



ICAR-CIAE

NEWSLETTER

Modernizing agriculture through engineering interventions

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From the Director's Desk



The growing demand for food to feed the increasing population of India has made it necessary to bring more land under cultivation with assured irrigation. By the year 2030, the demand for food in India is projected to be around 355 million tonne for food-grains and 180 million tonne for vegetables, and strategies to attain them are water-intensive. Therefore, development strategies need to be centred on regional water availability, water budgeting and its efficient use. Surface irrigation is still the dominant method of irrigation practised in large parts of the country with an efficiency of about 40%. Micro-irrigation (including drip and sprinkler irrigation) offers a scientific alternative for reducing irrigation water losses with an efficiency of 70-90%. During the last two decades, micro-irrigation systems have evolved to efficiently irrigate not only wide spaced horticultural fruit crops but also vegetables, cereals, pulses etc. Recognizing the

importance of micro irrigation, the Central Government has emphasized on micro-irrigation in 1992 and 2006 (Centrally Sponsored Scheme on Micro-irrigation), 2010 (National Mission on Micro-irrigation) and 2014 (National Mission for Sustainable Agriculture). The **Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)** launched in 2015, integrated micro-irrigation as an integral component of irrigation. This programme includes creating infrastructure to bring water to farms and watershed development. All these programmes and schemes have been initiated by the government with specific objectives to improve the water use efficiency and productivity by utilizing 'per drop more crop'. Integration of micro-irrigation with watershed projects for utilization of harvested water under PMKSY is likely to result in efficient utilization of available water resources in agriculture with significant savings thereby extending the irrigation facilities to hitherto un-irrigated areas. India has already achieved the distinction of having the largest area under micro-irrigation and is likely to surge ahead in its adoption in future in lieu of the increasing food demand and shrinking land and water resources availability for agriculture.

The institute has realized the importance of 'more crop per drop' as early as in mid-eighties and established mango, guava and ber orchards with drip irrigation system. In subsequent years, over 10 ha area is being irrigated with micro-irrigation systems. Experimental investigations were carried out in majority of the fruit crops grown in the area viz., mango, guava, papaya, pomegranate, watermelon, ber, goose berry etc. and in vegetable crops viz., tomato, capsicum, ladies-finger, gourds, potato, onion, garlic etc. Studies were also carried out in adoption of drip-irrigation system in rice and wheat crops by optimizing the drip emitter spacing. The institute has infrastructure for testing of drip emitters and filters. Demonstration field has been developed by installing all types of micro-irrigation systems and their overhead components that are available as on today in the market for the benefit of farmers and other users of the technology. Sub-surface drip lateral laying machine and trencher for installation of main/sub-main pipes are some of the hardware developed by the institute.

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This issue of the newsletter focuses on research and development of equipment like FYM applicator for grape orchards, tractor operated turbo bund former for mulched fields, pollinator for green house, TMR mixing machine for draught and milch animals etc.

ICAR-CIAE celebrated its 46th Foundation day in this quarter which was commemorated through live as well as virtual mode. Research Advisory Committee (RAC) and 105th Institute Research Council (IRC) meetings were also convened during this quarter. The institute organized brain storming sessions on "Strategies for *Atmanirbhar Bharat* in Agricultural Mechanization" and "Automation in Agricultural Engineering" through virtual mode. The 71st Republic Day was celebrated in the institute premises with enthusiasm and fervour following the COVID-19 protocols.

As Director, ICAR-CIAE, it is my proud privilege to present the first newsletter of this year.

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FYM applicator for grape orchards

FYM application is one of the most drudgery prone operation in grapes cultivation, which is done manually by digging a continuous trench near the plant. FYM applicator of 1 tonne capacity has been developed at ICAR-CIAE, Bhopal for placing FYM near the plant on each side continuously. The applicator consists of mixing chamber, a pair of augurs for dispensing FYM, hydraulic motor and conveyor type dispensing unit. It has the provision to increase the width of conveying system by extending the opening of slide tray attached to the lower part of conveyor. The applicator can dispense FYM from 2.3 to 2.6 m width to match the plant geometry of 2.5 to 3.0 m row to row spacing. The applicator can deliver recommended dose of 7.8 kg/min FYM from each outlet at 1000 rpm of the tractor engine. An effective field capacity of the equipment is 0.44 ha/h at field efficiency of 80%.

**Ergonomic interventions in semi-automatic vegetable transplanter**

Transplanting of vegetable seedlings is a tedious and drudgery prone farm operation that requires very high manual workforce. Semi-automatic type vegetable transplanters are commonly used, which require manual interventions to pick and drop the seedlings. The speed of operation is limited in semi-automatic transplanters due to human limitations of picking and dropping of seedlings in continuous manner. Therefore, AICRP on ESA (TNAU, Coimbatore centre) studied ergonomic interventions in semi-automatic vegetable transplanters. The workstation has been modified based on the anthropometric parameters to reduce the



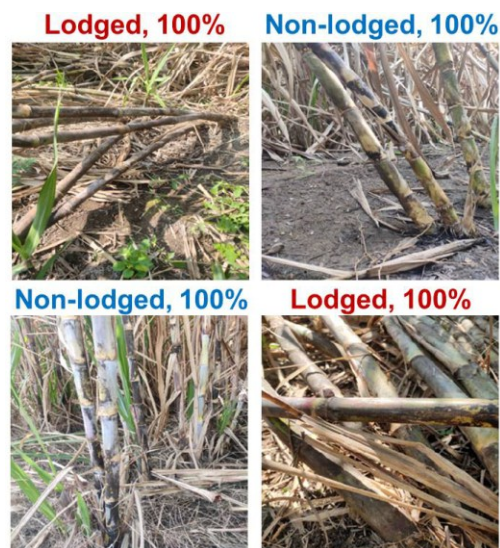
discomfort of the operator during operation. The seedlings when dropped from a height of about 500 mm results in breakage of the soil mass on ground contact. Hence, a seedling transfer mechanism consisting of an electronic metering mechanism with a conveyor belt has been developed to ensure seedlings placement at the ground level. Seedling trays are placed in a manner for easy pick-up and drop with less movement of the human arm. The effective field capacity of the modified transplanter is 0.14 ha/h. The maximum number of seedlings that can be picked and placed are 42-45 per minute. The mean values of heart rate, energy cost, oxygen consumption rate in terms of VO_2 max and work pulse for the operation of modified vegetable transplanter are 100 beats/min, 2.2 kcal/min, 26% of VO_2 max and 14 beats/min, respectively.

