



ICAR-CIAE NEWSLETTER

Vol. 33, No. 2
April-June, 2023



Sardar Patel Outstanding ICAR Institution 2020

<https://ciae.icar.gov.in/>

@CIAE, Bhopal

subscribe our YouTube channel

@ICAR_CIAE

From the Director's Desk



Nowadays, applications of mechatronics, sensors, IoT, AI etc. in agriculture have become inevitable. In order to map variability across the agricultural fields and apply agricultural inputs effectively, drones can be one of viable options. The applications of drones in agriculture have opened up a new horizon to increase the agriculture outputs and real-time access to high-quality information. Crop monitoring has become a simple task with the emergence of drone based data collection, replacing the traditional labour-intensive and time-consuming data collection. Drones can assist in precision agriculture by performing various agricultural tasks including soil health scanning, seed planting, fertilizer application, crop stress management, irrigation scheduling, weed management, crop yield estimation and weather analysis. Drones with infrared, multi-spectral, and hyper-spectral sensors can analyse crop health and soil

conditions precisely and accurately. Spraying drones can help to reduce operator exposure while also improving the capacity to distribute chemicals in a timely and spatially resolved manner. The plethora of drone based applications in agriculture on spatio-temporal scales make it a promising futuristic technology to address the challenge of growing food insecurity. Overall, drones have become indispensable tools in modern agriculture, facilitating precision farming, data-driven decision-making, resource optimization, and more sustainable agricultural practices, which are critical in meeting the growing global demand for food production while minimizing environmental impacts.

For promotion of use of Kisan Drones, Government of India is providing financial assistance @ 100% of the cost of drone up to a maximum of Rs. 10 lakhs per drone under Sub-Mission on Agricultural Mechanization (SMAM) for purchase of drones for their demonstration by institutes under ICAR, Farm Machinery Training & Testing Institutes, KVKs, SAUs, State and other Central Government Agricultural Institutions/Departments. Standard Operating Procedures (SOPs) which provide concise instructions for effective and safe operations of drones for pesticide and nutrient applications have been released by GoI. The awareness among farmers is being created through demonstration and capacity building programmes.

ICAR-CIAE, Bhopal has developed a state-of-the-art Drone Systems Laboratory (DSL) to conduct basic study, design, and testing of drone application technologies. The DSL facility is equipped with instruments, simulation platform, patterator and drones enabled with spraying, broadcasting, and RGB-multi-spectral camera system. The institute is engaged in research in drone spraying systems and droplet deposition characteristics, image based yield estimation in horticultural crops using deep learning method, irrigation water scheduling, etc. The institute is also conducting experiments to formulate standard operating parameters (SOP) for use of drones for different chemicals and nutrients applications for various field crops. The institute is also involved in promotion of drone technology in farmer's fields of Bhopal and other districts of Madhya Pradesh. The outputs of CIAE innovations will propel drone technology to address the complex challenges, fostering safer operations, optimizing applications, and contributing to sustainable and efficient solutions in agricultural operations.

This issue of the newsletter focuses on research and development of farm equipment and machinery like Remote control site-specific chemical applicator for field crops, Tractor operated turbo bund former for mulched fields, Power operated two row rice transplanter for root wash seedlings, Biomass based hot air generation system, Agro-residues based bio-sorbent for the treatment of Bulk Milk Chiller (BMC) effluents etc. A number of MoUs were signed in this quarter. In this quarter, two HoDs joined at the Agro Produce and Processing and Agricultural Mechanization Divisions of the institute, while one Project Coordinator joined at AICRP on Utilization of Animal Energy. Quinquennial Review Team (QRT) visited ICAR-CIAE, Bhopal and centres of AICRP schemes FIM, UAE, ESA and EAAI and CRP on FMPF and EA to conduct review during this quarter. Three staff members were promoted and six colleagues superannuated in this quarter as well.

DIGEST

| | |
|---|-------|
| Drone spraying system..... | 2 |
| Power operated rice transplanter for root wash seedlings..... | 3 |
| Food by-products based food grate coagulant mixture..... | 5 |
| Assessment of impact of EDP on soybean processing | 6 |
| Signing of MoUs..... | 9 |
| Publications..... | 11-13 |
| Coimbatore centre gets Regional Centre status..... | 14 |
| News from personnel..... | 16-17 |

As Director, ICAR-CIAE, I am happy to share this Newsletter for this quarter.

RESEARCH & DEVELOPMENT

Evaluation of spray droplet deposition characteristics of unmanned aerial vehicle simulation platform

The drone simulation platform provides a virtual environment for testing and optimizing drone spraying system. The platform can be used for evaluation of flow rates, spray patterns and droplets depositions characteristics of different nozzles. This system helps to study the effect of different operational parameters of drones such as speed, height, nozzle discharge rate and propeller rpm on droplets deposition. The system has been evaluated at different operating heights, discharge rates, propeller rpms and speeds. Before conducting the experiment, the spraying system has been calibrated at different settings of pump control valve. Speed and propeller sensor such as optical and magnetic sensor have also been calibrated. The water sensitive papers were placed at top and bottom sections of the plants. The spray droplets characteristics has been recorded at water sensitive paper and scanned in 600 dpi. The scanned images are processed in ImageJ software and Excel data are recorded. The effect of operating parameters has a significant effect ($p < 0.05$) on droplets characteristics. Spray coverage (%) increased with an increase in application rate, however, it decreased with an increase in operating height and speed. Droplet density (droplets/cm²) increased with an increase in application rate, however, it decreased with increase in operating height and speed. The volume median diameter (VMD), coverage, droplets density and deposition of spray are in the range of 200-650 μm , 5-25%, 44-150 dots/cm², 0.3-0.8 $\mu\text{L}/\text{cm}^2$ for the plants leaf surface in the experiment.

**Remote control site-specific chemical applicator for field crops**

Remote control site specific chemical applicator for field crops has been modified with new version of four wheel drive mechanism for improved traction by the AICRP on FIM, Bapatla. Two 24 V batteries are used for driving both DC motors placed at left and right wheel driving system.

