical benefits, couldn't uphold the global status due to limited scientific

studies. In this direction, preliminary study aimed at evaluating the natural variability in the inherent matrix composition owing nutritional and antioxidant potential of pigmented niche rice varieties revealed *Chak-hao* (black rice) as a potential

candidate. The comprehensive Nutritional Quality Matrix (NQM) developed indicated that *Chak-hao*, geographical indication (GI) rice has stout nutritional makeup in terms of phenolics (2.5 mg/g GAE), anthocyanins (0.65 g/kg), proanthocyanidins (54 mg/100g), antioxidant activity (36 μmol TE/g) and resistant starch (4.13%). The content of high-quality fatty acids like oleic (38.8%), linoleic (29%) and anthocyanin forms like cyanidin-3-glucoside (C3G)- 304 mg/Kg, delphinidin-3-glucoside (D3G)- 220 mg/Kg and peonidin-3-glucoside (P3G)- 120 mg/Kg was also most expressive in the black pigmented rice. The correlation between nutritional attributes endorsing antioxidant potential being strongly positive and most significant for *Chak-hao*. It could be the stellar addition for functional food industry as a nutritional supplement for addressing the ever-increasing pandemics like diabetes, obesity and other chronic diseases.



Nutritional quality matrix of non-pigmented (NJ 72, PB 1509) and pigmented (Matta, Chak-hao) rice varieties developed based on the distinct pattern of expression of matrix components relevant to nutritional quality. Eleven parameters having relevance in nutritional attributes was compared to develop the heat map based on hierarchical clustering in R using correlation as the distance metric

Development of Functional Fruit Vinegar from Phalsa and Cantaloupe

In this study, the potential of phalsa (*Grewia asiatica*) alone and in combination with cantaloupe (*Cucumis melo var cantaloupe*) was evaluated to produce vinegar. Phalsa is an arid perishable fruit, rich in anthocyanins. The vinegar was produced by a two-step fermentative conversion- process to acetic acid. Preliminary screening showed that the *G. asiatica* and *C. melo* alone were unable to generate requisite acetic acid during fermentation process. Composite blend of *phalsa* and cantaloupe was able to provide desirable conditions for conversion of reducing sugars to alcohol followed by acetic acid. At appropriate blend, the ethanol and acetic acid fermentation efficiency was determined to be 79.5% and 71.75, respectively. The resulting vinegar was having pleasant aroma and taste and retained appreciable amounts of phenolics (138.5 mg/100 mL), antioxidants (42.6 μmol TEAC/mL), anthocyanins (39.9 mg/L) and flavonoids (31.06 mg/100 mL) and is under society acceptance trials.

EDUCATION

Teachers' Day Lecture

IARI organized Teachers' Day lecture-2020 on September 5, 2020 on the birthday of former Hon'ble President of India, Dr. S. Radhakrishnan, through virtual mode. On this occasion, Dr. Rashmi Aggarwal, Dean & Joint Director (Education), IARI delivered the welcome address. Dr. A.K. Singh, Director, IARI emphasized the significance of the Teachers' Day and introduced the Chairman of the function, Prof. R.B. Singh, Former Chancellor, CAU, Imphal and Former President, NAAS, New Delhi.

Dr. Trilochan Mohapatra, Secretary (DARE) & Director General (ICAR), New Delhi delivered the Teachers' Day Lecture on the topic "Future Perspectives in Agricultural Education". In his thought provocative and introspective lecture, Dr. Mohapatra discussed in detail about the current status and achievements of agricultural education in India. He also talked

about future challenges under the New Education Policy.