Identification of lodging of sugarcane crop based on deep learning

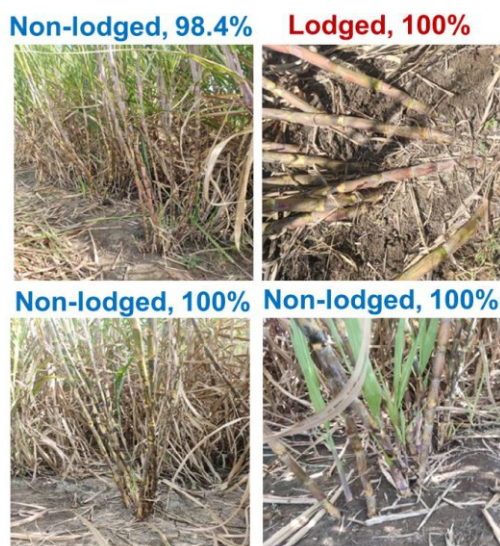
The lodging of sugarcane crop is a widespread problem that occurs in the middle and mature or late periods of growth of sugarcane crop. This hinders mechanical spraying and harvesting operations in the crop. Deep learning (DL) methods for image processing are popular techniques and convolutional neural network (CNN) based on DL is being commonly used in recent years. In the study, comparative assessment of seven DL models viz., GoogLeNet, AlexNet, InceptionV3, ResNet50, Xception, DarkNet53 and MobileNetV2 have been applied for identification of lodging in sugarcane (*Saccharum officinarum* L.) crop. A total 1020 digital images (having 510 images of each class)

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have been acquired to form the input dataset for the deep learning models. Among these models, performance of the InceptionV3 has the highest accuracy of 99% at 16 mini-batch size corresponding to 20 epochs and learning rate of 0.0003. CNN models based on deep learning techniques have higher training accuracy of 92.2-99.0% for the identification of sugarcane crop lodging. These trained models can provide precise input to the mechanical sugarcane harvesters, autonomous vehicles or mechatronics based sprayers for decision making to have efficient working with higher field efficiency.



Inception V3



DarkNet53

Tractor operated turbo bund former for mulched fields

A tractor operated bund former for mulched fields has been developed and evaluated by AICRP on FIM (PAU, Ludhiana centre). It performs three operations viz., straw removing (up to 1.25 m width), soil pulverization and trapezoidal shaped soil bund forming simultaneously in one pass. It consists of a mulcher, rotavator and bund former unit. The mulcher has flat flail type blades (without serrations) which act on standing stubble with impact action to pick up the straw and throw out with centrifugal force. The cut stubble and loose straw are thrown out of the chute opening which fall ahead of the bund plates on the ground. It removes the straw from front of 1.25 m wide rotavator. Second working unit rotavator is having C type blades (30 blades) arranged in pairs on each side of the flange alternately in staggered manner. The bund forming unit is placed at the rear of the machine and consists of main frame, holding plates and a pair of rectangular plates on both sides. The effective field capacity of the tractor operated bund former is 1.2 ha/h at forward speed of 1.5 km/h. The operational cost of the machine is ₹ 1922/ha while cost of forming bund per meter length is ₹ 1.45/m. There is saving in labour of 78 % over the conventional bund forming method.



Pollinator for greenhouse

Greenhouse provides a desired climatic condition for crops but, at the same time, creates obstacles for natural pollination. In order to address this problem, a pollinator has been designed by AICRP on ESA (ICAR-IARI, New Delhi centre) on the principle of a pulsating air-jet for pollination.

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It consists of 3D printed three pulsation units to provide varied air pulsation frequency and angular movement to cover the complete flower-bed. An operator in the greenhouse alleys can easily move it. The performance of developed pollinator has been compared with manual pollination and polli-

nation by a blower in tomato crop. The effect of airflow rates, pulsation frequencies of air and exposure time on pollination efficiency and yield was studied. The highest pollination efficiency of 83.7% has been achieved at 1.9 m³/min airflow rate, 23.5 Hz pulsation frequency and 19.4 s exposure time. The yield of tomato crop increased by 37 % and 96 % due to pollination by the blower and the developed pollinator, respectively as compared to manual pollination. The cost of the developed pollinator is ₹15,000/- and the cost of operation is ₹ 80/h. The cost of pollination by the developed pollinator is ₹ 400/ha as compared to ₹ 1,500/ha by manual hand pollination.

Total Mixed Ration (TMR) mixing machine for draught and milch animals

Total Mix Ration (TMR) machine has been developed by AICRP on UAE (MPUAT, Udaipur centre). It consists of a large conical hopper with a single vertical tapered spiral type flight centered in the hopper. This spiral type flight is coupled to a gearbox to churn the feed mixture in the hopper. The gearbox is coupled to a 2.25 kW electric motor. As the spiral type flight rotates, the feed mixture in the hopper is churned and mixed uniformly. The tapered flight moves



feed toward the top of the mixer and it bubbles to the top toward the sides and back down to the flight. The feed eventually moves toward the discharge door provided at the bottom of the hopper and is unloaded when the door is opened. For preparing TMR mixture, 60 % wheat straw and 40% concentrates were used. The concentrate comprised of mineral mixture, de-oiled rice bran, wheat/barley, gram churi, groundnut cake and salt. All these ingredients were fed into the machine and machine was operated for 10, 15 and 20 min. Uniformity of the mix has been determined using sieve technique. The performance of the TMR has been evaluated using four sieves of 9, 11, 13 and 24 mesh to separate ingredients into five fractions based on proportions. The capacity of the TMR machine is 25 kg. The mixing time of 10 min was found to be the best for obtaining uniform TMR mixture. The variation in quantity of ingredients and nutritive value in TMR mixture ranged 1.5-4.5% and less than 6%, respectively, within the batch which indicates that the ingredients are mixed uniformly.