An alternator and 0.75 kW petrol engine is used to charge the two batteries placed for supplying power to the DC motor for continuous working. A separate 24 V battery is used for supplying power to the plant detection system (PDS) and remote control unit. A chemical tank of 20 litre capacity and two sheet metal boxes covering four solenoid valves, DC pump and

RESEARCH & DEVELOPMENT



electronic circuit boards are placed on top frame. A spray boom section is mounted at the rear end. Field evaluation of applicator has been carried out in chilli crop at the farmer's field, Bapatla. The ultrasonic sensors are adjusted in the range of 300 - 650 mm to have uniform detection range during trial. The average discharge of the boom is 0.653 l/min at 2.34 km/h forward speed. The actual field capacity and field efficiency are 0.28 ha/h and 63.5%, respectively. The developed remote-control unit works satisfactorily in reducing the risk of exposure to harmful chemicals during spraying by the operator. The cost of operation of sensor-based chemical applicator in chilli crop is 125 Rs/h.

Tractor operated turbo bund former for mulched fields

AICRP on FIM (PAU, Ludhiana centre) has developed and evaluated a tractor operated bund former for mulched fields. The machine performs three operations simultaneously in one pass viz. straw removal followed by soil pulverization and bund forming in trapezoidal shape. It consists of a mulcher, rotavator and a bund forming unit. The mulcher has a horizontal rotating shaft perpendicular to the direction of travel on which flat flail type blades (without serrations) rotates in vertical plane in a direction parallel to the direction of travel. The blade hits the standing stubble, pick up the stubble as well as loose straw and throws it out ahead of the bund plates on the ground. Mulcher rotor rotates with 1100 rpm in the direction opposite to forward travel of the tractor. It removes the straw from front of the rotavator (1.25 m). The rotavator is having C-type blades (30 blades), arranged in pairs on each side of the flange alternately in staggered position. It pulverizes the soil at 210 rpm. A



rubber flapper is used for separation in between the rotavator and mulcher unit. The bund forming unit is placed at rear of rotavator and consisting of main frame, and a pair of discs facing each other. The discs are kept just behind the rotavator to carry the tilled soil and pile it in form of a bund. The developed tractor operated bund former for mulched fields was evaluated in combine harvested paddy field at Research Farm, PAU, Ludhiana. The performance is superior at rotor speed ratio 4:1 and disc opening width of 200 mm under straw loads of 4.0-4.5 and 6.0-6.5 t/ha. This combination gives optimum height of bund (335 mm), width of bund (770 mm), mean mass diameter (9.9 mm) and fuel consumption (6.0 l/h) under both the straw loads. The effective field capacity of the tractor operated bund former is 1.3 ha/h for 10-12 m bund spacings at field efficiency of 75% and forward speed of 1.5 km/h. There is 78% saving in labour over the conventional bund forming method.

Power operated two-row rice transplanter for root wash seedlings

AICRP on FIM (BAU, Ranchi centre) has developed a DC motor operated two row pull-type rice transplanter for root washed type seedlings. It consists of picking mechanism, transplanting mechanism, power transmission, float assembly, seedling tray, handle and ground wheel. Two DC motors are used as power source for transplanting mechanism and ground wheel. One DC motor has been attached for operations like picking and transplanting mechanism simultaneously through cam shaft assembly with the help of chain and sprocket arrangement. Other DC motor is attached with the ground wheel for easy movement of the machine in the puddled field. Two dry lead acid batteries (12 V, 7Ah) power the motors. A provision has been made to

RESEARCH & DEVELOPMENT



attach/detach the transplanting unit with the ground wheel as per suitability. Boat shaped floats are provided to reduce the draft. Effective field capacity of the transplanter is 0.04 ha/h at an average operating speed of 0.96 km/h, with average field efficiency of 85%. Average visible damage, floating hills and missing hills are 4.5, 9.0 and 10.5%, respectively. Estimated cost of the rice transplanter is Rs. 15,000/- whereas, the cost of transplanting is Rs. 2620/ha, which is 73% less than the traditional method (Rs. 9750/ha) of transplanting.

Biomass based hot air generation system

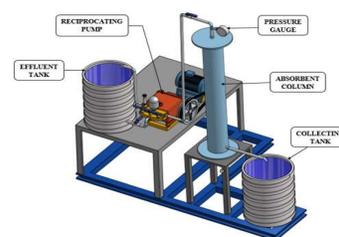
A lot of biomass is generated on the agricultural field and in agro and post-harvest process industries. This biomass can be used for the combustion to extract the hot air for drying applications of agro commodities by harnessing the heat from flue gases. The developed hot air generator is equipped with biomass combustor, heat exchanger and drying chamber. There is a provision for feeding of biomass briquettes manually according to the heat requirement from one side of combustion chamber. The flue gases generated inside the combustion chamber are fed to the heat exchanger (SS 302, 18 gauge) where heat of flue gases transferred to the air entering from ambient. The dried air then passes through the drying chamber to evaporate the moisture of the material. Drying chamber of 25 kg loading capacity has been integrated with hot air generator unit. The developed chamber is having two frames with 20 nos. of SS wire mesh trays and divided into two equal parts. The hot air from inlet enters the upper side and exited from bottom side. The drying chamber is insulated with 50 mm glass wool to avoid the heat loss. The trials have been performed for drying of 11 kg tomatoes in the developed system. After cleaning and



sorting of tomatoes, they are cut into ring size (5mm thick) and spread over the trays of drying chamber. Fifty five kg of biomass fuel has been consumed during the drying process. The moisture content of the tomato was reduced from 95% to 15% in 14 h drying time. Drying temperature has been maintained at 60-65°C inside the drying chamber. Temperature inside the drying chamber has been maintained by controlling feed rate of fuel and regulating the flow of ambient air at the inlet. The drying efficiency has been obtained around 31%.