Inauguration of Guest House and Naming of New Administrative and Academic Building after Late Dr. Shyama Prasad Mukherjee on his Birth Anniversary at IARI-Jharkhand

On July 6, 2020, Hon'ble Union Minister of Agriculture & Farmers' Welfare, Rural Development & Panchayati Raj, Shri Narendra Singh Tomar inaugurated the newly constructed guest house of the Indian Agricultural Research Institute (IARI)-Jharkhand at Gouria Karma, Hazaribagh, Jharkhand, and named the new Administrative and Academic building after Late Dr. Shyama Prasad Mukherjee on his birth anniversary through video conference in the gracious presence of Shri Parshottam Rupala, Hon'ble Minister of State for Agriculture & Farmers' Welfare, Shri Kailash Choudhary, Hon'ble Minister of State for Agriculture & Farmers' Welfare; Dr. Trilochan Mohapatra, Secretary (DARE) & DG (ICAR), New Delhi and Dr. Ashok Kumar Singh, Director, IARI, New Delhi. On this occasion, Shri Tomar said that the Government is committed to doubling farmers' income by the year 2022 and has taken several important initiatives in this direction through various schemes and programmes.

ICAR - Post-Doctoral Fellowship at IARI, New Delhi

The ICAR Post-Doctoral Fellowship (ICAR-PDF) 2020-21 is a new initiative under the 'Strengthening and Development of Higher Agricultural Education in India' Scheme of Agricultural Education Division (ICAR) with an objective to support the bright and talented researchers to pursue post-doctoral programme to build



Teachers' Day Lecture

capacity in frontier areas in agriculture and allied sciences initiated during 2019-2020 session. Under the ICAR-PDF programme 2020-21, the selection committee for the ICAR-PDF based on online interview and presentation of research plan recommended the provisional selection of the ten scientists from the nine institutions.

World Ozone Day

World Ozone Day 2020 was celebrated on September 16, 2020 by the Centre for Environment Science and Climate Resilient Agriculture (CESCRA) during the ongoing “Hindi Chetna Mas” at the Institute. The programme was organized to promote the use and spread of scientific knowledge in Hindi language, for better understanding of the masses and to remove our misgivings and ignorance in respect of the ozone impact on Agriculture and Human Health, through an informative lecture on “Ozone layer depletion – Present status and future challenges” by the world renowned scientist, Dr. Madhoolika Agrawal, Professor and Head, Botany Department, Banaras Hindu University, Varanasi. Dr. Agrawal in her lecture discussed at length the importance of good ozone (stratosphere) and the adverse impact of bad ozone (troposphere) dispelled the belief about later's relevance to the urban area alone as ozone levels are significantly higher in the rural area which are agriculture dominated. While making the concluding remarks, the Chairperson of the function, Dr. Ashok Kumar Singh, Director, ICAR-IARI, thanked Dr. Madhoolika Agrawal and called upon the scientists to undertake an in-depth investigation to understand the processes and the mechanisms that govern the ozone response in

crop plants besides its effect on the economic produce and the nutritional quality. He also emphasized the need to harness the genetic potential of our old and the new germplasm across crops for improving the ozone stress tolerance. The program ending with a vote of thanks by Dr. Renu Singh, Scientist, CESCRA.

Parthenium Awareness week

Parthenium Awareness Week was organized on August 16-22, 2020. Two awareness programmes were organized on August 17 and 22, 2020 at Raiseena village of Sohna block and Tripadi village of Farrukh Nagar block where in 45 farmers have participated. They were made aware about side effects of Parthenium weed and its control measures.

Institute Research Council (IRC-I) meetings

The Institute Research Council (IRC-I) school wise meetings were held during as listed below under the

IRC-I meeting schedule

Date of IRC meeting	School
July 1-6, 2020	School of Crop Improvement
July 7-8, 2020	School of Basic science
July 9, 10, 13-15, 2020	School of Horticulture
July 17, 18, 20-25, 2020	School of Natural Resource Management
July 27- 31 and August 4, 2020	School of Crop Protection
August 5-7, 2020	School of Social Science

Chairmanship of Dr. A.K. Singh, Director, IARI. Individual scientists of respective school presented their annual progress report in respect to the research, teaching and extension activities during the year 2019-20.

