

**DEPARTMENT OF AGRICULTURAL RESEARCH AND EDUCATION
MONTHLY SUMMARY - APRIL 2021**

IMPORTANT RESEARCH ACHIEVEMENTS:

Varietal Improvement/Promotion:

- High yielding extra-long (ELS) cotton variety CICR-B Cotton 37 (CCB-51) identified for cultivation in south zone to boost domestic production of ELS cotton to reduce the dependency on imports.
- In lesser Yam (*Dioscorea esculenta*), three promising breeding lines namely, DE62, DE103 and DE145 were identified for high tuber yield (>4Kg/plant).

Agricultural Biotechnology:

- At ICAR-VPKAS, Almora, 94 wheat local germplasms were genotyped with WMC 364 (Yr2), BARC 187 (Yr7), XBARC 167 (Yr5), and Xgwm 501 (Yr5). Thirty-two (32) rust resistance genes linked SSR and STS markers were optimised for PCR amplification. Sixteen Markers were optimised, the remaining markers were unable to amplify.
- At ICAR-NIPB, New Delhi, an association panel of 402 chickpea genotypes was constituted to study genes involved in seed protein content. SNP genotyping by GBS provided 31956 SNP markers with an average of 3994 SNPs per chromosome. Genome-wide association mapping identified 23 gene-based SNPs exhibiting significant association that explained 13-18% of phenotypic variance in seed protein content.
- ICAR-IISS, Mau identified the major genes involved in seed shattering in sesame. The genes FRUITFUL, SHAT1, Shattering4, ADPG2 and shatterproof-1 were mapped to sesame chromosomes 8,9,3,5 and scaffold00388, respectively.
- At ICAR-IIRR, Hyderabad, cloning and characterization of a novel blast resistant gene *Pi68* for leaf and neck blast was transformed to susceptible genotype.
- At ICAR-DRMR, Bharatpur, one hundred thirty-eight (138) germplasm accessions of yellow sarson were characterized with 25 SSR markers.
- 2-methyl-1,4-Benzenedicarboxaldehyde, N, N-dimethyl-, 4-isopropylphenyl ester and 3,5-bis (1,1-dimethylethyl)- 4-hydroxy-, methyl ester identified as two key metabolites involved in conferring resistance to root knot nematode resistance in *Psidium guajava* (susceptible) and *Psidium cattleianum* (resistant).
- At ICAR-IIOR, Hyderabad, a major QTL (*QUc-Ct3.1*) for tolerance to aphid in safflower has been validated in different generations of the cross, CO-1 x EC-523368-2
- Plasmocin™ affected cellular activity of porcine mesenchymal stem cells, and thereby, could eliminate *Mycoplasma* from bone marrow derived porcine mesenchymal stem cell (pBM-MSC) culture.
- Genetic characterization of grey donkeys of *Braj* region of Western Uttar Pradesh undertaken using eleven heterologous microsatellite loci.
- Transcriptome analysis for evaluation of meat of *Bandur* sheep. The transcriptional changes in skeletal muscles of *Bandur* sheep were found more prominent during transition of lamb to adult. The gene-protein network demarcated key interactive genes involved in muscle development and proliferation.
- Whole genome methylome data for white and black skin of *Nili Ravi* and *Murrah* buffaloes generated by RRBS, revealed differential methylation regions across the genomic regions. Genes like Bcl2, ASIP, KIT, KITLG, DTNBP1 were identified potentially regulating the skin pigmentation.

- BHK21 cells were genetically manipulated by CRISPR/Cas9-mediated genome editing to knockout a cellular protein-PFAS. These PFAS knock out cells are least sensitive to FMD virus propagation, suggesting a virus supportive role of PFAS.
- ICAR-IASRI has developed a new hybrid model (NBPF-CROS) based on parametric and non-parametric statistic for the identification of DE-genes (differentially expressed). The performance of NBPF-CROS model was compared with NBP, FCROS, edgeR and DESeq2 models using synthetic and real RNA-Seq datasets and it was found that the developed model NBPF-CROS is more robust as compared to the other models.
- Salt tolerant plants have recently been a source of attraction for exploring the survival and tolerance mechanisms at extreme saline conditions. ICAR-CSSRI, ICAR-IASRI and ICAR-NRRI jointly offered the first report of comprehensive transcriptome profiling of the grass halophyte *Urochondra setulosa* under increasing salt concentrations. Examining non-model organisms that can survive in harsh environment can provide novel insights into the stress coping mechanisms which can be useful to develop improved agricultural crops. Additionally, this study identifies potential genes involved in salt tolerance in STGs which can be used as donors for other halophytes or grasses such as cereal crops.