Agro-residues based bio-sorbent for the treatment of Bulk Milk Chiller (BMC) effluents

AICRP on EAAI (SPRERI, VV Nagar centre) has developed the agro-residues bio-sorbent for the treatment of Bulk Milk Chiller (BMC) effluents. The bio-sorbent has been prepared through pyrolysis of agro-residue under controlled environment. The agro residues such as sawdust, groundnut shell and cotton stalk have potential ingredients for preparation of bio-sorbents. The developed bio-sorbent has been applied for treatment of BMC effluents. Quality of the BMC effluent water in terms of COD (mg/l) has improved (1,300 mg/l to < 250 mg/l) with the help of selected feedstocks. The COD (mg/l) of treated effluents using bio-sorbent prepared from sawdust, groundnut shell and cotton stalk are <250, <250 and 760 mg/l, respectively. This treated effluent has shown the compatibility with the quality water specified by the Central Pollution Control



RESEARCH & DEVELOPMENT/ SUCCESS STORY

Board (CPCB), Ministry of Environment, Forest and Climate Change, Govt. of India and Food and Agriculture Organization, United Nation. The treatment using developed bio-sorbent through adsorption process is capable to convert the BMC effluent into the irrigation quality water. The cost of bio-sorbent prepared through pyrolysis of agro residues is 33% less as compared to the commercially available adsorbent.

Food by-products based food grade coagulant mixture

Tofu or soybean curd, is mainly made by coagulating soymilk. Tofu whey, a by-product of tofu manufacturing, is currently discarded by the food industry. The Tofu whey refuse is highly perishable and needs quick treatment for effective utilisation. A tofu whey-based coagulant powder has been developed using tofu whey and tomato (TWTP). A tofu whey-tomato based hydrolysate mixture is prepared using overnight fermented tofu whey. Damaged tomatoes are washed and ground in fermented tofu whey to make a slurry, which is further incubated for 7-8 hours at 25° C. Titrable acidity, pH, and other physiochemical parameters have been analysed during fermentation and incubation. TWTP has been dried in an oven at 55°C for 48 h, then ground with a grinder. The powders obtained are packed in aluminium pouches and stored at 4° C in the dark until tofu production. Different coagulating conditions (concentrations, time, and temperature) have been used to optimise the coagulating parameters, and the optimal concentration of coagulation (OCC) at different temperatures has been used for soymilk coagulation and tofu preparation. Each soymilk batch has been prepared with coagulant, and the concentration of coagulant powder varied from 0.5% to 5.0% at temperature from 60°C to 95°C. Coagulated batches have been pressed to

make tofu and measured for whey volume, pH, transmittance, tofu yield, and coagulant efficiency. The OCC value has been found to differ with coagulating conditions. The food-grade coagulant mixture has demonstrated optimal coagulation conditions with a concentration of 4%, a temperature range of 92 ± 2 °C, time duration of 8 ± 2 min, and a yield of 1.3 kg/kg soybean. Tofu prepared with tofu whey-tomato based (TWTP) powder is very similar to tofu prepared with citric acid coagulant (a common coagulant) in terms of yield, composition, texture, and other functional parameters.

Success Story

ICAR-CIAE Tractor Operated Cassava Stake Cutter Planter

The tractor operated Cassava stake cutter planter has been developed to form the ridges and to cut the cassava stakes and planting the cassava stakes in raised bed. The planter was extensively tested for its feasibility at farmer's fields in collaboration with KVKs of TNAU, Coimbatore and Sago industry. Farmers' fairs were organized for creating awareness about the implement in the Cassava growing areas of Tamil Nadu with the help of KVKs. The tractor operated Cassava stake cutter planter was released by ICAR-Central Institute of Agricultural Engineering and licensed to M/s Bhansali Agro Tech, Ahmednagar, Maharashtra. The manufacturer had exported 175 number of cassava planters to Cameroon country.



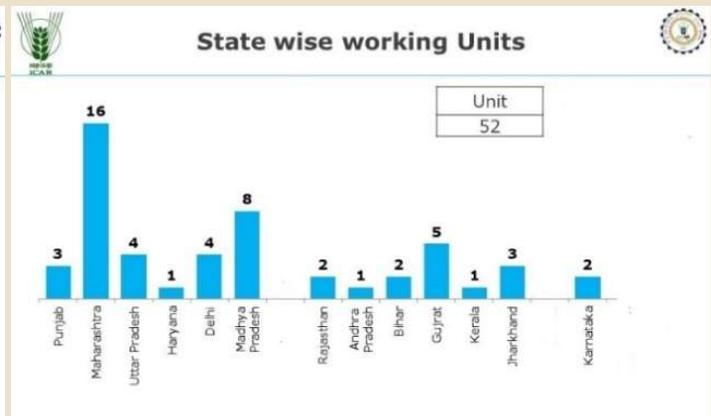
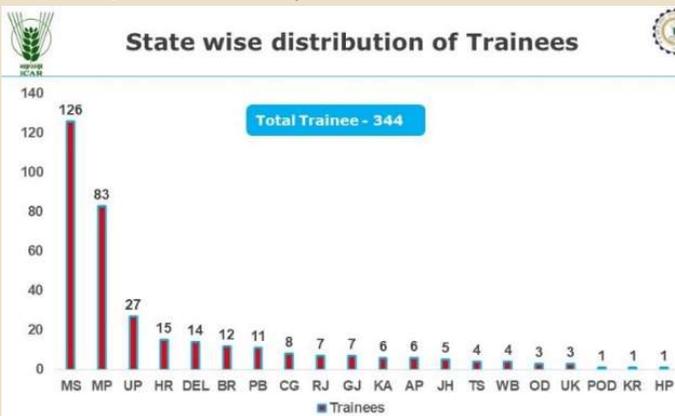
TECHNOLOGY TRANSFER/ TRAINING

Assessment of the Impact of Entrepreneurship Development Programme (EDP) on Soybean Processing

Soybean is a rich source of high quality protein at low cost. Besides nutritional benefits, soybean also possesses many health-promoting factors. Keeping the health and nutritional benefits of soybean into consideration, the Entrepreneurship Development Programme (EDP) on soybean processing was started in the year 1995 at ICAR-Central Institute of Agricultural Engineering, Bhopal. Till February 2017, 167 batches (2,524 participants) underwent the EDP.

From 2017 onwards, 33 regular batches and 3 special batches underwent training with 344 trainees from different states of country. Maximum trainees are from Maharashtra followed by Madhya Pradesh, UP, Haryana, Delhi, Bihar and Punjab.

