



IARI NEWS



Vol. 36, No. 2

April-June, 2020

RESEARCH

Wheat Varieties Released

Four new wheat genotypes, HI 1621 (Pusa Wheat 1621), HI 1628 (Pusa Wheat 1628), HI 8802 (Pusa Wheat 8802), HI 8805 (Pusa Wheat 8805), were identified for release during 58th All India Wheat and Barley Research workers' meet, Indore and were notified for release vide gazette notification no S.O. 99(E) dated 06.01.2020.

Promising Hybrids/ Seedlings of Rose (*Rosa hybrida* L.)

RH-24-2017: It is a hybrid of cv. Barbara Bush × Jawala and produces floribunda type dark pink coloured semi-double



Rose hybrid: RH-24-2017

medium sized blooms. RH-24-2017 is highly floriferous hybrid. The plants are medium in height and bushy. It is easily propagated through cuttings. The promising hybrid is suitable for garden display purpose.

R-SD-6-2015: It is a selection from open pollinated seedlings of var. Rose Sherbet. It belongs to



R-SD-6-2015 (Selection from open pollinated seedling of var. Rose Sherbet)

floribunda type. The plants are medium in height and bushy. Flowers have fragrance, more compactness and pinkish (RHS-65-A) in colour. It produces recurrent and floriferous semi-double flowers with 40-48 petals/flower. The major volatile compound in R-SD-6-2015 and its seed parent var. Rose sherbet is phenyl ethyl alcohol (per cent peak area: 44.26 and 38.48, respectively). It is propagated

through cuttings. The promising seedling is suitable for fragrant loose flower purpose.

Identification of Cold Tolerant Lines in Pigeonpea [*Cajanus cajan* (L.) Millsp.]

Late and Medium maturing varieties are grown in most of the area under pigeonpea cultivation and therefore the risks of facing cold/frost are obviously high. North India generally has been witnessing very low temperature during the last fortnight of December and first fortnight of January, which is favourable for frost injury and snow injury in sensitive lines. For three consecutive years (2016-18), we screened 302 germplasm/lines of pigeonpea comprising of varieties and advance materials against frost injury facilitated to find tolerant and sensitive lines. In the year, 2019 -20, again some selected lines were screened for cold tolerance, among these lines the resistance parent ICP 10509 hardly showed any symptom of frost injury and appeared best among all the resistance lines. The sensitive parent (ICP 11182) was affected severely to cold injury.

Characterization of ASR Gene and Its Role in Drought Tolerance in Chickpea (*Cicer arietinum* L.)

Chickpea is an important crop with a profound nutritional and economic value. Continuous decline in chickpea productivity is attributed to insufficient genetic variability and different environmental stresses. Chickpea like several other legumes is highly susceptible to terminal drought stress. Multiple genes control drought tolerance and ASR gene plays a key role in regulating different plant stresses. Our study described the molecular characterization and functional role of ASR gene from chickpea (*Cicer arietinum*). Molecular analysis proved that the ASR nucleotide sequences in different legumes showed variations at various positions although ASR genes are conserved in chickpea with only few variations. Sequence similarity of ASR gene to chickpea putative ABA/WDS induced protein mRNA clearly indicated its potential involvement in drought tolerance. Conserved domain search, protein structure prediction and validation, network analysis using Phyre2, Swiss-PDB viewer, ProSA and STRING analysis established the role of hypothetical ASR protein NP001351739.1 in mediating drought responses.

NP001351739.1 might have enhanced the ASR gene activity as a transcription factor regulating drought stress tolerance in chickpea. This study could be useful in identification of new ASR genes that play a major role in drought tolerance and also develop functional markers for chickpea improvement with those of other plant species.

DBR-160-2-3-1-3: A *Fusarium* Wilt Resistant Brinjal Line in India

The brinjal line DBR-160-2-3-1-3 was developed at the Division of Vegetable Science, which is recorded resistant to *Fusarium* wilt disease both under artificial inoculation in pot trays and sick plot. The Disease Index (DI) was calculated and listed in table. The identified lines can be used in breeding programme to transfer resistant gene(s) in the susceptible commercial variety (s).

Solanum pseudocapsicum: An Immune Source of Resistance to Leaf Curl Disease in Chilli

An experiment was carried out to screen for resistance to chilli leaf curl disease in different genera of *Capsicum* *C. frutescens*, four of *C. chinense* and one of *C. baccatum*. In addition one genotype was



Bushy Architect of *S. pseudocapsicum*



Flower of *S. pseudocapsicum* with protruding anther

procured from ICAR-IARI, regional station, Katrain for screening was *C. flexousum*. In our study one line from *C. chinense* (EC 787146) showed resistance to leaf curl while the genotype *C. flexousum* showed immunity to leaf curl disease. The morphological characters and molecular diagnosis of the genotype which was available with us had high similarity to *Solanum pseudocapsicum* and not to *C. flexousum*. Hence, it was confirmed that genotype present with us was actually *S. pseudocapsicum*. Field screening of *S. pseudocapsicum* for resistance is being done from 2016. No leaf curl symptoms were observed in the field for four continuous years. The genus was also challenge inoculated with viruliferous whiteflies carrying Chilli leaf curl virus and tomato leaf curl New

Disease index (DI) of *Fusarium* wilt in different lines of brinjal in sick plot

Lines	Disease Index (%)			Reaction
	2015-2016	2016-2017	2017-2018	
DBR-160-2-3-1-3	0	0	0	R
Pusa Uttam	85%	90.38%	97.22%	S
Pusa Kaushal	90%	94.44%	100%	S

Delhi virus in 2018, as these two viruses have been found to be predominant viruses causing leaf curl in chilli at IARI, location.