Conservation and Management of Genetic Resources:

- One thousand eight hundred and thirty-seven (1837) accessions were added to the National Genebank bringing the Genebank holdings to a total of 452212. Additionally, regenerated material (785 accessions) was added to long-term conservation. Twenty-seven (27) samples along with the proposals for release of varieties were received for long-term conservation. Seed health testing of 1217 accessions was carried out for its pest free conservation in National Genebank and 1209 accessions were approved for conservation by the NBPGR, New Delhi.
- The current holding status of *In vitro* Genebank is 1927 accessions and that of Cryo bank is 14130 accessions at NBPGR, New Delhi.
- Current status of National Genomic Resource Repository at ICAR-NBPGR, New Delhi is 9044 samples belonging to 46 species.
- At ICAR- NBPGR, New Delhi, a total of 2374 accessions of imported exotic germplasm were processed for quarantine clearance and all were released to the indenters. Major interceptions made were that of *Aphelenchoides besseyi* in *Oryza sativa* imported from the Philippines and *Phomopsis phaseolorum* & *Colletotricum gleosporoides* in *Luffa acutangula* & *L. cylindrica* imported from Thailand. A total of 5481 accessions to be exported, were processed for quarantine clearance and 5411 were released. Six (6) phytosanitary certificates were issued.
- Two thousand eight hundred and eighty-seven (2887) accessions of various crop species namely cereals (1017), grain legumes (67), oilseeds (273), millets (50), vegetables (1407), fruits (3), fibres (4), medicinal plants (5) and spices (61), were introduced from 10 countries. The major promising accessions that were imported include Soybean (EC1075826) from USA- high-yielding, conventional, late maturity group III germplasm line that brings in new genetic diversity and wild species in Sesame (1075822-24; 1076106-1076132) from Kenya.
- Fifty (50) herbarium specimens were added to the National Herbarium of Cultivated Plants bringing the holdings to a total of 24,583 herbarium specimens.

- At ICAR-IARI, New Delhi, 500 new specimens were added to 1.4 million insect specimens preserved in the institutes' "National Collection of Insect Specimens".
- A total of 430 accessions (4,114 cultures) of various vegetative propagated crop species were sub cultured at ICAR-NBPGR, New Delhi for maintenance. Eleven (11) accessions including *Musa* sp. (ABB) (1), *Malus* sp. (1), *Pyrus* sp. (2) and *Prunus* spp. (7) were added to *in vitro* genebank (IVAG). Four accessions including *Citrus* spp. (2), *Elaeis guineensis* (1) and *Ziziphus mauritiana* (1) seeds were cryobanked.
- A total of 12 elite types of wood apple (*Feronia limonia*) from Karnataka; three new germplasm accessions of sweet potato from Tamil Nadu & Kerala; & six accessions of Country potato from Kerala and Tamil Nadu) were collected.

Whole genome sequencing and GenBank Accessioning of the following virus isolates

- Lumpy skin disease virus isolate- LSDV/Cattle/India/2019/Ranchi-1, complete genome.
- Buffalopox virus isolate-BPXV/buffalo/India/2011/Meerut-1/P0, complete genome.
- Buffalopox virus isolate- BPXV/buffalo/India/2011/Meerut-1/Control/P40, complete genome.
- Buffalopox virus isolate- BPXV/buffalo/India/2011/Meerut-1/CGP57380/P40, complete genome.
- Jaagsiekte sheep retrovirus, isolate-JSRV/Sheep/India/2020/Tonk-1, complete genome.
- Newcastle disease virus isolate-NDV/India/2015/Hisar/Control/P70, complete genome.
- Newcastle disease virus isolate-NDV/India/2015/Hisar/P0, complete genome.
- Newcastle disease virus, isolate- NDV/India/2015/Hisar/Thapsigargin/P70, complete genome.