Biomass Torrefaction System

Torrefaction is the process of biomass pyrolysis at low temperature. In this process, the moisture and lighter volatiles are removed from bio-material. A pilot scale torrefaction system of 200 kg biomass capacity has been developed and installed at the institute. The unit is equipped with six electric heaters of 9 kW capacity and has provision for removal of torrefied bio-material by



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tilting the reactor. Torrefaction of paddy straw has been done in the temperature range of 200–300°C with residence time of 60–180 min. The total carbon of raw paddy straw was 30–32%. The product yield increases with decreasing moisture content of raw paddy straw in the process. For better efficacy, the paddy straw needs pre-treatment of sun drying to reduce moisture content. The size of raw material and compaction level of raw material inside the torrefaction reactor influence the recovery. The recovery was found to vary from 90 to 98%. The fixed carbon of raw paddy straw was 14–16% and enhanced by 3–4% due to the torrefaction process.

Manual and power operated graders for multiplier onions

Grading of agricultural produce according to their size adds value to the product and results in additional economic gain to the farmers. Manual and power operated graders have been developed for grading multiplier onions into three grades. The manual grader consists of feed inlet, perforated drum, handle, shaft with bearing, collecting tray and supporting frame. The inlet for feeding onions to the grader is at 30° slope. The grading drum is made of light weight transparent polycarbonate material and is provided with round holes based on size of onions. The drum is rotated by a handle provided opposite to the feed inlet. The outlet of the grader is divided into three compartments below the grading drum for collecting the graded onions of different sizes, small (25 mm), medium (40 mm) and large (55 mm). The capacity of the grader was 200 kg/h with a grading efficiency of 93%. The cost of the

operation of the grader is ₹ 0.4/kg and results in savings in cost of about 82% compared to manual grading by human labour.

Power operated grader for multiplier onion consists of feeding inlet, perforated grading drums, feed outlets, variable speed drive, outer frame etc. The grader is operated by 0.75 kW single phase electric motor. The grading assembly is provided with three perforated metal drums rotating at desired speed controlled by variable speed drive. The drums have been mounted at 100 mm spacing. The multiplier onions fed into the feed inlet move to the rotating grading drums and the graded onions get collected at the respective outlets. The capacity of the grader is 580 kg/h. The cost of the operation of the grader was ₹ 0.2/kg and results in cost savings of 90%.



Fertilizer applicator as an attachment to walk-behind rice transplanter for deep placement

The fertilizer applicator, as an attachment to walk-behind rice transplanter, has been developed for deep placement of fertilizer. The unit consists of hopper, electronic control metering system and soil floats with furrow openers. The electronic metering mechanism consists of auger-metering mechanism, proximity sensor, digital hour meter counter, solenoid actuator for fertilizer placement and air blower. Auger-metering mechanism has been operated at optimized speed using 12 V motor to meter required amount of fertilizer. A single proximity sensor with relay is attached close to the planting unit to detect planting arm. When



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the planting arm is detected by the sensor, it sends signal to the digital hour meter counter. Digital hour meter counter actuates linear solenoid attached opener to drop the fertilizer at alternate hills in between rows so that it ensures nutrient supply to four hills. The battery is used to power the electronic control system. The air-assisted system using air blower is attached with the fertilizer unit to avoid the blockage in the delivery tube end. The effective field capacity, field efficiency and fertilizer application efficiency of fertilizer applicator as an attachment to walk-behind rice transplanter for deep placement of fertilizer have been 0.16 ha/h, 72% and 94%, respectively.



Drainage technology for waterlogged vertisols

In India, maximum amount of rainfall occurs usually with high rainfall intensity during the monsoon season of four months, resulting into high surface runoff within a short time, necessitating surface drainage. Vertisols (clay soils) offer good prospects of production only when adequately drained since they suffer from flooding, surface ponding and/or waterlogging due to poor soil physical properties. The high initial cost of sub-surface drainage (SSD) technology is main constraint in large scale adoption of the technology. Mole drainage is cheaper and an effective technology to enhance productivity of temporarily waterlogged vertisols. The study has been carried out to investigate the effect of broad bed furrow (BBF) with mole drainage on productivity of soybean



crop (sensitive to waterlogging) during five consecutive *kharif* seasons at institute farm. The BBFs have been formed at the time of sowing using BBF-cum-seeder machine. Mole drains are unlined circular soil channels, which function like pipe drains. Mole drains of 85 mm size have been formed at 500 mm depth and 4 m spacing, using a mole plough pulled by a tractor (40-60 kN drawbar pull).

The adoption of surface drainage (BBF of triangular shape having 200 mm depth, 400 mm top width and 1.5 m spacing) technology resulted in increase of soybean yield by 27-30% in temporary waterlogged vertisols over the conventional practice of cultivation. In the region receiving normal and heavy rainfalls (monsoon rainfall >1070 mm), the adoption of BBF of 200 mm depth with mole drainage system enhanced soybean yields by 67-70% over the temporary waterlogged vertisols. The payback period of BBF with mole drainage is less than 2 years. BBF with mole drainage has been observed to be a cheaper and viable alternate to costly pipe drainage system.