Scientific Advisory Committee Meeting

34th SAC meeting of Institute's KVK Shikohpur was held on August 28, 2020 through virtual mode. The meeting started with welcome

address by the Dr Anamika Sharma, Head KVK Gurugram followed by presentation on action taken report of the proceedings of 33rd SAC held on August 23, 2019. The meeting was chaired by Dr. V.K. Singh, Joint Director, Extension. During meeting, head KVK presented the progress report of 2019-20 in detail followed by the action plan of 2020-2021 of KVK Gurguram. During discussion Director IARI suggested valuable inputs for demonstrations of newly released variety of wheat (late sown wheat HD-3298) and chickpea (Pusa Green 112) where seed is also green in colour. Director IARI suggested that the formation of FPO should be promoted by the IARI scientist also. Dr. V.K. Singh, Joint Director, Extension also gave his valuable suggestions for improvement of functioning of KVK. Dr. JPS Dabbas, I/c CATAT suggested to popularize the roof gardening and cultivation of flowers due to increasing demand. Dr. Sanjay Kumar, I/c SPU suggested to increase the area under breeder

seed production at KVK Farm. The meeting ended with vote of thanks proposed by Dr Anamika Sharma, head KVK.

EXTENSION

Field Days

INM on Pearl-millet under OFT

Institute's KVK Shikohpur was organized one day programme as field day cum farmers' training on

INM in pearl millet at Sakatpur village on September 1, 2020. The seed treatment with NPK liquid bio-fertilizers @10 ml/kg of seed before sowing was compared with farmers practice. This trail was conducted in 4 ha area with 10 farmers. Fertilizer was applied as per soil test results with FYM and 75% recommended NPK dose. Performance of trial and farmers practice was compared during field day. Crop performance at grain formation and milking stage was found better in technical intervention than farmers practice. A total of 26 farmers have participated during field day programme from SC community. During above programme importance and benefits of bio-fertilizers, method of seed treatments, soil sampling and crop management was discussed with the farmers.

Field Day under AICRP Pearl-millet

Institute's KVK Shikohpur was organized one day programme as field day cum farmers' training for pearl millet during front line demonstrations on improved hybrids and fortified varieties of Pearl millet under AICRP Pearl millet on September 8, 2020 at Lokra village. The total area under AICRP FLD was 14 ha with 24 farmers/ farm women. Ten ha area with 14 farmers were demonstrated with proagro-9450 variety and 4 ha area with 10 farmers under variety HHB-299, which is rich in iron and zinc. Performance of demonstrations and farmers practice was compared during field day. A total of 51 farmers and farm women have participated during field day programme. During above production technology of pearl millet, soil health improvement and use of bio-fertilizers, water saving technology, problems saved faced

farmers during crop season and method, soil sampling methodology for next crop season was discussed.

Field Day under NFSM Pulses on Pigeon-pea

Institute's KVK Shikohpur was organized one day programme as field day cum farmers' training for pigeon pea var. Pusa Arhar-16 on September 19, 2020 at Raiseena village block Sohna for CFLDs under NFSM on improved varieties with package and practices of cultivation. The total area under CFLDs under NFSM was 20 ha with 60 farmers/ farm women. Crop is in good condition and at maturity stage and will be harvested in next 10-15 days. A total of 37 male farmers have participated during field day programme. During the training, production technology of pigeon pea, soil health improvement and use of bio-fertilizers, water saving technology, problems saved faced farmers during crop season and method, soil sampling methodology for next crop was discussed.

Popularization of Meghdoot at Raiseena and Tripadi village

Institute's KVK Shikohpur were organized farmer awareness programme on use of “Meghdoot App”. These programmes were conducted at Raiseena village of Sohna block and Tripadi village of

Farrukhnagar on August 17 and 22, 2020, in which 45 farmers had been participated to understand the forecast of the weather events helps for suitable planning of farm. Meghdoot app provide forecast relating to temperature, rainfall, humidity, and wind speed and direction, which play critical roles in agricultural operations and advisories to the farmers on how to take care of their crops and livestock. The crop and livestock-specific weather-based agro advisories would be updated twice a week on Tuesdays and Fridays Meghdoot App. Farmers can download the app from either Google Play Store or App Store. One will have to register for name as well as location so as to obtain area specific information.