Brown Manuring: A Novel Practice for Weed Management in Maize

Brown manuring (BM) is a practice of growing *Sesbania bispinosa* /*Crotalaria juncea* as co-culture with a crop for a short period of 25-30 days after sowing (DAS), and then killing by the application of post-emergence herbicides selective to the crop of prime interest. In addition to weed management, BM offers multiple benefits such as improving organic matter, C and N reserves, and soil physical and biological properties. A BM option, *Sesbania* + *Crotalaria* (12.5 + 12.5 kg/ha) mixture applied with 2, 4-D at 25 DAS resulted in 65.4% higher grain yield (5.8 t/ha) over the unweeded control (3.5 t/ha) with a reduction of 86.2% in weed density (at 60 DAS), thus, giving a net return of 48,900 Rs/ha. Besides, it resulted in production of 1.69 t/ha brown manure biomass and addition of

52.6 kg N/ha into soil. Therefore, a combination of 1:1 mixture of *S. bispinosa* and *C. juncea* (12.5 + 12.5 kg/ha) and 2, 4-D applied at 25 DAS would be an effective weed management practice in maize for higher productivity and profitability.

Conservation Agriculture (CA) Based Crop Intensification of the Rice-Wheat System with Summer Mungbean

Conservation agriculture based management packages aims at natural resource conservation and improvement and increased input use efficiency through integrated and judicious management of inherent soil, water and biological resources augmented with external inputs. In the present experiment, integration of various CA techniques was applied to RWCS viz., zero-tilled direct seeded rice (ZTDSR), brown manuring (BM) in DSR, zero tilled wheat (ZTW), crop residue retention and summer mungbean (ZTM) inclusion which were evaluated against conventional transplanted rice (TPR) – conventionally tilled



Zero till direct –seeded rice, ZT–Wheat



Zero-till summer mungbean with wheat residue

wheat (CTW) system. Although rice grain yields were significantly higher under the transplanted rice systems i.e.



Maize field (a) at 2 days after brown manuring (DAB) and (b) at 7 DAB

TPR-ZTW (5.4 t/ha) and TPR-CTW (5.2 t/ha), it was comparable with the CA practice: ZTDSR + mungbean residue (MR) – ZTW + rice residue (RR) – ZTM + wheat residue (WR) (4.9 t/ha). In contrast, wheat yields were consistently higher in CA based treatments, the highest being under the triple ZT+R system ZTDSR + MR – ZTW + RR – ZTM + WR (6.23 t/ha) which was ~16% higher compared to conventional TPR-CTW system (5.45 t/ha). With comparable rice yield, high wheat yield and inclusion of mungbean, the net profitability of the aforesaid CA treatment was 86% (78,900 Rs/ha) higher compared to the TPR-CTW system. Therefore, the ZTDSR – ZTW – ZTM system with triple residue retention could be an ideal sustainable solution to the widespread problems associated with the conventionally practiced TPR – CTW system.

Evidence of Foliar Uptake and Translocation of Particulate Matter Associated Zinc Using Radiotracer (⁶⁵Zn) in *Morus alba*

In urban set up, increasing combustion and processing activities have contaminated the air with toxic heavy metals which are generally enriched to atmospheric particulate matter. Vegetation around urban area act as a sink where such metal enriched particles generally deposit on the foliar surfaces, however, role of vegetation in uptake of metals adhered on the atmospheric particulate matter is poorly understood but is

important in order to evaluate their role as bio-remediator. The undertaken work was executed to understand foliar uptake mechanism and translocation of atmospheric metal enriched on particulate matter. A simulated experiment was conducted by labeling the known particle size (45 micron and 120 micron) with radio labeled ⁶⁵Zn, applied on the tagged leaf with two particle loads, 25mg and 50mg. *Morus alba* efficiently trapped heavy metal enriched particles and was capable of accumulating metals from particulate matter into different plant parts. Study supports that avenue trees like *Morus alba* are not only capable of efficiently trapping the atmospheric PM on their foliage but also exhibit foliar uptake and in plant translocation and accumulation of the PM-associated metals, thus can be exploited to improve air quality.

Application of Steel Slag-Based Sulfur Nutrient for Improving Grain Productivity of Bread and Durum Wheat

Experiments conducted under the Tata-Steel Ltd – ICAR-IARI contract research program at the ICAR-IARI, Regional Station, Indore Madhya Pradesh indicated that the application of yellow Gypsum (YG) @ 45 kg S in combination with 100% NPK to bread wheat cv. HI 1544 (Purna), produced a maximum grain and biological yield of 6.30 and 14.00 t/ha, respectively, which was ~4.13 and 3.47 per cent higher than the other experimental treatments. Similarly, durum wheat cv. HI 8759 (Pusa Tejas) under the same

YG treatment produced a maximum grain and biological yield of 5.65 and 13.73 t/ha, respectively which was at par with 100% NPK + 45 kg S/ha but significantly higher over the remaining treatments. The study indicates that yellow gypsum which is a steel slag-based S nutrient can be used as an effective alternative to gypsum.