Externally Funded Project

DST has sanctioned a project entitled '**Instrument for Rapid Detection of Aflatoxin-B1 in Cereal Grains and Oilseeds: HyperAfla**' with a budget of Rs.43.10 lakh.

Patent Application

Patent application for 'Tractor-Operated Grass Seed Harvesting Equipment' was filed on 5 February, 2021. The technology was developed in collaboration with ICAR-IGFRI, Jhansi.

RESEARCH & DEVELOPMENT/ TECHNOLOGY TRANSFER**Demonstration of Technologies****Tractor operated tobacco seedling transplanter with spot application of water at Andhra Pradesh farms**

The tractor operated tobacco seedling transplanter with spot application of water has been developed in collaboration with ICAR-Central Tobacco Research Institute (ICAR-CTRI), Rajamundhry. This transplanter reduces the labour requirement and cost of cultivation in tobacco cultivation practice. The transplanter was demonstrated to the scientists of ICAR-CTRI, officials of Tobacco Board and ITC and leading farmers of Andhra Pradesh at the Kanthkur farm of ICAR-CTRI, Regional Centre on 29 January, 2021. Dr. T. Senthilkumar, Principal Scientist explained about the operation of transplanter. Fifteen officials and farmers from Prakasam district of Andhra Pradesh and three scientists from the CTRI participated in the demonstration.

**Tractor operated sugarcane seedling transplanter at farmers field**

The tractor operated sugarcane seedling transplanter was demonstrated by the CIAE- RC, Coimbatore in presence of Honourable Vice Chancellor, Tamil Nadu Agricultural University,



Officials of TNAU, TN-Agricultural Department, sugar mills and about 150 farmers from Thiruvannamalai district, Tamil Nadu in collaboration with Tamil Nadu Agricultural University, Coimbatore at Vazhavachanur village, Tamilnadu on 19 February, 2021. During the demonstration, Thiru. Murugan, Joint Director of Agriculture (Thiruvannamalai) and Smt. Malathi, Managing Director (Co-operative sugar mill, Kallakurichi) were also present.

Technology and Machinery Demonstration Mela-2021

The Technology and Machinery Demonstration Mela was organized at centres of AICRPs on Farm Implements and Machinery, Ergonomics and Safety in Agriculture, Utilization of Animal Energy located in different parts of country during 12-15 March, 2021. More than one lakh farmers attended the programme at different centres of AICRPs. An exhibition of improved crop production and post-harvest equipment and machinery developed by the centres and commercially available equipment was organized at different centres. For the benefit of farmers, video shows were also organized at some centres with movies of improved crop production and post-harvest machinery. Interactive sessions between the scientists and farmers were also held at numbers of centres to answer the queries of the farmers related to farm machinery and processing equipment. Ergonomically refined tools, equipment and machinery were also demonstrated in the mela. The safety pamphlets were distributed for awareness of safety among farmers and explaining them for prevention of road accidents.



TECHNOLOGY TRANSFER/ PUBLICATIONS

Technology dissemination and agricultural mechanization in selected villages of Madhya Pradesh for increased productivity and income generation (SCSP programme)

A total of six numbers of training programmes of 3 days duration each on "Practical training of farmers on agricultural machinery, agricultural product processing including soybean processing, renewable energy and water management" involving 116 participants of six villages namely Balampur, Nipaniajat, Kurana, Kachibarkheda, Sukaliya and Barodi of Madhya Pradesh were organized during January–March 2021 at ICAR-CIAE, Bhopal under the SCSP programme. The various CIAE technologies were demonstrated to the participants such as "Soy milk and paneer processing plant" including its benefit, packaging, storage and marketing.



CIAE-RC, Coimbatore organized one-day capacity building program on 'Farm mechanization techniques in maize, onion and groundnut crops' under SCSP in collaboration with State Department of Agriculture and Agricultural Engineering for 50 rural SC-BPL farmers of Melapuliyur Village, Perambalur block, Perambalur District on 22 January, 2021. Mr. S. Karunanidhi, Joint Director (Ag), Perambalur District delivered a brief lecture on 'Irrigation and plant protection management' in maize, groundnut and onion crops where he accentuated the benefit of micro irrigation techniques to conserve the water and soil fertility.

Soy-food training

The Institute organized 189th Batch of 6-days soy-food training programme for upcoming

entrepreneurs during 15-20 February, 2021 in which 18 participants from different parts of the country attended. The training covered various aspects of soybean processing that included information of different soy-based food products, preparation of soy milk and tofu, introduction to soy processing equipment, project planning, storage and packaging, marketing aspects of soy products and health benefits of soybean.

**Media Programme**

Dr. Dilip Jat delivered a talk on कटाई-गहाई के उन्नत कृषियंत्र in Krishi Darshan program of DD, MP on 22 February, 2021.

Training organized by KVK

KVK organized following trainings during the quarter, which were attended by 452 farmers/extension officers.

- Use of improved agril. implements for farmers
- Innovative agriculture equipment, Processing and value addition, Potential of horticulture, Integrated farming and Watershed and its importance mode of implementation
- Importance of farm machinery in agricultural crop produce

Consultancy/Contract Projects

Contract service for testing of "Flexible Screw conveyor" with M/s National Engineering Works, Dhar, MP.

Publications

Research papers

Chethan CR, Tewari VK, Shrivastava AK, Nare B and Kumar SP. 2021. Planting of cut potato tubers in India and global: urgent need of planter mechanization to produce higher tuber yield. *Significances of Bioengineering & Biosciences*, 4(3): 371-373.

PUBLICATIONS

Dawn CP Ambrose. 2020. Engineering properties of peeled and unpeeled multiplier onion. *Current Agricultural Research*, 8(3): 232-238.