Celebration of Poshan Maah

Institute's KVK Shikohpur celebrated *Poshan Maah* from September 1-30, 2020 during which a total of 5 days awareness programme viz. on September 9, 2020 at Khwaspur village, September 14, 2020 at KVK campus, September 28, 2020 at Garhi Harsaru village, September 29, 2020 at Sakatpur village and September 30, 2020 at village Bhorakalan-Chitrasen ki Dhani were organized on “Balanced diet, *Poshan* thali and establishment of nutria-garden” in



Celebration of Poshan Maah at KVK Shikohpur



which 30, 14, 27, 28 and 40 women participated, respectively. During the programme, they were given knowledge about nutrients, their role in our body, their food sources and their requirement in our body. They were motivated to adopt healthy dietary practices and to establish a nutri-garden in their backyard to include more fruits and vegetables in their as well as their family member's diet. They were also made aware about role of hygiene and cleanliness for maintaining good health and nutritional status and were motivated for maintaining personal hygiene and sanitation. One awareness programme was organized on September 17, 2020 at KVK campus in which 40 anganwadi workers and 68 farm women participated where they were given lectures on balanced diet, nutri-thali, establishment of nutri-garden, bio-fortified varieties, package and practices of vegetable and horticultural crops. In this programme, Dr. V. K. Singh, Joint Director (Extension), IARI was present as Chief Guest.

CAPACITY BUILDING

Trainings

NAHEP-CAAST Sponsored Online Training on Life Skills and Personality Development

Division of Agricultural Extension organised online Training on "Life Skills and Personality Development" from September 21-25, 2020 for the Post graduate students of National Agricultural Research Education System (NARES). This training program sensitized and empowered students regarding life skills enhancement for enhancing personal and professional effectiveness through lectures delivered in the areas of stress management, team building, conflict

management, problem solving skills, self-management, effective communication, goal setting, critical thinking, interpersonal skills, presentation skills and leadership abilities by eminent trainers. Around 40 M.Sc/M.Tech./Ph.D Agricultural students from 12 states representing 15 institutes/universities such as ICAR-IARI New Delhi, SAUs, CAUs, DUs, Central Universities with Agriculture faculty were attended the training programme. Dr Premlata Singh, Head Agricultural Extension was the convenor of the training program.

Webinars

Stakeholders Dialogue on Current Challenges and Way Forward for Pesticides Management

A national online meet was organized on July 24, 2020, jointly by Trust for Advancement of Agricultural Sciences, Society of Pesticide Science, Indian Phytopathological Society and Entomological Society of India on "Current Challenges and Way Forward for Pesticides Management". Large number of participants from Industry, Ministry of Agriculture & Farmers Welfare, research institute of NARS, NAAS, TAAS, ICAR, IARI attended the event and deliberated upon the need to re-orient the regulatory mechanism, enable favorable environment for growth of pesticide industry, strengthen pesticide research and innovation.

MISCELLANEOUS

Externally Funded Projects Sanctioned

- Identification and validation of newer approaches for management of white fly *bemisia tabaci* (Hemiptera: Aleyrodidae)

funded by NASF (ICAR) for an amount of ₹ 40.36 lakhs for 3 years. PI: Dr. S. Subramanian, Principal Scientist, Division of Entomology, IARI.