Effect of steel slag-based S nutrient as bread and durum wheat genotypes

Reactive Nitrogen Flux in Soil under Rice Cultivation

The fluxes of reactive N can be reduced by managing the application of integrated organic and synthetic fertilizer. Measurements of NH₃ volatilization, N₂O emission, NO₃-leaching, soil ammoniacal and nitrate N was carried out from soil growing four rice varieties of Pusa 44, IR 64, CR Dhan 310 and MTU 1010 under treatments of leaf colour chart (LCC) based application of neem coated urea (NCU 90 kg N ha⁻¹), 50% N through FYM+50% N through NCU (LCC) + biofertilizer and prilled urea (90 kg N ha⁻¹). The total loss of reactive N fluxes through the different pathways was reduced by 29-41% in the integrated treatment (FYM+NCU+BF) as compared

to the prilled urea application in the different varieties.

Temperature Influence on Leafhopper Population in Chickpea and its Potential Distribution to Predict the Chickpea Stunt Disease

An attempt was made to develop an epidemiological model using vectors populations vs change in temperature for the spread of chickpea stunt disease in India. Effect of temperature on leafhopper population was assessed using two epidemiological models viz., non-linear beta model and Briere's model by employing cardinal temperatures for leafhopper growth and development. Comparison of accumulated temperature index pattern from both the models with the leaf hopper population counts at IARI, New Delhi confirmed that beta-model was a better fit model with counted leaf hopper population abundance. Therefore, monthly temperature index based on beta-model represented as better indicator of leaf hopper population abundance. Spatio-temporal distribution of vector abundance was predicted in whole country using monthly temperature index

and found that the western zone and most of the Indo-Gangetic plains were moderately adapted and suitable to vector growth and population all the year around expect for the northern hill zones. Therefore, based on temperature, prediction of stunt disease in large geographical scale is possible. Prediction of chickpea stunt disease on a broad geographical scale is therefore, possible based on temperature, leafhopper population and geographical distribution and prediction can be helpful in planning of crops and developing disease management strategy.

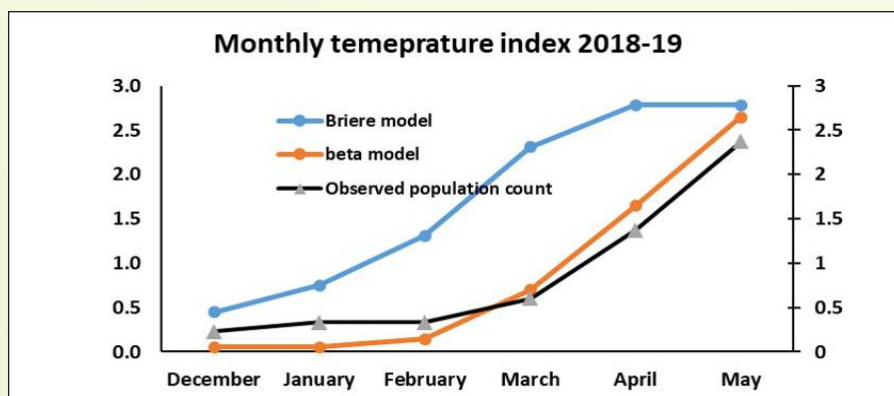
Virome Profiling and Whole Genome Reconstruction of Viruses and Viroids in Grapevine

Viral/viroidal spectrum and reconstruction of whole genome were achieved in Indian grapevine cultivars using the publically available mRNAome and sRNAome datasets. Twenty three viruses and viroids (including 2 variants of grapevine leafroll associated virus 4-GLRaV4) were identified from two tissues (fruit peels and young leaves) of three cultivars among which 9 unique grapevine viruses and viroids were identified for the

first time in India. The mRNA based approach identified more number of acellular pathogens than the sRNA based approach across cultivars. The reconstructed viral genomes included four larger RNA genomes (>13 kb), a DNA genome (grapevine geminivirus A), a divergent genome (grapevine virus B) and a genome for which no reference is available (grapevine virus L). A large number of SNPs detected in this study ascertained the quasi species nature of viruses. Detection of three recombination events and phylogenetic analyses using reconstructed genomes suggested the possible introduction of viruses and viroids into India from several continents through the planting material. The whole genome sequences generated in this study can serve as a resource for reliable indexing of grapevine viruses in quarantine stations and certification programmes.

First Report of Crop Feeding Flower Fly, *Eumerus vestitus* Bezzi

Eumerus Meigen is a flower fly genus which have agricultural and quarantine importance globally, but its taxonomy and ecology is poorly studied in the orient region. In the study, a first record of distribution of *Eumerus vestitus* Bezzi (Diptera:



Comparison of Briere's model and beta model with leaf hoppers population count using reported cardinal temperature



Crop feeding flower fly

Syrphidae) (from New Delhi, India which was successfully and reared on tomato fruit). Biosystematic studies including species diagnosis, molecular characterization and redescription with male genitalia was carried out for the identification of species.

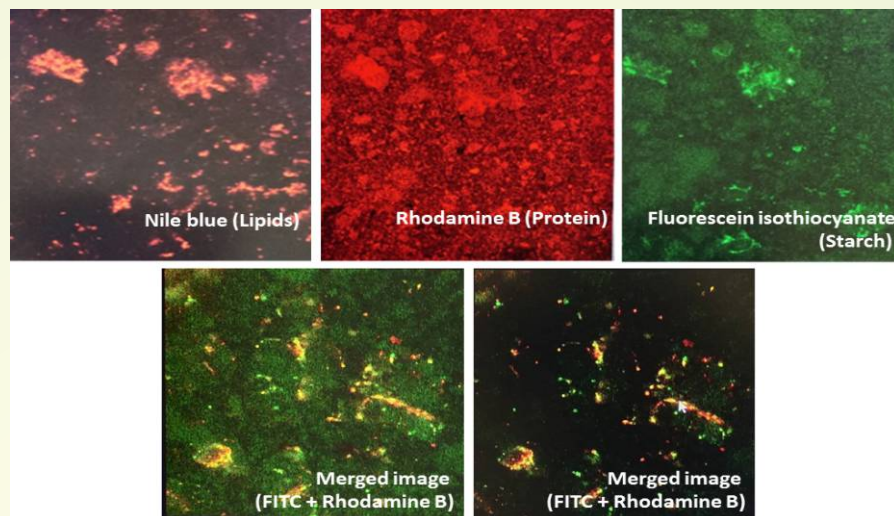
Mechanisms of Odour and Chemo- Sensation by the Plant and Insect- Parasitic Nematodes