Kumar M, Thakur TC, Kumar M and Kumar SP. 2021. Modification and evaluation of Pant-ICAR controlled traffic seed-cum-deep fertilizer applicator for multi-crop seeder-cum-deep placement of fertilizers applicator. *Pantnagar Journal of Research*, 18(3): 272-279.

Kumar V, Jaiswal KK, Vlaskin MS, Nanda M, Tripathi MK, Gururani P, Kumar S and Joshi HC. 2021. Hydrothermal liquefaction of municipal wastewater sludge and nutrient recovery from the aqueous phase. *Biofuels*, DOI: 10.1080/17597269.2020.1863627.

Kumar V, Sharma N, Jaiswal KK, Vlaskin M, Nanda M, Tripathi MK. 2021. Microalgae with a truncated light-harvesting antenna to maximize photosynthetic efficiency and biomass productivity: Recent advances and current challenges. *Process Biochemistry*, 104: 83-91.

Mahanti NK, Chakraborty SK, Sudhakar A, Verma DK, Sanganamoni SS, Thakur M, Singh S and Srivastav PP. 2021. Refractance Window™ Drying vs. Other drying methods and their effect on different process and quality parameters of foods: A comprehensive review of trends and technological developments. *Future Foods*, 3: 100024.

Mohapatra D, Patel AS, Kar A, Deshpande S and Tripathi M. 2021. Effect of different processing conditions on essential minerals and heavy metal composition of sorghum grain. *Journal of Food Processing and Preservation*, 45(1): e14909.

Pawar DA, Joshi DC and Sharma AK. 2021. Effect of gamma irradiation and microwave energy on milling characteristics of pigeon pea. *Journal of Agricultural Engineering*, 58 (1): 29-39.

Potdar RR, Tiwari PS, Agrawal KN, Jyoti B and Shukla P. 2021. Intervention of dynapod in cleaner-cum-grader for drudgery reduction. *Journal of Agri Search*, 8(1): 35-39.

Thakur RR, Shahi NC, Mangaraj S, Lohani UC and Chand K. 2021. Development of an organic

coating powder and optimization of process parameters for shelf life enhancement of button mushrooms (*Agaricus bisporus*). *Journal of Food Processing and Preservation*, 45(3): e15306.

Upendar K, Agrawal KN, Chandel NS and Singh K. 2021. Greenness identification using visible spectral colour indices for site specific weed management. *Plant Physiology Reports*, 26(1): 179-187.

Popular Articles

Balasubramanian S, Chakraborty SK, Kotwaliwale N, Kate A and Ambrose DCP. 2021. Entrepreneurship opportunities in Nutri-cereal processing sector. *Indian Food Industry Mag*, 3(1): 29-38.

Imran S, Kumar SP and Senthilkumar T. 2021. Deep placement fertilizer applicator as an attachment to rice transplanter, *Agro India*, February: 18-19.

Senthilkumar T and Imran S. 2021. Custom hiring operation models for promotion of farm mechanization. *Agro India*, February: 24-25.

Senthilkumar T. 2021. Rice transplanter for safe operation and efficiency. *Agro India*, January: 32-33.

Singh R, Singh KP, Kumar M and Singh SK. 2021. मोल जल निकास प्रणाली. कृषकजगत, जनवरी: 5.

Tripathi H, Chandel NS and Tripathi A. 2021. रबी फसलो की कटाई गहाई और सुरक्षित भंडारण. खेती, फरवरी: 53-54.

Book Chapter

Jadhav SK, Dubey AK, Nagori A, Gupta M, Gajendra S and Singh P L. 2021. Micro Algae Production for Bio Fuel Generation, Textbook of Advances In Bioenergy Engineering, Narendra Publishing House, Delhi (India), ISBN: 978-81-94726-97-5: 153-169.

Technical Bulletins/ Manuals

Agrawal KN, Khadatkhar A and Thakur N. 2021. E-Coffee Table Book on Safety Gadget on Agricultural Operation. Technical Bulletin No. CIAE/AMD/2021/305.

PUBLICATIONS/ AWARDS & RECOGNITIONS/ HRD/ EVENTS

Agrawal KN, Potdar RR and Thakur N. 2021. E-Coffee Table Book on women friendly tools and equipment. Technical Bulletin No CIAE/AICRP on ESA/2021/304.

Din, M. 2021. Research highlights...2020-21. Technical Bulletin No. CIAE/UAE/2020.

Din, M. and Jadhav, M.L. 2021. E-coffee table book on Animal drawn implements. Technical Bulletin No. CIAE/UAE/2021.

Technical Reports

Gangil S, Jena PC, Bhargav VK, Mandal S and Jadhav SK. 2021. Annual Progress Report-2021, ICAR-CIAE Bhopal Centre of AICRP on EAAI. Technical Report no. ICAR-CIAE/AEP/2021/513.

Sawant, C. P (Ed). 2021. Progress Report 2020-21 of ICAR-CIAE Centre, VI Annual Review Workshop of Consortia Research Platform on Farm Mechanization and Precision Farming and Micro Irrigation Systems. Technical Report No. CIAE/CRP-FM and PF 2021/511.

Awards and Recognitions



Dr. Sandip Mandal was selected as NAAS Associate for the year 2021 wef 1st January 2021.



Dr. M.K. Tripathi was nominated as Editor of the journal - Clinical Medicine Research, Science Publishing Group, USA.