Management of Natural Resources:

- Developed CSR GROMOR - a bio-consortia comprising of highly efficient salt tolerant bacteria strains viz. CSR-M-16 (*Bacillus licheniformis*), CSR-A-11 (*Lysnibacillus fusiformis*), and CSR-A-16 (*Lysnibacillus sphaericus*) for enhancing crop productivity in sodic soils up to pH 9.0.
- Developed organic farming package for rice-wheat system with improved varieties of rice (*Pusa Sugandha* (PS3)) and wheat (HI1418) giving higher rice equivalent yield (7230 kg/ha), net return (Rs. 140935/ha) and B:C ratio (2.09) under organic production system for Jabalpur, Madhya Pradesh.
- In sandy loam soil of Sri Ganganagar, drip irrigation at 0.8 ETc and fertigation with 75% N, P & K with no basal application to bottle gourd (var. *Arjun*) resulted in 28.5% higher yield, 38.1% higher water use efficiency and 25% fertilizer saving over surface irrigation and application of recommended dose of fertilizer (N: P₂O₅:K₂O kg/ha -100:40:40).
- Cotton based integrated farming system model was developed by ICAR-CICR, Nagpur for rainfed conditions of Nagpur. Field crops (cotton, pigeon pea, soybean, chick pea) were integrated with inclusion of vegetables, fruit crops, poultry, and goat as components. The IFS system produced cotton equivalent yield (CEY) of 70.2 q/ha cotton with net profit of Rs. 1.89 lakhs and B:C ratio of 1:95.
- ICAR-IIRR, Hyderabad isolated a rare actinobacteria (*Amycolatopsis orientalis*) from the endophytic niche of N22 which was found to possess plant growth promoting traits viz., IAA production (49.65 µg IAA/ml) and ACC deaminase activity (4.25 µg α ketobutyrate/ml/24hrs).

- A process for preparing compost using sugarcane bagasse and wheat straw with excellent spawn run for white button mushroom was standardized.

Livestock, Poultry & Fish Health:

- A total of 3915 samples of poultry, ducks, crows, wild birds and environment were received from 10 States/UTs. Highly pathogenic Avian Influenza viruses (H5N1 and H5N8 subtypes) were detected in 5 States, viz., Himachal Pradesh, Jammu & Kashmir, Maharashtra, Punjab and Rajasthan.
- Serum samples/ Nasal Swabs/faecal samples of 12 imported Mini pigs received through AQCS were screened for Porcine Reproductive and Respiratory Syndrome (PRRS), African Swine Fever (ASF), Swine Influenza, Porcine Epidemic Diarrhoea (PED), Transmissible gastroenteritis (TGE) and pseudorabies and all were found negative.
- Fourteen samples of cattle were tested for Lumpy skin disease from Anand district of Gujarat and two samples were found positive.
- A total of 2053 equine samples from four states namely Uttar Pradesh, Madhya Pradesh, Haryana and Uttarakhand were tested for Glanders. Out of which, 23 equines were found positive from Uttar Pradesh (n=22) and Madhya Pradesh (n=1).
- A total of 26,436 serum samples collected from field from different states were tested using SPC-ELISA for measuring anti-FMDV structural antibody. Besides, 1100 serum samples from organized government farms were tested.
- A total of 7 FMD virus serotype O isolates were sequence determined at VP1 coding region. The analysis revealed clustering of serotype O in O/ME-SA/Ind2001e sub-lineage.
- National FMD Virus repository was updated with 3 serotype Asia1 and 2 serotype A viruses.
- During this period, a total of 8180 bovine samples were tested by DIVA ELISA to assess NSP prevalence. In addition to it a total of 2898 sera from small ruminants and 518 sera samples from pigs have been tested for NSP-antibody.
- SPCE kit for testing of 13500 serum samples (Telangana, Punjab and Jammu), DIVA kit for testing of 6800 serum samples (Manipur, Assam and Karnataka), were supplied to carryout sero-monitoring and sero-surveillance under NADCP, and serotyping kit for 100 samples was supplied to Manipur.
- The disease outbreaks data from 516 districts and 120 villages in the country updated in the NADRES database.