Nematodes locate their hosts in soil by sensing the chemicals emitted/ secreted by plants. The expression of nematode genes involved in odour sensing was investigated and characterised in the entomopathogenic nematode *Heterorhabditis bacteriophora*. The fluorescence *in-situ* hybridisation assays revealed that *Hb-odr-2* mRNA expression was

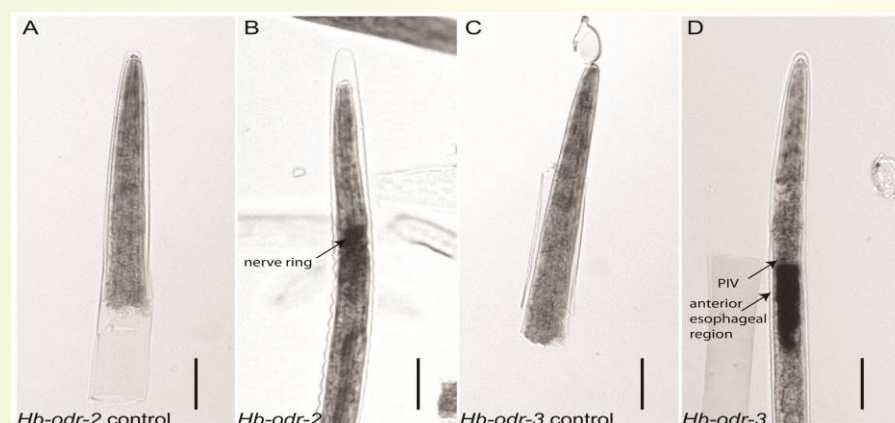
Development of a Tool to Evaluate Food Matrix Component Interactions Using Confocal Laser Scanning Microscopy

Rice ageing or storage vital for the preferred eating and

protein, and lipid) at molecular level. As aged rice fetch a premium price, it is relevant to understand the kinetics and dynamics of the metabolites during ageing to evaluate the



Confocal Laser Scanning Micrograph (CLSM) of cooked rice slurry stained with Nile blue (pink for lipids), FITC (green for starch) and Rhodamine B (red for protein) in the upper panel and the merged image at two different back ground where starch and protein /lipids interacted, depicted as yellow in the lower panel



In-situ hybridisation of gene-specific DIG-labelled probes showed that the expression of *Hb-odr-2* was confined to the nerve ring region whereas *Hb-odr-3* expressed in the pharyngo-intestinal valve (PIV) and anterior intestinal region of the IJs (Scale bar = 20 µm)

localised at the nerve ring region while that of *Hb-odr-3* in the pharyngo-intestinal valve and anterior esophageal region of the IJs. This is the second such investigation on the characterisation of *odr* genes in a parasitic nematode in world.

cooking qualities (ECQ), is an intricate phenomenon that starts at pre-harvest and lasts until consumption. The significant changes which occur in the physico-chemical, sensory as well as other quality attributes are governed by the interaction of matrix components (starch,

indices of ageing. Thus to evaluate the micro-composition as well as their dynamics in interactions, a tool was deduced based on Confocal Laser Scanning Microscopy (CLSM), whose principal is based on fluorescence optics where laser light is focused onto a defined spot at a specific depth within the sample has been optimized. Different fluorescent tags like Nile blue (interacts with lipids to give pink fluorescence), Rhodamine B (with proteins gives red) and Fluorescein Isothiocyanate (FITC) (with starch give green fluorescence) were used (upper panel). Merged images depicting possible interactions among starch with protein (yellow fluorescence (lower panel) as well with lipids could be easily evaluated using

this tool. This established protocol would be helpful in identifying the indices of rice ageing in future research programmes.

Low Glycaemic Potential of Red Rice (Njavara)

A comparative study on red, black and white rice based on their starch and phenolic quality, revealed that red rice cv. Njavara has the least inherent glycaemic potency. The intricate biochemical mechanism was studied using *in vitro* hepatocyte model system. *In vitro* starch hydrolyzation kinetics revealed red rice is rich in nutraceutical starch (NS), which is low digestible in nature. Many more, the presence of proanthocyanidins owing higher carbolytic enzyme inhibition, enhanced intracellular glucose uptake through GLUT2 receptors, down regulation of gluconeogenic enzymes (FBP1 and PCK1) and up regulation of glycogen synthase gene (GYS2) are involved in regulating glucose homeostasis. The role of proanthocyanidins in reducing advanced glycated end products (AGEs) and thus in turn reducing the oxidative stress induced apoptosis was also validated using the *in vitro* model.