From 2017 onwards, around 52 soybean processing units have been established. The units are distributed in the different parts of country in 13 states, however, the maximum 16 units are located in Maharashtra.



Trainings Organized

organized jointly by ABI unit and AEP Division of the Institute during 22-26 May 2023 on the topic 'Utilization of biomass for generation of briquettes and pellets'. The training was attended by 23 participants from five states. The five days training focused on the recent technologies implemented for conversion of biomass to

briquettes and pellets. The machineries required, operating process, feedstock characterization, etc. were covered in this training for entrepreneurship development. Both practical and theory classes were organized for the trainees.

Training on 'Computer Aided Design'

Regional Centre, Coimbatore organized Online Training programme on 'Computer Aided Design' during 10 April, 2023 to 9 May, 2023. Total 37 participants from 10 different states across the country attended this training programme. The training programme covered topics like basic sketch tools, extrude features, part modelling, exploded view, evaluation assembly, drawing views annotations, drafting, simulation etc.



TRAINING/ TECHNOLOGY TRANSFER

Training and awareness programmes on soybean

| Sl. No. | Title of the training | Date | No of participants |
|---------|---|---------------------------------------|--------------------|
| 1 | Soy-food training programme for upcoming entrepreneurs | 17-21 April, 2023 12-16 June, 2023 | 7 3 |
| 2 | Online meet with Officials of Bihar Government on awareness of food uses of soybean | 24 April, 2023 | 54 |
| 3 | Online meet with SAU's faculty on awareness of food uses of soybean | 25 April, 2023 | 62 |
| 4 | Awareness programme at Sultanpur, Uttar Pradesh | 18 June, 2023 | 200 |
| 5 | Awareness programme at Barh, Harnaut, Patna and Gaya (Bihar) | 1-5 June, 2023 | 100 |



Demonstration of Drone Technology

A drone demonstration programme was organized on 22 May, 2023 under proposed activities of World Environment Day 2023. Thirty farmers from 11 villages of Bhopal district participated to see the live demonstration of drone spraying system at Institute farm.

Another programme was organized for participants of training programme on 'Engineering technologies for enhancing production and productivity' on 7 June, 2023 in which 14 students participated. A lecture was delivered by Dr. Satya Prakash Kumar, Scientist on drone technology, basic function and its application in agriculture. The function of each component of UAV simulation platform and hexacopter spraying drone was explained in detail.



Participation in Exhibitions

Agri. Horti & Food Tech Expo- 2023 held during 26 - 28 May, 2023, organized by Bharti Media at Bhopal. Around 750 visitors visited CIAE stall.

Kisan Mitra academia and industry workshop for farmers and students, organized by Sagar Institute of Science, Technology and Research in association with Eicher Tractors, Bhopal.



Patent application filed

On 15 June, 2023, patent application for 'Continuous and recirculatory electric-assisted hot air fluidized millet popping machine' was filed.

KVK NEWS

Trainings organized

| Sl. No. | Title of the training | Date | No of participants |
|---------|---|---------------|--------------------|
| 1 | Farmer Producer Organization/ Farmer/ Authorized Seed Dealer: Importance of seed | 22 May, 2023 | 36 |
| 2 | Buyer-seller interaction programme for Farmer Producer Company (FPO), organized by CBBO- Swami Vivekanand Shiksha Samiti (SVSS) Bhopal. | 22 June, 2023 | 17 |

Technologies demonstrated at farmer's field

| Sl. No. | Technology Demonstrated | Villages | No. of farmers benefitted | Area (ha) | Yield (q/ha) |
|---------|---|---|---------------------------|-----------|--------------|
| 1 | Tractor operated broad bed former-cum-seeder for sowing of maize variety JM-218 | Barkhedi Abadulla | 01 | 1.0 | 43.5 |
| 2 | Tractor operated Potato planter for sowing potato variety Kufri Chipsona-1 | Kuthar | 01 | 3.0 | 180.0 |
| 3 | Tractor operated happy seeder | Kalyanpura | 01 | 01 | 6.0 |
| 4 | Tractor operated mulcher | Narela | 01 | 22 | - |
| 5 | Tractor operated reversible M.B. plough | Pipaliya Baz kha | 02 | 12 | - |
| 6 | Groundnut decorticator | Chandpur, Parwaliya sani, Parevakheda and Bhanpur | 06 | - | - |
| 7 | Tractor operated bed maker machine for sowing of maize | Parwaliya sani | 01 | 0.6 | - |
| 8 | Power operated grain cleaner | Lambakheda, Parwaliya sani, Khajuri | 05 | - | - |



TECHNOLOGY TRANSFER/ IP&TM

MoUs signed

| Sl. No. | MoU signed with | Purpose | Date |
|---------|---|--|----------------|
| 1 | Agriculture University, Jodhpur | Joint research, training and consulting services in the field of agricultural engineering and other programmes of mutual interest. | 6 April, 2023 |
| 2 | Indian Institute of Technology, Indore | To extend expertise in farming and agriculture sector by collaborative research work and programmes (training, capacity building and consultancy). | 19 April, 2023 |
| 3 | Department of Agriculture and Farmers' Welfare (DA&FW) and National Committee on Plasticulture Applications in Horticulture (NCPAH) | To develop, refine, validate and use of available innovative technologies of precision farming for the benefit of farmers/growers and to disseminate and demonstrate technologies of precision farming to farmers. | 8 June, 2023 |



MoU with IIT, Indore



MoU with Agriculture University, Jodhpur

Technologies Commercialized

| Sl. No. | Technologies | Name of License/firm | Signing Date of License Agreement |
|---------|--|---|-----------------------------------|
| 1. | Process technology for soya chaap | M/s Vezlay Foods Private Limited, Delhi | 6 June, 2023 |
| 2. | Manually operated pull type three row planter for millets multi-crop (Model – II Vertical plate type) Manually operated push type single row vertical plate planter with fertilizer drill for millet multi-crop | M/s Nabhitha Engineering Private Limited, Hyderabad | 26 June, 2023 |
| 3. | Tractor operated pneumatic dibbler for rice and bold seeds Tractor hydraulic operated front mounted harvester for pigeon pea Instrumented sticky belt set up for evaluation of metering mechanisms Tractor hydraulic operated front mounted harvester for sorghum | M/s Dharti Agro Engineering, Rajkot | 30 June, 2023 |