IRC Meeting

The 105th Institute Research Council meeting was held in online mode in three sessions during January 2021, participated by 64 members of IRC. Thirty projects (13 RPF-I, 6 Extension Proposal and 11 RPF-III) were discussed and reviewed during the IRC. Dr. C. R. Mehta, Chairman, IRC and Director, ICAR-CIAE welcomed all the members and congratulated the scientists for their sustained efforts in spite of difficulties faced due to COVID-19 pandemic. He instructed all the members to maintain punctuality and submit action taken report (ATR) on time. He also emphasized that good publications are to be made from every project and efforts should be made by the investigators for further dissemination of their technologies to the users, wherever applicable. He also reiterated that scientists should formulate research projects based on national need, government policies & initiatives, and recommendations of major committees. Dr. S. Mandal, Member-Secretary, IRC presented the follow-up action on



Human Resource Development

Name & Designation	Training Title (Virtual Mode)	Duration	Organized by
Subeesh A, Scientist	Cyber security	21 January, 2021	Ministry of Electronics and Information Technology, Govt. of India
Swapnaja Jadhav, Scientist	Environmental practices and renewable energy utilization	5-14 January, 2021	Dr PDKV, Akola
Subeer K Chakraborty, Principal Scientist	Data visualization for agribusiness and agricultural research	22-27 February, 2021	ICAR-NAARM, Hyderabad

EVENTS

adopted RPF IIIs and action taken report of 103rd and 104th IRC meetings. He thanked all the members for providing the information required for compilation of agenda items and fruitful deliberations in the meeting.

Brain Storming Session on Strategies for Atmanirbhar Bharat in Agricultural Mechanization

The institute organized a brain storming session through virtual mode on "Strategies for Atmanirbhar Bharat in Agricultural Mechanization". The theme was chosen under the Atmanirbhar Bharat mission, recently launched by Government of India. The main aim of the brain storming session was to identify specific areas of agricultural mechanization wherein country may focus in coming years to ensure a self-reliant India. The session was chaired by Dr. K. Alagusundaram, Deputy Director General (Engg.), ICAR, New Delhi and Ms. Shomita Biswas, Joint Secretary, DoAC & FW, Govt. of India, New Delhi was the Chief Guest. The session was co-chaired by Dr. Kanchan K. Singh, ADG (FE), ICAR and Shri T.R. Kesavan, President & Chief Operating Officer (COO), TAFE & President, Tractor Manufacturers' Association [TMA] and Chairman, FICCI, National Agriculture Committee.

About 100 delegates including national and state level policy makers, academia and R&D institutes and allied industries and agricultural machinery manufacturers participated in the brain storming session and deliberated on the theme. The lead papers on the theme were presented by Shri V.N.

Kale, Additional Commissioner (M&T), DOAC & FW, Govt. of India and Shri T.R. Kesavan.

Dr. C.R. Mehta, Director, ICAR-CIAE, Bhopal delivered welcome address and presented the current status of agricultural mechanization in India and highlighted the need and importance for preparing the strategies for *Atmanirbhar Bharat* in the sector of agricultural mechanization in the country. Dr. Kanchan K. Singh stated that the farm machinery sector in India has grown a lot during last decade and called upon R&D Institutes to develop small and smart multi-purpose farm machinery and tools suitable for different agro-climatic zones. Chief Guest, Ms. Shomita Biswas congratulated ICAR-CIAE, Bhopal for organizing the brain storming session on this important theme and stressed upon the need for Institute-Industry-Policy Makers to work in tandem to develop a policy framework for *Atmanirbhar Bharat* in agricultural mechanization sector. She also stressed upon the need to strengthen the ICAR and DOAC & FW interface for effective results. The Chairman of the session, Dr. K. Alagusundaram, stated that the agricultural mechanization should now focus on creation of facilities for storage, primary, secondary and tertiary processing and value addition of perishable, semi perishable and highly perishable agro produce in production catchment. Further, there is need to create agro processing and agri-business incubation centres to support advanced processing technologies and create custom hiring centres for post-harvest processing and value addition so as to facilitate *Atmanirbhar Bharat* mission launched by Govt. of India.

Brainstorming session on Automation in Agricultural Engineering

CIAE RC-Coimbatore organized a brainstorming session on 'Automation in Agricultural Engineering' through virtual mode on 19 February, 2021. The purpose of the session was to discuss the status and need of automation in agricultural engineering and way forward to enhance input use efficiency and reduce drudgery



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of agricultural workers. The pro-programme was chaired by Dr. C.R. Mehta, Director, ICAR-CIAE, Bhopal. After inaugural address, he highlighted the importance and the need of automation in agricultural engineering in the global/ Indian context and the way forward. About 85 invited experts/ scientists/ faculty members from various ICAR Institutes, SAUs, and PIs of various AICRPs/ AICTE approved Institutions and Deemed Universities attended the session.

Five invited talks were delivered by experts working in the area in the session and followed by discussion to identify areas of immediate attention and way forward for automation in agriculture for small landholding.

Automation in Farm mechanization	Dr. H.L. Kushwaha Principal Scientist, ICAR IARI, New Delhi
Application of robotics in farm mechanization	Dr. Dhanashri Balaso Shinde R&D Engineer, Automation of cultivation system, Farmship, Inc, Tokyo, Japan
IOT based start-ups in Agriculture and Allied field	Dr. Gawthaman Ramasamy Vice President, Kultivate.in, Coimbatore
IoT enabled food grain warehouse monitoring	Dr. Balaji Ganesh Dean (Research) Velammal Engineering College, Chennai
Automation in Micro irrigation System	Er.Tushar Karande Manger for Digital Farming Solutions, NETAFIM, Maharashtra

Republic Day celebration

The 71st Republic Day was celebrated in the institute premises with enthusiasm and gaiety following the COVID-19 protocols. Dr. C.R. Mehta, Director, ICAR-CIAE hoisted the National Flag and addressed scientists, officers and other employees. In his address, Dr. Mehta highlighted about the national agricultural scenario and significant role of the institute in agricultural engineering development in the country. He called upon everyone to understand their role and responsibility in the development and prosperity of the country.