Rapid Breeding in Soybean

The technique of speed breeding i.e. exposing the plants to 22 h light and 2 h dark period per day can't be used directly in soybean, as it is a highly photoperiod sensitive crop. Instead, rapid-breeding approaches comprising elevated CO₂, temperature, pre-mature pod harvest followed by oven-drying

were applied to enhance generation turn-over in soybean. One extra early maturing genotype SKAF148 and three late maturing varieties viz., DS9712, DS1213 and Pusa 5 were subjected to rapid breeding techniques under controlled conditions of the National Phytotron Facility, IARI, New Delhi. Under elevated CO₂ (>400 ppm) and temperature (25-30°C), the plants found to flower 5-7 days earlier than control. The growth of the plants and biomass was significantly higher under elevated CO₂. Further, the size of the flowers was large resulting in higher success of hybridization under CO₂ supplemented condition than control. The pods were harvested once physiological maturity was obtained i.e. when the full grown pods turned color from green to light green or yellowish than pods were oven dried for 5-7 days. Germination of the oven dried seeds was 100% and vigour was normal. With this rapid breeding approach, generation time of soybean was reduced by 10-30 days depending on genotype allowing growing of 4.5-6.0 generations/year.

EDUCATION

27th Dr. B.P. Pal Memorial Lecture Delivered through Zoom Webinar

Post Graduate School, ICAR-IARI, New Delhi and Genetics Club of IARI organized 27th Dr. B.P. Pal Memorial Lecture on May 27, 2020 through online mode. The topic of the lecture was “Reforms for Secure and Sustainable Agriculture: A Road Map” and the Speaker was Padma Bhushan Dr. R.S. Paroda, Chairman, Trust for Advancement of Agricultural Sciences, New Delhi. The Lecture was chaired by Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR, New Delhi. Dr. Ashok Kumar Singh, Director, ICAR-IARI in his address introduced the Chair. Dr. Mohapatra introduced the speaker and welcomed various dignitaries and the participants present.

Dr. Paroda emphasized the role of Indian National Agricultural Research System in strengthening food security in the nation. He stressed on the needs and roles of policy support, institutions, human resources and



partnership for success of agriculture. Dr. Paroda also advocated for the reforms like agricultural diversification, secondary agriculture, speciality agriculture, production to post-production value chain, focus on small holder farmers, research orientation towards farming system mode, Agricultural Research for Development and linking farmers to the market.

Organization of Foundation Day of ICAR-IARI Jharkhand

In order to replicate the success of Indian Agricultural Research Institute, the Hon'ble Prime Minister of India Shri Narendra Modi ji, dedicated another IARI like Institute in the Eastern Part of the country at Gauria Karma, Barhi Block, Hazaribag, Jharkhand and laid down the foundation stone of this Institute on June 28, 2015. The responsibility of establishing IARI like Institution at Jharkhand was entrusted to the Indian Agricultural Research Institute at New Delhi by the Indian Council of Agricultural Research. The ICAR-Indian Agricultural Research Institute-Jharkhand has completed 5 years from the day of its establishment on June 28, 2020. On this occasion, the Foundation Day Celebration of ICAR-IARI-Jharkhand was organized on June 28, 2020. Shri Kailash Choudhary, Hon'ble Minister of State for Agriculture & Farmers Welfare, Govt. of India graced the online session as Chief Guest and Dr. Trilochan Mohapatra, Secretary, DARE & DG, ICAR, New Delhi chaired the function. On this occasion, various programmes have been organized such as avenue tree plantation in and around the IARI-Jharkhand

campus and also organised interaction sessions with local leaders, government agencies & institutions, farmers, children in order to make them aware about the significance of this Institute for increasing the farm income.

Lecture on Water Management

Professor Man Singh, Project Director, Water Technology Centre, ICAR – IARI New Delhi delivered a lecture on the topic, “Water Science and Technology in Averting Looming Water Crisis” on May 18, 2020 on Agrivision India highlighting the importance of Scientific Water Management in India. Professor Singh stressed the urgent need for adoption of modern irrigation methods by all farmers in irrigated areas as well as making concerted effort for *in-situ* soil moisture conservation, especially in rainfed agriculture. He also emphasized the need for *ex-situ* rain water harvesting during monsoon season as well as rejuvenation of old dilapidated rainwater harvesting structures (RWHS) that will augment the groundwater recharge as well as water availability in time and space. Further the need for scientific measurement and pricing of the water for every user so that the wastage of water could be minimized was emphasized upon.

EXTENSION

On Farm Trial (OFT) on Integrated Nutrient Management in Pearl Millet

Low productivity and profitability of PM was observed in Gurugram district (19.5-29.5 q/ha) due to low level of organic carbon & imbalance application

of nutrients by farmers, so an OFT was organized on Integrated nutrient management in pearl millet at Sakatpur village in 4 ha area of Gurugram district involving 10 beneficiaries. Soil test based Integrated Nutrient Management @ FYM 10 ton/ha. + NPK liquid biofertilizers @ 10 ml/kg seed + 75%NPK of recommended dose (Recommended-60: 30: 30, NPK kg/ha), is under testing, which will be compared with farmers' practice @ 60: 46, N: P kg/ha.

Farmer's Training

Institute's KVK, Shikohpur was organized one day farmer's training on integrated crop management in pearl millet at Lokra village of Gurugram district on June 10, 2020 where in 12 farmers have been benefitted.

Plantation on the Occasion of World Environment Day

Institute's KVK, Shikohpur celebrated World environment day on June 05, 2020 at KVK campus by planting 130 plants of mango, aonla and guava and 30 plants of kinnow, guava and aonla were given to farmers of Tirpadi village of Farruknagar block of Gurugram district for development of Vatika.

Frontline Demonstrations

• Pearl Millet

FLD under AICRP on pearl millet was organized for 14 ha area, where in 4 ha area under fortified variety HHB-299 which is high in iron and Zinc and rest 10 ha area is under improved hybrid, benefitting 24 farmers of the Gurugram district.