EXTENSION ACTIVITIES/ AWARDS & RECOGNITIONS

Participation in Electronic Media Programmes

| Name | Date | Title | Media |
|-------------------------|----------------|---|-------------------------------------|
| KV Ramana Rao | 19 April, 2023 | Adoption of plastic mulches for enhancing crop production. | Krishi Darshan, DD Bhopal |
| KV Ramana Rao | 26 April, 2023 | Leafy vegetable production during summer season using shade net structures. | Krishi Darshan, DD Bhopal |
| Dipika Agrahar-Murugkar | 4 May, 2023 | Processing and value addition of coarse grains. | Akashvani (All India Radio), Bhopal |
| KV Ramana Rao | 8 June, 2023 | Off season cultivation of sweet corn under plastic mulching. | Krishi Darshan, DD Bhopal |
| Dipika Agrahar-Murugkar | 9 June, 2023 | Processing and value addition of coarse grains. | DD Bhopal |
| Dilip Jat | 10 June, 2023 | Advanced technologies for land preparation of Kharif crops. | Akashvani (All India Radio), Bhopal |
| MP Singh | 17 June, 2023 | Sowing of kharif crops and importance of seed treatment (live phone-in programme) | Akashvani (All India Radio), Bhopal |

Awards and Recognitions

| Scientist | Awards/ Recognitions | Journal/ Organization |
|--------------------------|--|--|
| Dr. Manish Kumar | Certificate of Excellence for reviewing a manuscript | Journal of Engineering and Research |
| Dr. MKTripathi | Guest Editor | Journal BMC-Microbiology (Springer Nature) |
| Dr. Debabandya Mohapatra | Guest Editor (for a special issue on Storage and shelf life of foods) | Foods |
| Dr. Debabandya Mohapatra | Guest editor (for a special issue on Millet processing and value addition) | Frontiers in Sustainable Food Systems |
| Dr. Punit Chandra | Soy based Researchers of the year 2023 | Soy Food Processors Welfare Association |

Human Resource Development

| Name and Designation | Training Title | Duration | Venue/ Place |
|--|--|------------------|----------------------------------|
| Dr. Muzaffar Hasan, Scientist | Laboratory Quality Management System and Internal Audit as per IS/ISO/IEC 17025:2017 | 6-9 June, 2023 | Bureau of Indian Standard, Noida |
| Dr. M Muthamil Selvan, Principal Scientist | Management Development Programme on Leadership Development (A pre -RMP programme) | 12-23 June, 2023 | ICAR-NAARM, Hyderabad |

PUBLICATIONS

Research Papers

Chakraborty SK, Subeesh A, Potdar R, Dubey K, Chandel NS, Jat, D and Shelake, PS. 2023. AI-enabled farm-friendly automatic machine for washing, image-based sorting and weight grading of citrus fruits: Design optimization, Performance evaluation and Ergonomic assessment. *Journal of Field Robotics*. DOI: 10.1002/rob.22193.

Hasan M, Meena NL, Krishnan V, Rudra SG. and Dahuja A. 2023. Impact of Storage on Probiotic Viability, Nutritional and Sensory Quality of Fermented Soymilk Produced from Different Soybean Varieties. *Legume Research*. doi:10.18805/LR-5051.

Jat D, Dubey K, Potdar RR, Chakraborty SK, Kumar SP, Chandel NS, Rajwade YA and Subeesh A. 2023. Development of an automated mobile robotic sprayer to prevent workers' exposure of agro-chemicals inside polyhouse. *Journal of Field Robotics*. <https://doi.org/10.1002/rob.22181>.

Jat D, Imran S and Chethan CR. 2023. Tractor-drawn weeder to manage weeds in garlic grown on raised beds. *Indian Journal of Weed Science*, 55 (1): 79-85.

Jat D, Imran S and Singh KP. 2023. Development and evaluation of garlic harvester for raised beds. *Journal of Scientific & Industrial Research (JSIR)*, 82(05), 493-503.

Kate AE, Tiwari S, Gujar JP, Modhera B, Tripathi MK, Ray H, Ghosh A and Mohapatra, D. 2023. Spotting of Volatile Signatures through GC-MS Analysis of Bacterial and Fungal Infections in Stored Potatoes (*Solanum tuberosum* L.), *Foods*, 12(10), 2083.

Kumar M, Bej G and Pandey HS. 2023. Status and scope of automated coconut harvester in India: a review. *Journal of Experimental Agriculture International*, 45(5): 1-15.

Kumar M, Chandel NS, Singh D and Rajput L S. 2023. Soybean disease detection and segmentation based on Mask-RCNN algorithm. *Journal of Experimental Agriculture International*, 45(5):63-72.

Kumar M, Mehta CR, Agrawal KN and Tripathi MK. 2023. Optimization of operating parameters for spraying

microbial (*Bacillus thuringiensis* and *Beauveria bassiana*) based bio-pesticide solutions for foliar application, *International Journal of Pest Management*, DOI: 10.1080/09670874.2023.2213183.

Kumar M, Mehta CR, Agrawal KN and Tripathi MK. 2023. Optimization of operating parameters for spraying microbial (*Bacillus thuringiensis* and *Beauveria bassiana*) based bio-pesticide solutions for foliar application, *International Journal of Pest Management*, DOI: 10.1080/09670874.2023.2213183.

Kumar M, Selvasekaran P, Chidambaram R, Zhang B, Hasan M, and Ryszard A. 2023. Tea (*Camellia sinensis* (L.) Kuntze) as an emerging source of protein and bioactive peptides: A narrative review, *Food Chemistry*. <https://doi.org/10.1016/j.foodchem.2023.136783>.

Kumar N, Din M, Agarwal KN, Kumar M, Kumar M and Singh D. 2023. Effects of moisture content and stem diameter on mechanical properties of chickpea Plants for harvester development. *Legume Research*, 1-7 (online publication).