Integrated Pest Management:

- At ICAR–VPKAS, Almora, the plant extract of *Urtica dioica* at 5% concentration was found to be highly effective with growth inhibition of more than 35% on garden pea wilt pathogen (*Fusarium oxysporum* f.sp pisi).
- At ICAR-IARI, New Delhi, the evaluation of biomixtures for removal of atrazine and fipronil resulted that Rice husk was more effective than the bagasse ash in increasing atrazine adsorption and adsorption increased with increasing ash/biochar content.
- To know the pathotype distribution pattern, more than 150 samples of three wheat rusts and barley yellow rust were received by ICAR-IIWBR, Karnal. During April, 2021; 60, 18 and 31 samples of brown, yellow and black rust, respectively, were analyzed. Four pathotypes of wheat yellow rust (46S119, 110S119, 6S0, and 238S119), four pathotypes of wheat brown rust (77-5, 77-9104-2, and 104A) and four pathotypes of wheat black rust (11, 40A, 40-2, and 40-3) were identified in these samples. Pathotypes 77-9, 11 and 238S119 of brown, black and yellow rusts, respectively, were most frequent in these samples.

- ICAR-NRRI, Cuttack reported first time that *Fusarium proliferatum* can cause sheath rot disease of rice in eastern India. The pathogenicity was confirmed by satisfying Koch's postulates.
- Five potato varieties Viz. Kufri Badshah, Kufri Chandramukhi, Kufri Gaurav, Kufri Himalini and Kufri Jyoti, were observed highly sensitive to the toxin Thaxtomin-A produced by *Streptomyces scabies* associated with black to brown necrosis and deep pit formation on potato tubers.

International Cooperation/recognition

- An International Symposium on Advances in Plant Biotechnology and Genome Editing (APBGE-2021) organised by ICAR-IIAB, Ranchi during Apr. 8-10, 2021 through virtual mode. More than 450 registered participants from across India and nine other countries participated.

Farm Implements, Machinery and Post-harvest Technologies Developed:

- Peanut protein isolates enriched "High Protein Soft Atta" was developed which provides 55% of daily requirement of quality protein besides superior dough quality.
- Developed post-harvest technology of fried savouries from quinoa and pearl millet.
- Designed and fabricated pilot plant for extraction of oil from mango kernel flour.
- Fabricated pilot plant for mahua flower candy and nectar.
- Fabricated the modified solar operated PCM based push cart.
- Garlic harvester for raised beds.
- Fabricated baby corn dehusker.
- Developed a robotic transplanter for planting seedlings
- Designed FRP pedal boat having length 3.0m, breadth 0.95m and depth 0.35m for inland water fishing which does not require any fuel.
- Developed improved manual multi row seed drill for jute and other small seeded upland crops.
- Protocol optimized for the production of "peanut protein isolates" that gave 90% protein recovery with 70% yield.
- Technology process to produce vinegars from coconut water and coconut inflorescence sap was standardized.

Farmers/Public Outreach:

- Frontline demonstrations on oilseed and pulses were taken up all over the country covering an area of 11584.64 ha and involving 27776 farmers.
- Organized 655 field-days with the participation of 24380 farmers and 513 *Kisan Goshies/Melas* with the participation of 33537 farmers.
- A total 2785 training courses for 66385 farmers, 371 trainings for 5809 rural youths and 260 trainings for 5759 extension functionaries and in-service personnel were organized in the frontline areas of technology development.
- KVK scientists undertook 27977 visits to the farmers' fields for diagnosing various problems and to sensitize them on location specific recommendations during the month.