- **Pulses**

FLD under NFSM pulses was organized for 40 ha area, where in 20 ha area under pigeon pea (variety Pusa Arhar -16) and 20 ha area under summer moong (variety MH-421) benefitting 60 farmers of the Gurugram district.

- **Wheat**

(i) RS Indore was conducted total of 18 demonstrations of 5 varieties of wheat crop in 10.20 hectares area conducted in 4 villages of Indore and Dewas Districts in M.P. Overall average increase in yield was 13 q/ha or 30 % in these demonstrations. The B: C ratio realized was 4.10 under demonstrations plots and 2.88 under farmers' practice.

(ii) RS Indore was conducted total of 27 demonstrations of 5 varieties of wheat crop in 11.40 hectares area. These demonstrations were conducted in 4 tribal villages of Dhar District in MP. Overall average increase in yield was 18 q/ha or 46 % in these demonstrations.

(iii) RS Indore was conducted total of 13 demonstrations of 5 varieties of wheat crop in 17.75 acres area. These demonstrations were conducted in 8 tribal villages of Dhar District in M.P. Overall average increase in yield was 3.2 q/acre or 20 % in these demonstrations.

Seed Distribution Programme and Farmers Meeting

IARI Regional Station, Kalimpong has distributed the improved paddy variety Pusa Sambha 1850 at village Bangkandi of Jalpaiguri district on June 25, 2020 for demonstration under 'Innovative Extension Model' project. Total

30 farmers participated in the programme. Farmers meeting was also arranged to discuss the kharif contingency plan due to heavy rain for paddy cultivation. It was advised to drain the excess water from the field, preparation of second nursery in case of inundation of previous nursery immediately, high dose of N-fertilizer should be avoided, prevent premature germination in field, postpone topdressing N fertilizers till water recedes, top dressing of 20kgN/ha after receding water to gain vigour.

World Environment Day 2020 Celebration

Centre for Environment Science and Climate Resilient Agriculture (CESCRA), IARI, New Delhi celebrated World Environment Day on June 5, 2020. On this occasion, Eminent Environmentalist Dr. Anil Prakash Joshi, Padma Bhushan and Padma Shri, delivered a vision talk on "Ecology is the stable Economy". Dr. Joshi covered all the aspects of environment and ecology such as natural resources, biodiversity, pollution and economy in a concise manner. He discussed that extensive, exhaustive, unsustainable and non-judicious use of natural resources creates enormous problems for living beings and the future generations. He emphasized on the natural resources as "Life" or "Jaan" and Gross Domestic Product (GDP) as "World" or "Jahan" and told that if there is no Life than there is no meaning of World. During this webinar, Dr. J.P. Sharma (Joint Director Extension), summarize the talk with all the highlights of speech with brief remark. More

the 1400 attendees actively participated in the webinar program. Finally, the program was finished with the vote of thanks by Dr. D. K. Sharma.

CAPACITY BUILDING

Webinars

Desert Locust Management: Current Status & Future Strategies

A Zoom Webinar on "Desert Locust Management: Current Status & Future Strategies" was organized on May 30, 2020 by Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi. The webinar was chaired by Dr. Trilochan Mohapatra, Secretary-DARE & DG-ICAR and Dr. T. R. Sharma, DDG (Crop Science), ICAR, as co-chair. Dr. T. Mohapatra in his opening remarks highlighted that this locust meeting was organized at the behest of Shri Kailash Choudhary, Minister of State for Agriculture and Farmers Welfare, Shri. Gajender Shekhawat, Minister of Jal Shakti and PMO officials to discuss and strengthen basic and applied research on locust by ICAR. More than 1000 participants attended the webinar. Dr. A.K. Singh, Director, ICAR-IARI, New Delhi welcomed the dignitaries, panelists, invitees and participants. Dr. S.N. Sushil, Principal Scientist, IISR, Lucknow made a presentation on "Desert Locust: An Overview in Indian Context" followed by a brain storming session, moderated Dr. T.P. Rajendran, former ADG, PP. The brain storming session emphasized the need to analyse the various facets of locust problem, its

management and development of effective models to tackle the problems in future.

National Web Conference Vegetable Farmers Forum 2020

IARI Regional Station, Pune, organized a National Web Conference on “Vegetable Farmers Forum: Post Lockdown with Particular Emphasis on Plant Protection” during June 25-26, 2020. The Web Conference was graced by more than 800 participants, directly on Zoom platform and in the YouTube Live streaming.

Workshops

The e-review workshop of IARI-VOs partnership outreach programme and National Extension programme were organized on June 20, 2020. The assessments of performance of the crops/ technologies under demonstrations during Kharif, 2019 were discussed under the chairmanship of Dr. A.K. Singh, Director, ICAR-IARI. In all 24 officials of ICAR Institutes, SAUs, VOs from 21 partner organizations along with 21 nodal officers from IARI participated in the workshop. The highlights of successful technologies were recorded for upscaling and assessment of location specific new technologies decided as the future course of action to strengthen the programme.

MISCELLANEOUS

Technology Commercialization

Amid lockdown due to covid-19, ZTMBPD Unit licensed Basmati rice variety PB 1718 to four companies and maize variety Pusa Jawahar Hybrid Maize-1 to one Industry Partner. Total revenue generation for the period April–June is ₹ 8.13 lakh only.