Kumar V., Singh KP, Mangaraj S, Chandel NS, Kumar M, and Singh K. 2023. Study of Advanced Techniques to Predict the Soil Properties. *International Journal of Environment and Climate Change*, 13(5), 69-74.

Lalita, Giri SK and Wahid A. 2023. Refractance window drying vis-à-vis osmotic and hot air drying of Indian Gooseberry: Comparison of Quality Attribute and Microstructural Changes. *Biological Forum – An International Journal*, 15(5):17-20.

Magar AP, Nalawade SM, Walunj AA, Khadatkar A, Bhangare SC, Bhalekar MN, Nibalkar CA and Gaikwad BB. 2023. Engineering properties of some plug-type vegetable seedlings for development of automatic vegetable transplanter. *Journal of Agricultural Engineering (India)*, 60(1):1-13.

Mahore A, Singh KP, Jyoti Bikram, Kumar Manoj, Patel Abhishek. 2023. Development of Grooved Belt Type Fertilizer Metering Mechanism for Spot Fertilizer Applicator. *International Journal of Environment and Climate Change*, 13 (4): 242-250.

PUBLICATIONS

Mandal S, Sharma, RK and Bhattacharya, TK. (2023). Deriving fuel from pine needles through pyrolysis, charring and briquetting and their GHG emission potential, *Current Science* 124 (10):1210-1215.

Mangaraj S, Ali, N and Nishad, P. 2023. Contribution of Agricultural Engineering Research and Development in Production and Post-Production agriculture of India since Independence: Status and Future Perspectives. *Agricultural Engineering Today*, 46(4), 23- 32.

Mangaraj S, Thakur RR, and Nishad P. 2023. Design of a modified atmosphere packaging for apple using concept of mathematical modeling for phytochemicals stability and shelf life enhancement. *Journal of Food Process Engineering*, e14285. <https://doi.org/10.1111/jfpe.14285>.

Pandey HS, Tiwari GS and Sharma AK. 2023. Design and development of an e-powered inter row weeder for small farm mechanization. *Journal of Scientific & Industrial Research (JSIR)*, 82, 671-682.

Pandirwar AP, Pandey HS, Magar AP, Shirale AO, Singh D, Majumdar G and Mandal S. 2023. Physical, chemical, thermal, and mechanical properties of cotton stalk: an industrial multi-purpose cotton by-product, *Journal of Agricultural Engineering*, 60(2):188-204. DOI: 10.52151/jae2023602.1807.

Potdar RR, Tiwari PS, Singh D, Kumar M, Roul AK, Jyoti B, Pandirwar AP and Chethan CR. 2023. Development and performance evaluation of herbicide applicator-cum-planter to manage weeds in soybean, 55: 174-180 . DOI: <http://dx.doi.org/10.5958/0974-8164.2023.00031.X>.

Rao KVR, Rajwade YA, Verma NS, Yadav D and Nangia V. 2023. Techno-economic feasibility of soybean based cropping systems under varying climates in Madhya Pradesh. *Journal of Agrometeorology*. 25 (2): 300 – 304. <https://doi.org/10.54386/jam.v25i2.1737>.

Sahay CS, Thorat DS, Kautkar SS, Patil AK, Pathak PK. 2023. Grass seed harvesting - methods, machines and aspects. *Research Journal of Agricultural Sciences*, 14(2): 512-515.

Sakare P and Giri SK. 2023. Color change kinetics of lac dye as influenced by some food spoilage metabolites: validation for spoilage monitoring of strawberries. *Pigment and Resin Technology*, DOI- 10.1108/PRT-12-2022-0151.

Sawant CP, Bikram Jyoti, BB Gaikwad, Nilesh Gaikwad, Neeraj Kumar, Manoj Kumar. 2023. Optimization of operational parameters of site-specific pesticide spray module for young pomegranate orchards using RSM and RBFNN-PSO techniques. *Biosystems Engineering*: 1-17.

Selvan SS, Mohapatra D, Kate A, Kar A, and Modhera B. 2023. Mapping and analysis of volatomes from pearl millet (*Pennisetum glaucum* L.) grains during different storage conditions with solid-phase micro-extraction-gas chromatography-mass spectrometry. *Cereal Chemistry*. DOI: doi.org/10.1002/cche.10693.

Shelake PS, Mohapatra D, Giri SK and Chakraborty SK. 2023. Dissociation Kinetics of Gaseous Ozone in Onion (*Allium Cepa* L.) Bulbs. *Ozone: Science & Engineering*, doi: 10.1080/01919512.2023.2195437.

Singh RK, Gupta A and Kumar M. 2023. Water management for supplemental irrigation based on rainfall characteristics of Ranchi district, India. *Indian Journal of Soil Conservation*, 51(1): 41-49.

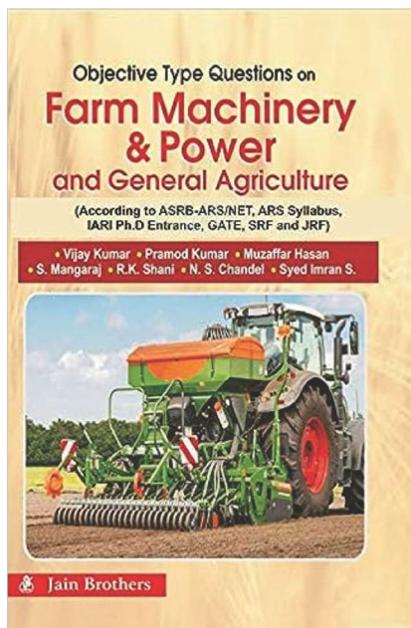
Singh, SK, Chowdhury A, Thakur RR, Mangaraj S, Sami R, Aljahani AH and Helal M. 2023. Development and characterization of polyvinyl chloride/poly lactic acid blend based biodegradable polymeric films. *Materials Express*, 13(4), 632-643.

Vijay Kumar, Singh KP, Mangaraj S, Chandel NS, Kumar Manoj, Singh Karan. 2023. Study of advanced techniques to predict the soil properties. *International Journal of Environment and Climate Change*, 13 (5), 69-74.