- In *Mera Gaon Mera Gaurav* program, 522 scientists visited 665 villages and organized 1725 demonstrations benefitting 24542 farmers. A total of 9035.46 quintals of seed and 17.74 lakh planting materials were also distributed to 7824 and 90204 farmers respectively.
- A total of 17582 improved germplasm of diversified poultry species distributed to 18 beneficiaries belonging to 2 states (UP and UK).
- A total of 1000 virus disease-free plants of citrus were distributed for bringing new area under disease free orchard.
- The major precautionary measures during the month of April are to protect the birds from heat stress and vaccinate birds against New Castle disease and other diseases issued by ICAR-DPR, Hyderabad.
- ICAR-NRC on Pig advised farmers to procure pigs/piglets from known sources having disease free status. It is also advised to screen the pigs against the important diseases such as Classical Swine Fever (CSF), Porcine Respiratory and Reproductive Syndrome (PRRS), Foot and Mouth Disease (FMD), Porcine Circo Virus (PCV2), Porcine Parvo Virus (PPV) and Brucella prior to their introduction in the existing herd.
- Advisories for Veterinarians and Farmers with respect to African Swine Fever (ASF) issued and hosted in the institute website (www.nrcp.in)

Use of Space Technology & Agromet Advisories:

- A spatial wheat yield prediction prototype framework was developed at ICAR-IARI, New Delhi wherein remote sensing derived leaf area index on multiple dates were assimilated in the crop simulation model Info Crop to improve the accuracy of prediction using different assimilation techniques. Provision was also made to make use of weather forecast in the framework. The prototype framework showed a decrease in error in wheat yield prediction from 20% to 7%. Further efforts were made to develop a Graphical User Interface (GUI) in Python for the prototype framework.
- Agro-met advisory bulletins were prepared by IARI, New Delhi every Tuesday and Friday. During March 20 – April 19, 2021, a total of 9 agro-advisory bulletins were prepared in Hindi as well as in English and SMSs sent to the farmers through farmers Kisan portal. These advisories are sent to IMD for preparation of national bulletins and uploaded on the IMD website (www.imdagrimet.gov.in) in both Hindi and English. These advisories and real time weather data along with medium range weather forecast was uploaded on the IARI website (www.iari.res.in). E-Atlas on inland waterbodies of 18 States of India is made available for public use through Institute website (<http://cifri.res.in/UR/ls/index.html>).
- A unique satellite data reception centre has been established in the Division of Agricultural Physics, ICAR-IARI, New Delhi. These data are being used for monitoring crop health and drought condition in all the districts of the country. This information is regularly updated in the webportal <http://creams.iari.res.in>, which is available to all stakeholders for their own decision making

Other important activities:

- ICAR-CIFA organized National Virtual Stakeholder Consultation on *Indian Ornamental Fisheries 2.0 - The way forward* in collaboration with Department of Fisheries, Ministry of Fisheries, Animal Husbandry and Dairying and National Fisheries Development Board

during April 22-24, 2021. Hon'ble Minister, Shri Pratap Chandra Sarangi graced the occasion as the Chief Guest.

- At ICAR-SBI, Coimbatore, a Juice Quality Analytical Programme (JAP) was developed in Microsoft Visual Studio Professional 2017 in C# to estimate juice quality parameters.
- Data-base of around 1300 farmers uploaded by ICAR-IISR, Mau in Seed Direct Benefit Transfer (Seed DBT) on seed net India Portal of Ministry of Agriculture and Farmers Welfare, Gol (with details of name, address, gender, mobile, UID number etc. along with subsidy details).
- State-of-the-Art Aqua-Climate Laboratory was inaugurated on 27th April 2021 at the ICAR-Central Institute of Brackishwater Aquaculture, Chennai. The Laboratory houses State-of-the-art equipment, viz., Greenhouse Gases Analyser, CHNS Analyser, Carbon Fractions Analyser, Ion Chromatograph and shall support advance research in aquaculture to address the climate change issues.
- Animal Science Institutes viz. IVRI, Izatnagar, NISHAD, Bhopal and NRC on Equines, Hisar screened 34,127 human samples for COVID 19 during April, 2021 taking the cumulative tests up to 4,98,997 human samples for COVID 19 till the end of April 2021.