Awareness Program on IPR & Entrepreneurship

Pusa Krishi Incubator organized an online session on “IP Strategy for Start-up and prior art search,” on April 29, 2020. Understanding the potential power of Intellectual Property Rights (IPR) and formulating IP strategies for best business outcomes. Leveraging patent information and importance of prior art search in developing effective business strategies was the key take away from the session. Participants from more than hundred startups from fourteen incubators across India were benefitted.

ITMC Meeting

During April-June, 2020, first Institute Technology Management Committee (ITMC) meeting was organized via ZOOM Online Platform by the unit under the chairmanship of the Director, ICAR-IARI. This meeting was organized to evaluate research outcomes of the technologies, management of

IPR portfolios, forage the inventions that need to be protected under IPR and to contrive the terms and conditions for commercialization of new varieties and technologies developed by IARI. In the ITMC meeting decision on IPR protection were taken for four technologies and terms and condition for commercialization were fixed for nine technologies.

Techno-Commercial Assessment and Expert Committee Meeting

First Techno-Commercial Assessment and Expert Committee Meeting with Agrinnovate India Limited was organized by ZTM & BPD Unit on July 19, 2020 for fixing the Terms and condition for commercialization of fifty technologies and varieties developed by IARI.

Patent Granted

Liquid bioinoculant of *azotobacter chroococcum* and the process thereof [338098 (518/DEL/2011)]

Patent Filed

A microcontroller based real time data acquisition system integrated solar dryer (202011024290).

Copyright

Infocrop V2.1 (SW-13440/2020)

Externally Funded Projects Sanctioned

- DUS Centre for Gladiolus funded by PPV&FRA. Amount ₹ 2.00 lakhs for 1 year. Principal Investigator: Dr. KishanSwaroop, Principal Scientist, Division of F&LS, IARI.
- Leveraging genetic resources for accelerated genetic improvement of linseed using comprehensive genomics and phenotyping approaches. Funded by DBT. Amount ₹ 37.85 lakhs for 5 years. Principal Investigator: Dr. Lakshman Prasad, Principal Scientist, Division of PI. Pathology, IARI (Lead Centre: NBPGR).
- Germplasm Characterization and trait discovery in wheat using Genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 2-Component 7-Characterization and evaluation of wheat germplasm lines for biotic stress resistance. Funded by DBT. Amount ₹ 47.26 lakhs for 5 years. Principal Investigator:

Dr. M.S. Saharan, PS, Division of Pl. Pathology, IARI (Lead Centre: NBPGR).

- Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 4-Component 1-Evaluation of wheat germplasm for quality traits). Funded by DBT. Amount ₹ 85.06 lakhs for 5 years. Principal Investigator: Dr. Anju M. Singh, Principal Scientist, Division of Genetics, IARI. (Lead Centre: NBPGR).
- Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 2-Component 2- Characterization and evaluation of wheat germplasm lines for biotic stress resistance). Funded by DBT. Amount ₹ 74.97 lakhs for 5 years. Principal Investigator: Dr. V.K. Vikas, Principal Scientist, IARI Regional Station, Wellington. (Lead Centre: NBPGR).
- Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 2-Component 1- Characterization and evaluation of wheat germplasm lines for biotic stress resistance). Funded by DBT. Amount ₹ 99.15 lakhs for 5 years. Principal Investigator: Dr. S.K. Jha, Sr. Scientist, Division of Genetics. (Lead Centre: NBPGR).
- Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 3-Component 9- Evaluation of wheat Germplasm for abiotic stresses). Funded by DBT. Amount ₹ 44.04 lakhs for 5 years. Principal Investigator: Dr. S.V. Sai Prasad, Head, IARI Regional Station, Indore. (Lead Centre: NBPGR).
- Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 2-Component 8- Characterization and evaluation of wheat germplasm lines for biotic stress resistance). Funded by DBT for 5 years. Amount ₹ 32.87 lakhs. Principal Investigator: Dr. S.V. Sai Prasad, Head, IARI Regional Station, Indore. (Lead Centre: NBPGR).
- Germplasm characterization and traits discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 3-Component 7- Nutrient Use Efficiency). Funded by DBT. Amount ₹ 50.04 lakhs for 5 years. Principal Investigator: Dr. Renu Pandey, Principal Scientist, Division of Plant Physiology, IARI. (Lead Centre: NBPGR)
- Germplasm characterization and trait discovery in wheat using genomics approaches and its integration for improving climate resilience, productivity and nutritional quality (Sub Project 3-Evaluation of Wheat Germplasm for abiotic stresses: Component-8: Salinity). Funded by DBT. Amount ₹ 41.04 lakhs for 5 years. Principal Investigator: Dr. Lekshmy S., Scientist, Division of Plant Physiology, IARI. (Lead Centre: NBPGR).
- Mainstreaming Sesame germplasm for productivity enhancement and sustainability through genomics assisted core development and trait discovery- Sub project 3 – Identification of Biotic Stress (Phyllody & Dry Root Rot) Tolerant Sesame Genotypes. Funded by DBT. Amount ₹ 63.84 lakhs for 5 years. Principal Investigator: Dr. G.P. Rao, Principal Scientist, Division of Plant Pathology, IARI.
- Mainstreaming sesame germplasm for productivity enhancement and sustainability through genomics assisted core development and trait discovery. Funded by DBT. Amount ₹ 38.89 lakhs for 5 years. Principal Investigator: Dr. Renu Pandey, Principal Scientist, Division of Plant Physiology, IARI.
- Mainstreaming sesame germplasm for productivity enhancement and sustainability through genomics assisted core development and trait discovery-Sub project 4 – Chemo Profiling of Sesame Germplasm. Funded by DBT. Amount ₹ 118.84 lakhs for 5 years. Principal Investigator: Dr. Virendra Singh Rana, Principal Scientist, Division of Agril. Chemicals, IARI.
- Development of IoT based custom hiring monitoring meter of agricultural machines. Funded by DST. Amount ₹ 42.06 lakhs for 2 years. Principal Investigator: Dr. Rajeev Kumar, Scientist, Division of Agril. Engineering, IARI
- Development of solar-powered variable swath herbicide applicator robot for high-value vegetable crop. Funded by DST. Amount ₹ 45.60 lakhs for 2 years. Principal Investigator: Dr. Dilip Kumar Kushwah, Scientist, Division of Agril. Engineering, IARI
- Genomics assisted tagging of restorer-of-male fertility (Ms) locus for hybrid development in short day Indian onion (*Allium cepa* L.). Funded By SERB-DST. Amount ₹ 35.93 lakhs for 3 years. Principal Investigator: Dr. Anil Khar, Principal Scientist, Division of Vegetable Science, IARI.