Waghaye A M, Singh D K, Sarangi A, Sena D R, Sahoo R N, Sarkar S K. 2023. Identification of suitable zones and sites for rainwater harvesting using GIS and multicriteria decision analysis. *Environmental Monitoring and Assessment*, 195: 279. <https://doi.org/10.1007/s10661-022-10801-6>.

PUBLICATIONS

Book



Vijay K, Kumar P, Hasan M, Mangaraj S, Sahni RK, Chandel NS and Imran S. 2023. Objective Type Questions on Farm Machinery & Power and General Agriculture-second edition. Jain Brothers ISBN 978-81-944137-0-7, pp 400.

Book Chapters

Garg NK, Maheshwari C, Hasan M, Kumar A, Bisen J, Prajapati RK, Meena ND and Gupta OP. 2023. Effects of storage conditions on nutritional quality of wheat. DOI: 10.1201/9781003307938-8. pp. 12.

Kumari A, Meena NL, Pratap V, Singh JP, Hasan M, Maheshwari C, Kumar R, Gupta OP and Tyagi A. 2023. Molecular mechanisms of major bioactive compounds for human health benefits. DOI: 10.1201/9781003307938-9. pp. 15.

Sahni RK and Khot LR. 2023. Fixed spray systems for perennial specialty crops. In: Zhang, Q. (eds) Encyclopedia of Smart Agriculture Technologies. Springer, Cham. (ISBN: 978-3-030-89123-7), https://doi.org/10.1007/978-3-030-89123-7_195-1.pp.5.

Popular Articles

Arunkumar R, Hemaprabha G, Vasantha S, Arumuganathan T, Hari K, Senthilkumar T, Sadvatha RH, Dawn CP Ambrose, Manikandan C, Lakshmi K, Suresha G,

Govindraraj P, Sreenivasa V, Palanisamy C, Gomathi R, Appunu C, Mahesh P, Yogambal C, Krishnapriya V, Tayade AS, Alagupalamuthirsolai M and Vinanyaka. 2023. Rapid Assesmemnt of Rind hardness in sugarcane and its association with biochemical Traits. International Journal of Environment and climate change, 13(8): 2019-2031.

Khadatkar A, Magar AP, and Sawant CP, 2023. Need for automation in vegetable transplanter for Indian agriculture. Indian Farming, 73 (02):31-34.

Meena ND, Kumari A, Dhaka AS, Hasan M, Maheshwari C, Taria S and Tyagi A. Bioactive Peptides Enhance Nutrition, Essential Elements, and Flavors in Foods (2023). Biomolecule reports.7 (1), 1-5

Technical Bulletins/ Manuals/Leaflets

Balasubramanian S, Syed Imran S, Muruganandam G, Vishnu M and Sarankumar V. 2023. Computer aided design (basic modelling & features). Technical Bulletin No. RC ICAR-CIAE/2023/01

Kumar M, Pandey HS, Singh D and Sahni RK. 2023. Technical manual on data collection, methodology, analysis, and interpretation for conservation agriculture machinery system, Technical Bulletin No.: CIAE/CRP-CA/TB/2023/353

Malathi P, T Rajula Shanthi, A Vennila, T Rama subramanian, Ravindra Naik and A Ramesh Sundar. 2023. Role of Sugarcane Sett Treatment Device in management of Pokkah Boeng disease. Extension Publication No 333(2023), pp 4. Published by Director, ICAR Sugarcane Breeding Institute, Coimbatore, Tamil Nadu, India

Kumari S, Sahni RK and Kumar M. 2023. लीची में छालभक्षी कीटों का हस्तचालित उपकरण द्वारा प्रबंधन. Leaflet No. CIAE/AMD/L/2023/15.

NEWS/ EVENTS

Coimbatore Centre gets Status of Regional Station



Coimbatore Centre of the Institute gets the status of Regional Station vide ICAR letter F. No. A. Engg.OI | 26 | 2022-r A- | I (AE) C. No. 222883 dated 16 May, 2023.

Visit of QRT Team to Institute and Different Centres

The Indian Council of Agricultural Research has constituted Quinquennial Review Team (QRT) to review the progress of CIAE including all AICRPs (FIM, EAAI, ESA and UAE) and Consortia Research Platforms (Farm Mechanization and Precision Farming including MIS and Energy from Agriculture) under the Chairmanship of Dr. M.M. Pandey (Ex-DDG, Agricultural Engineering), ICAR, New Delhi. The team comprised of Dr. TK Bhattacharya former Dean, JNKVV, Dr. YC Bhatt former Dean, MPUAT, Dr.B.Sridhar, former Dean, TNAU, Dr. TV Satyanarayana, former Dean, ANGRAU, Dr. SK Dash, Dean, OUAT; Dr. AK Dixit, Principal Scientist ICAR-NDRI, Dr. K.V.Ramana Rao, Head, CIAE & Member Secretary of QRT team.

To conduct review of ICAR-CIAE, Bhopal, AICRP schemes FIM, UAE, ESA and EAAI and CRP on FMPF and EA, the QRT team visited ICAR-CIAE Bhopal during 2-4 May,



2023. DR. CR Mehta, Director of the institute presented the overall achievements of the institute for the period 2017-2022. Member Secretary QRT presented the action taken report on previous QRT recommendations. Head of different divisions/sections and Project Coordinators and LCPCs of different schemes presented achievements of their divisions/schemes during the period under review. During 18-20 May, 2023, the QRT visited ICAR-RCNEH Complex Barapani. The achievements for the period were presented by principal investigators of FIM Centres (RCNEH Barapani, AAU Jorhat, CAEPHT Gangtok), ESA Centres (CAEPHT Gangtok, NERIST Nirjuli, UAE Centre of CAEPHT, Gangtok, CRP on FM&PF Centre of CPCRI Guwahati and CRP on FM&PF (MIS) centre of CAEPHT, Gangtok and reviewed by the QRT.