Foundation Day celebration

Institute celebrated its 46th Foundation Day on 15 February, 2021 through live as well as virtual mode. Dr. K. Alagusundaram, DDG (Engg.) ICAR, New Delhi was the Chairman on the occasion and Dr. Kanchan K. Singh, ADG (FE), ICAR was co-chairman. Dr. S.N. Jha, ADG (PE), ICAR and Dr. V.P. Singh, Director, ICAR-NIHSAD, Bhopal and Directors of ICAR-institutes under SMD (Engg), Dr. P.G Patil, Director, ICAR-CIRCOT, Mumbai, Dr. K.K. Sharma, Director, ICAR-IINRG, Ranchi, Dr. D.B.Shakyawar, Director, ICAR-NINFET, Kolkata, Dr. Nachiket Kotwaliwale, Director, ICAR-CIPHET, Ludhiana were also present.

Dr. C.R. Mehta, Director, ICAR-CIAE in his welcome address greeted the guests and dignitaries and highlighted the significant achievements of ICAR-CIAE during the year. He presented R & D achievements of the institute, technologies developed and commercialized, IPRs filed and awards and recognitions earned by

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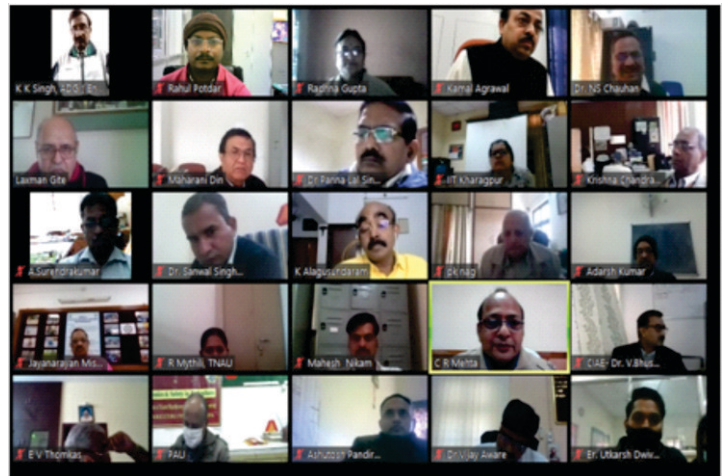


the institute and its scientists. Further, the success stories of the entrepreneurs who had set up their enterprises based on ICAR-CIAE technologies and the plan, priorities and challenges before institute for the next five year plan were presented. Dr. Kanchan K. Singh, ADG (FE) and Directors of different ICAR institutes present on the occasion greeted ICAR-CIAE on its 46th Foundation Day and lauded the significant achievements and contributions made by the institute at national and at international level in the area of agricultural engineering. The Chief Guest on the occasion, Dr. K. Alagusundaram, DDG (Engg.) appreciated the significant contribution made by the institute for modernization of Indian agriculture and its effectiveness in bringing self-sufficiency in food-grains at national level. Dr. K. Alagusundaram also delivered the 2nd Prof. AC Pandya Memorial Lecture wherein he stated that the future agricultural technologies would be an integration of multi-disciplinary sciences and engineering technologies including space, nano, robotics, precision farming and artificial intelligence while providing cost effective solutions for small, marginal and large farmers. He also congratulated the scientists who received national level awards and recognitions and the progressive farmers, entrepreneurs and start-ups felicitated by the institute on this occasion. The programme ended with the vote of thanks presented by Shri Kumar Rajesh, CAO, ICAR-CIAE, Bhopal.

Annual Workshop of AICRPs

The 12th Annual Workshop of **AICRP on Ergonomics and Safety in Agriculture** was organized during 27-28 January, 2021 in virtual mode. The workshop was inaugurated on 27 January by Dr. K. Alagusundaram, DDG (Agril. Engg), ICAR. The session was co-chaired by Dr. Kanchan K. Singh, ADG (FE), ICAR and Dr. C.R. Mehta, Director, ICAR-CIAE. The experts Dr. L.P. Gite, Ex-Scientist Emeritus and Dr. P.K. Nag, former Director, NIOH, Ahmedabad, also graced the occasion with their presence. During the two days deliberation, research engineers of twelve centres of the scheme presented their achievements and progress of work. The discussions were held on future programmes of the scheme for period 2021-26 and centre-wise work plan for year 2021. A total of 47 people attended the workshop. Following publications were released on the occasion:

- Two e-coffee table books
- Technical Bulletin on "Safety Measures for Snakebites In Agriculture".



The 24th Annual Workshop of the **AICRP on Energy in Agriculture & Agro-based Industries** was held during 9-11 February, 2021 through virtual mode under the Chairmanship of Dr. Kanchan K. Singh, ADG (FE), ICAR, New Delhi. Prof. B.S. Pathak, Ex-Director, SPRERI, VV Nagar and Dr. S. Kamaraj, Ex-Prof. & Head, Bio-energy Department of TNAU, Coimbatore were the subject matter specialists during the Workshop.

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The 35th Annual Workshop of **AICRP on Farm Implements and Machinery** was organized on virtual platform during 23-25 February, 2021. Around 100 participants from different SAUs, ICAR institutes and other organizations attended the workshop. Inaugural session of the workshop was held on 23 February, 2021 under the Chairmanship of Dr. K. Alagusundaram, DDG (AE), ICAR, New Delhi and Dr. C. Divaker Durairaj, Former Dean, AEC&RI, TNAU, Coimbatore was the Guest of Honour during the session. Dr. C.R. Mehta, Project Coordinator, AICRP on FIM presented Project Coordinator's Report on progress of work done by different centres of the scheme. Technical Sessions – I and II were conducted during 23-25 February, 2021 to take the stock of the progress made by 25 centres engaged in Research & Development (R&D), Prototype Manufacturing Workshop (PMW), Prototype Feasibility Testing (PFT) and Front Line Demonstration (FLD) activities.