Contract Research/Contract Service Projects Sanctioned in this Period

- Evaluation of IFFCO Nano-N, Zn & Cu under maize-wheat and pearl millet-mustard cropping at ICAR-IARI, Pusa, New Delhi. Funded by IFFCO, New Delhi. Amount ₹ 98, 35,276/- for 2 years. Principal Investigator: Dr. B.S. Dwivedi, Head, Division of SS&AC, IARI
- Fungicide resistance monitoring in pre mature leaf fall (*Marssonina coronaria*) of apple in Himachal Pradesh. Funded by BASF India Ltd. Amount ₹ 11, 19,773/- for 1 year. Principal Investigator: Mr. Santosh -Watapade, Scientist, IARI Regional Station, Shimla
- Efficacy of Isopyrazam 12.5%+Difenoconazole 12.5% w/v (250 SC) against Pomegranate disease reg. funded by Syngenta India Ltd. Amount ₹ 13, 99,235/- for 2 years. Principal Investigator: Mr. Santosh Watpade, Scientist, IARI Regional Station, Shimla.

Agri Business Incubation

The unit has launched various programs for the development of the agribusiness incubation ecosystem:

- **ARISE 2020: Launch and Selection of Cohort**

ARISE incubation program was launched to promote innovation and entrepreneurship of India's agri-startups ecosystem. This is a program to scale-up agri-startups that have passed the stage of Ideation and have developed or have a ready prototype. Under this programme 331 applications were received online, and finally 15 startups were selected after technical assessment & business viability by Selection committee (RIC) for 2 Month Online Incubation program starting from July 2020.

- **UPJA 2020: Launch and Selection of Cohort**

UPJA an incubation & business acceleration program was launched on April 22, 2020 for the startups at a Minimum Viable Product (MVP) stage. This is a program to scale-up agri-startups that have passed the stage of prototype and have developed product with market traction. Under this programme 219 applications were received, and finally 17 startups were selected after technical assessment & business viability by Selection

committee (RIC) for 2 Month Online Incubation program.

- **Pusa Krishi: IARI-RABIs Incubation Series**

Pusa Krishi launched its first and one of its kind virtual online incubation program and most probably the first largest incubation program in the ecosystem judiciously designed to help early stage to mid stage startups looking for a kick-start and connects. As the Knowledge Partner under RKVY-RAFTAAR scheme of MoA & FW, Pusa Krishi conducted a full-fledged intense 2 months online incubation program from April 03-June 01, 2020 for the start-ups from 13 RKVY-RAFTAAR Agribusiness Incubators. More than 100 start-ups across 13 incubators, which were selected for the funding support by Ministry, attended this two-month intense online incubation program, after completing initial training at each respective RABIs.

The series focussed on evidence-based entrepreneurship and trained the start-ups on the best practices of innovation and entrepreneurship management. The series adopted the design thinking process and included sessions that were focused on business growth by industry experts. These sessions ranged from design thinking, creative

problem solving, product market fit, hacking marketing and sales growth to financial management, regulatory aspects, IP and business. Valedictory Session was organized on June 01, 2020 chaired by Dr. A. K. Singh, Director, ICAR- IARI along with all PI/ Co-PI / Incubator team and ending with feedback by various startups.

Awards

- ❖ Dr. S.V. Sai Prasad, Head (Acting), Regional Station, Indore received Dr. S. Nagarajan Memorial Award from Society for Advancement in Wheat and Barley Research, Karnal and Fellow of Andhra Pradesh Academy of Sciences.
- ❖ Dr. Veda Krishnan, Scientist, Division of Biochemistry got selected for Fulbright-Nehru post-doctoral research fellowship 2020-2021.
- ❖ Dr. Suresh Kumar, Principal Scientist, Division of Biochemistry received Prof. Sushil Kumar Mukherjee Commemoration Lecture Award 2019-20

Corporate Membership

Corporate membership allows Industry partners and NGOs direct access to breeder seeds developed by IARI and its regional stations. In this quarter 46 corporate members were enrolled.

Published quarterly by the Publication Unit on behalf of the Director, Indian Agricultural Research Institute (IARI), New Delhi-11 0012, and printed at M. S. Printers, C-108/1 Back Side, Naraina Industrial Area, Phase-1, New Delhi-110024, Tel.: 011-45104606

Joint Director (Research): Dr. A.K. Singh; **In-charge, Publication Unit:** Dr. G.P. Rao; **Technical Assistant, Publication Unit:** Dr. Sunil Kumar

Website: <http://www.iari.res.in>