During 8-10 June, 2023, QRT visited MPKV Rahuri to review the achievements of FIM Centres (MPKV Rahuri,



EVENTS

JAU Junagarh, PDKV Akola, MPUAT Udaipur); ESA Centres (BSKVV Dapoli, MPUAT Udaipur); EAAI Centres (SPRERI VV Nagar, MPUAT Udaipur, PDKV Akola); UAE Centres (VNMKV Parbhani, MPUAT, Udaipur); and CRP on EA centres (SPRERI, VV Nagar, MPUAT Udaipur, JAU Junagarh). The principal investigators of each centre presented the significant achievements. QRT next visited TNAU Coimbatore during 14-16 June, 2023 to review the ICAR-CIAE scheme achievements during 2017-22 by different AICRP centres located in Southern India along with Regional Station of ICAR-CIAE. The principal investigators of FIM Centres (TNAU Coimbatore, UAS Raichur, UAS Bangalore, PJTSAU Hyderabad, ANGRAU Bapatla, KAU, Thirssur); ESA Centres (TNAU Coimbatore, UAS Raichur); EAAI Centres (TNAU Coimbatore, UAS Raichur, UAS Dharwad; SPCW Courtallam; IIHR Bangalore); CRP on FM&PF Centres (RS Coimbatore; CRIDA Hyderabad, IIHR Bangalore); CRP on FM&PF (MIS) TNAU Coimbatore centre presented the centres achievements before QRT.



The QRT during the review meets conducted at Barapani, Raturi and Coimbatore also visited the agricultural machinery manufacturing industries, progressive farmers' fields apart from institute facilities to understand the role and need of different stakeholders in promoting pre and post production mechanization.

IRC Meeting

The 109th IRC was held during 26-27 June, 2023 and participated by 70 members of IRC from Bhopal and Coimbatore. There were 111 projects (29 RPF-I, 35 RPF II, 26 RPF III and 21 Extension Proposals) which were discussed and critically reviewed during the IRC meeting. Dr. C.R. Mehta, Director, CIAE & Chairman, IRC



stated that scientist's should focus more in the recent areas like AI, IoT and robotics and also the projects formulated by the scientists should meet the institute mandate, national priorities and recommendations of RAC and QRT committees. He also stressed that scientist should fill the information in ARMS, KRISHI and SPARROW timely and try to publish research papers in good NAAS rated journals for better ranking of institute among ICAR institutes.

International Yoga Day

International Yoga Day (IYD) was celebrated on 21 June, 2023 with the theme "*Vasudhaiva Kutumbakam*" with great enthusiasm and active participation. In the yoga session, yoga trainer and Coach Shri HL Giri addressed the importance of yoga in daily life. This was followed by General yoga (Protocol), yogic practices that included different yogasans, pranayams and meditation procedures. Mrs. Preeti Chouksey, a health trainer in Bhopal, delivered a lecture on the importance of healthy habits and yoga practice in daily life. Dr. S. Mangaraj, Incharge Director, appealed to all the staff for regular practice of yoga and emphasized the importance of yoga.



EVENTS/ NEWS FROM PERSONNEL

ICAR-CIAE participates in the meeting of agricultural chief scientists of G-20

Under the G-20 Presidency of India, a meeting of Agricultural Chief Scientists (MACS) of G20 nations on Sustainable Agriculture and Food Systems for Healthy People and Planet was held on April 17–19, 2023 in Varanasi, India. Leading scientists from G-20 member countries and international organizations participated in the discussion on R&D in agriculture to identify priorities in agriculture to promote transformation towards diverse, sustainable agriculture and food systems. The delegates discussed important topics like 'Frontiers in science and technology for achieving food security & nutrition' on the first day of MACS. The second session of the meeting mainly focused on Climate-resilient agri-food systems. Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR, highlighted science-based solutions to achieve sustainable and profitable agri-food systems. On the last day of the programme, Dr. Himanshu Pathak, Dr S.N. Jha, (DDG-Agricultural Engineering, ICAR) and other dignitaries from G-20 member countries visited the Agricultural Engineering stall of ICAR and also had a special discussion on the techniques developed by various agricultural engineering institutes of ICAR. Dr. MK Tripathi, Principal Scientist of the Institute participated in demonstrations and technical discussions with the G-20 delegates. The institute displayed some of the major equipment developed related to Shree Anna (Millet), food items prepared from Shree Anna (Millet), and other CIAE-developed technologies in front of the G-20 delegates. Various other institutes of ICAR also demonstrated their selected technologies at the meeting.

**Principal Scientists takes Charge of Departments and Coordination Cell****Dr. Sukhadev Mangaraj**

Head,
Agro Produce Processing Division
wef 8 May, 2023

**Dr. Shiv Pratap Singh**

Project Coordinator,
AICRP on Utilization of Animal Energy
wef 15 June, 2023

**Dr. Ved Prakash Chaudhary**

Head,
Agricultural Mechanization Division
wef 22 June, 2023

Staff Promoted**Smt. Ashalata Waghmare**

Assistant
wef 20 June, 2023

**Shri Kalyan Singh**

Upper Division Clerk
wef 20 June, 2023

**Shri Rahul Chouksey**

Lower Division Clerk
wef 16 May, 2023

NEWS FROM PERSONNEL

Staff Superannuated



Shri AN Pawar
Lower Division Clerk
30 April, 2023



Shri PL Jaison
Private Secretary
31 May, 2023



Shri RK Tripathi
Assistant Administrative Officer
30 June, 2023



Shri DK Jain
Chief Technical Officer
30 June, 2023



Dr SP Singh
Chief Technical Officer
30 June, 2023



Shri Sitaram Raikwar
Senior Technician
30 June, 2023

Chief Editor: Dr. RK Singh, Principal Scientist

Editors: Dr. Ashutosh Pandirwar, Dr. Mukesh Kumar, Dr. Syed S Imran, Dr. Harsha Wakudkar and Dr. Pravitha M

Word Processing: K. Shankar

Photography: M/s SS Bagde & Kalyan Singh

Publisher: Director, ICAR-Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal - 462 038

Phone: 91-755-2737191 **Email:** director.ciae@icar.gov.in, directorciae@gmail.com **Web:** <https://ciae.icar.gov.in>