- Biological markers for soil suppressiveness funded by ICAR for an amount of ₹ 5 lakhs for 1 year. PI: Dr. Y.S. Shivay, Principal Scientist, Division of Agronomy, IARI.
- Impact evaluation of carbon dioxide (CO₂), temperature and ozone stress on rice cultivars under project "Climate Smart Management Practices" funded by ICAR-International Rice Research Institute (IRRI) for an amount of USD 4000 for 2 years. PI: Dr. Bidisha Chakrabarti, Senior Scientist, CESCRA, IARI.
- Identification of traits, genes, physiological mechanisms to develop climate varieties for unfavorable environment funded by ICAR-International Rice Research Institute for an amount of USD 3500 for 2 years. PI: Dr. C. Viswanathan, Head, Division of Plant Physiology, IARI.
- Mainstreaming rice landraces diversity in varietal development through genome-wide association studies: A model for large-scale utilization of gene bank collections of rice funded by DBT. Amount ₹ 655.50 lakhs for 5 years. PI: Dr. Gopala Krishnan, Principal Scientist, Genetics.
- Expansion of activities of Biotech-KISAN Hub in three aspirational districts (Karauli, Dholpur, Baran) of Rajasthan, one aspirational district (Mewat) of Haryana and three aspirational districts (Balampur, Baharaich

- and Sravasti) of Uttar Pradesh under Biotech-KISAN Hub funded by DBT. Amount ₹ 161 lakhs for two years. PI: Dr. R N Padaria, Professor and Principal Scientist, Agricultural Extension.
- Design and development of acoustic based gadget for maturity detection in melons funded by DST Amount ₹ 55.16 lakhs for three years. PI: Er. Pramod Aradwad, Scientist, Agricultural Engineering.
 - Genetics improvement of Kalanamak for productivity traits, biotic and abiotic stress tolerance, aroma and nutritional quality funded by UP Council of Agricultural Research. Amount ₹ 49.96 lakhs for three years. PI: Dr. A. K. Singh, Director, IARI.
 - Emission of carbon dioxide from application of urea to agricultural soils funded by MoEF& CC. Amount ₹. 42.00 lakhs for 2 years. PI: Dr. Niveta Jain, Principal Scientist, CESCRA.
 - Development of high yielding DH lines of broccoli using microspore culture, their conversion into CMS lines using MABC and utilization in hybrid breeding funded by BIRAC. Amount ₹ 19.12 lakhs for 2 years. PI: Dr. Chander Prakash, Head, Regional Station, Katrain, Kullu Valley.
 - Paddy straw residues management through in-situ microbial decomposition with mechanical interventions funded by NASF. Amount ₹192.0 lakhs for 3 years. PI: Dr. Indra Mani, Head, Division of Agricultural Engineering.
 - Development of solar-powered variable swath herbicide applicator robot for high-value vegetable crop funded by DST. Amount ₹ 48.0 lakhs for 2 years. PI: Dr. Dilip Kumar Kushwaha, Scientist, Division of Agricultural Engineering.
 - Development of smart mobile e-power unit with matching implements for small farmers funded by DST. Amount ₹ 30.0 lakhs for 2 years. PI: Dr. Shiv Pratap Singh, Principal Scientist, Division of Agricultural Engineering.
 - Development of sensor based precision seeding retrofit module for cultivators funded by DST. Amount ₹ 28.44 lakhs for 2 years. PI: Dr. H.L. Kushwaha, Sr. Scientist, Division of Agricultural Engineering.
 - Development of IoT based custom hiring monitoring meter of agricultural machines funded by DST. Amount ₹ 46.0 lakhs for 2 years. PI: Dr. Rajeev Kumar, Scientist, Division of Agricultural Engineering.
 - Design & Development of Sensor based early pest detection Technology funded by DST. Amount ₹ 37.0 lakhs for 2 years. PI: Er. Utpal Ekka, Scientist, Division of Agricultural Engineering.
- Contract Research**
- Testing, validation and field evaluation for performance of specifically formulated HDPE Laminated Woven Lay Flat Tubes for precision farming agriculture with IARI and V.K. Pack Well Pvt. under the PI ship of Dr. Mam Singh, Principal Scientist, CPCT at a total cost of ₹ 17.52 lakhs and duration of two years.
 - Evaluating the agronomic performance of Urea-S and other S fertilizer sources in India with IARI and Shell India Pvt. Ltd. Under the PIship of Dr. V.K. Singh, Head, Division of Agronomy at a total cost of ₹154, 28, 500 and duration of two years.
 - Evaluation of Gloit 300 w/v and Scholar 230SC against apple diseases with IARI and Syngenta India Ltd. Under the PIship of Mr. Santosh Watpade, Scientist, IARI Regional Station, Shimla at a total cost of ₹13, 56,681 and duration of two years.
- Technology Commercialization**
- During July-September, Amid Covid-19, Eight technologies namely Basmati rice variety PB 1509, mustard- PM 27, PM 28, PM 30, PM 31, wheat variety HD 2967, HD 3086, HD 3226 were licensed to thirteen Industry Partners generating revenue of ₹ 10,00,000. The online MOA and payment processes were streamlined and strengthened by the Unit to avoid disorder in the peak of *Rabi* season. Industry partners appreciated unit's initiative of no contact online MoA process.
- IP Management**
- Patent Granted**
- Plant Transformation Vector for Suppressing Mips Gene Expression and Method for Culturing Low Phytate Soybean [341699 (2432/DEL/2015)]
 - A Cross Flow Flexible Membrane Filtration Assembly for Small Processing Volume [343546 (3771/DEL/2012)]
 - Insecticidal Formulation of Novel Strain of *Bacillus thuringiensis* A K 4 7 [340541 (2361/DEL/2014)]

- Pusa Basmati Rice Thresher [346124(1802/DEL/2013)]

Patent Filed

- UAN cum Seed Applicator (202011028155)
- Off-Grid Battery less Solar Refrigerated Evaporatively Cooled Mesh-Fabric Structure for Storage of Perishable (202011030310)
- A Semi-Synthetic Diet For Mass Rearing of Lepidopteran Pests of Agricultural Importance (202011035827)
- Efficient Methodology for Natural Vitamin E Extraction from Edible Vegetable Oils (202011035828)
- Hydro, Hydro-Thermal and Thermal near Infrared Rays Treatments to Reduce Rancidity in Pearl Millet Flour (202011037363)

Trade Marks Registered

- UPJA [4430609 (Class 41)]
- UPJA [4430611 (Class 35)]

- UPJA [4430610 (Class 42)]

Copyrights Filed

- Draksha- Vitismod V1, A Grape Simulaion Model (11672/2020-CO/SW)

Incubation Activities for Arise & UPJA

- Pusa Krishi launched online Cohort for 32 startups selected under Unit's flagship incubation programs Arise and UPJA 2020 from July 6 – Sept 5, 2020. Pusa Krishi successfully created a virtual platform for Entrepreneurs and pool of eminent mentors for exchange of information and knowledge.
- Pusa Krishi organized a welcome ceremony for the Cohort which was launched in presence of the Chief Guest, Dr. T.R. Sharma, Deputy Director General (Crop Science) - Indian Council of Agricultural Research, Dr. A.K. Singh, Director, ICAR- IARI on July 06, 2020. During the ceremony, Dr. Neeru Bhooshan,

CEO, Pusa Krishi apprised the Guests about activities of Pusa Krishi, program brief and expectation from the program followed by introduction by the startups about their innovations selected under Pusa Krishi Cohort 2020. We also organized special session with Shri. Sanjay Singh, Additional Secretary (DARE) and Secretary (ICAR) were our new startup cohort under ARISE & UPJA2020 Programs interacted and introduce their technologies.

- During this well curated program startup were empowered 360⁰ perspective on agriculture with 28+ Technical cum Business sessions, 30+ Intellectual Property sessions catalyzed by 1-on-1 mentoring session from the agribusiness corporate leaders, mentors and financial advisors.
- Under our handholding program “Samarth” we organized Sixth “Samarth” online workshop titled “Process Flow for Startup Funding” under RKVY-RAFTAAR 2020 on August 21, 2020. The workshop was attended by 67 budding Incubator managers representing 20 agri-incubators pan India with the all PI/ Co-PI/ Business Managers.

Corporate Membership

In this quarter from July- Sept 2020, Unit enrolled new membership of 11 industry partners and membership of 14 existing members were renewed for this year generating a revenue of ₹ 1,25,000.



Cohort welcome celebration