Following publications from different centres were released on the occasion:

- Booklet: Success Story on Impact of PFT & FLD Activities (Allahabad)
- Folder: Mat Type Nursery Raising for Transplanting (Barapani)
- Booklet: *Chara Phasalon ke Utpaadan Evam Sanrakshan Hetu Krishi Yantra* (Jhansi)
- Booklet: Research Digest :1960-2021 (Coimbatore)
- Coffee-Table e-Book: Technologies Developed (Coimbatore)
- Coffee-Table e-Book: Recent Technologies (PC Cell)

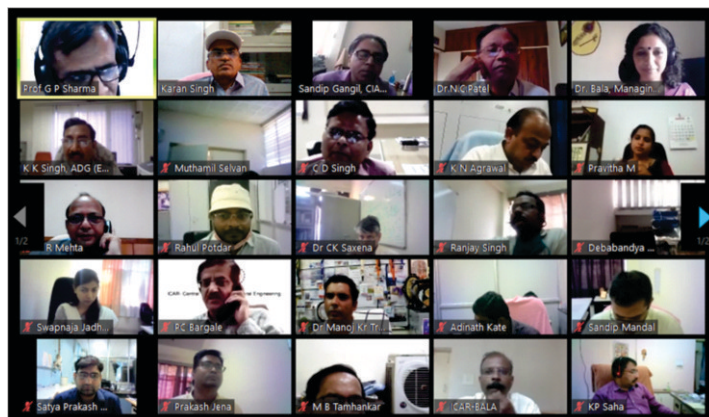
The 20th Annual workshop of **AICRP on Utilization of Animal Energy** was held on 11 January, 2021. Following publications were released:

- Research highlights...2020-21
- E-coffee table book on Animal drawn implements
- Improved technologies for utilization of animal energy (OUAT, Bhubaneswar Centre)

- *Pashu Chalit Unnat Krishi Yantra* (MAU, Parbhani Centre)
- Success story on "Yashogatha" (MAU, Parbhani Centre)

RAC Meeting

The 26th meeting of the Research Advisory Committee (RAC) of the Institute was held during 9-10 March, 2021. Dr. C.R. Mehta, Director welcomed the Chairman and the members of the Research Advisory Committee. In his welcome address, Dr. Mehta highlighted the major achievements of the institute during 2020-21. Dr. N. C. Patel, Chairman RAC, in his opening remarks emphasized to develop the linkage with the industries across the countries for disseminating the technologies developed by the CIAE. Dr. Kanchan K. Singh, ADG (FE), ICAR stated that the research in AI, robotics and IoT should be initiated and done in fast-track mode. He further suggested to develop the self-sustaining business model for the industries. The other expert members of RAC who provided valuable advice to CIAE scientists included Dr. Jaskaran Singh Mahal, Director of Extension Education, PAU; Dr. K.N. Tiwari, Professor (HAG), Agricultural & Food Engineering Department, IIT, Kharagpur; Dr. Balaram Panigrahi, Professor & Head, SWCE, CAET, OUAT, Bhubaneswar; Dr. Balasankari, Executive Director, Renewable Cogen Asia, Chennai and Dr. G.P. Sharma, Professor, CTAE, Udaipur. The RAC members also witnessed virtual demonstration of some new technologies developed by institute.



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World Water Day Celebration

World Water Day was celebrated on 22 March, 2021. An expert talk-cum-discussion meeting was planned and organized online. Dr. S.K. Ambast, Joint Director (Edn.), ICAR-NIBSM, Raipur and Former Director, ICAR-Indian Institute of Water Management, Bhubaneswar was the Chief Guest for the occasion. Dr. C.R. Mehta, Director, ICAR-CIAE, Bhopal chaired the meeting and welcomed the Chief Guest and other participants. Dr. Ambast delivered the expert lecture on "Importance of Water in different spheres of life". He discussed many aspects and scenarios of water availability and its utilization using several management options and emphasized that water management should be a way of life. Scientists and staff of the institute attended the celebration.



CIAE-RC, Coimbatore celebrated World Water Day on the theme 'Valuing Water' at Yelur village (MGMG village), Madhukarai block, Coimbatore district in collaboration with ICAR-Indian Institute of Soil and Water Conservation Regional Centre (Ooty, TN) and leading manufacturers of drip/rain hose and farm machinery. About 85



farmers (men & women) attended this programme. During the special address of Dr. S. Balasubramanian, Principal Scientist & Head, CIAE-RC, detailed about the theme of world water day and he emphasized the farmers to adopt recent technologies to conserve moisture and save water. The farmers were also provided with AV aids and relevant literature in bilingual form.

International Women's Day Celebration

International Women's Day was celebrated on 8 March, 2021 on the thematic area "Women leadership in Agriculture: Entrepreneurship, equity and empowerment. A meet was organised along with KVK at the institute wherein 50 farm women participated. They were given information on the role of nutrition and entrepreneurship in food processing for improving quality of life by Dr Dipika Agrahar Murugkar, ICAR National Fellow. Products developed under the National Fellow project were also distributed to the farm women. On this occasion, a lady farmer who became a successful entrepreneur in the area of baking was felicitated. She also shared her experiences with the visiting farm women.

Later in the day a lecture was delivered by Dr. Ruma Bhattacharya, renowned psychiatrist on the theme of International Women's Day 2021 "Choose To Challenge": Mental health issues in the workplace and how to deal with it. All the women staff and students attended the lecture. The lecture was followed by a skit on women's issues by the PhD students of CIAE. This program was organised by the Women's Cell of the Institute.



NEWS FROM PERSONNEL

Ph.D. Awarded



Mrs. Deepika Shende Channe, ACTO (T-7-8) has been awarded PhD degree in Food Process Engineering on 19 February 2021 for her thesis titled "Development of Refractance Window Drying Protocol for Production of Intermediate Moisture Mango Leather" from Agricultural and Food Engineering Department, Indian Institute of Technology Kharagpur. She did her PhD under the guidance of Prof. Ashis Kumar Datta, Emeritus Professor, IIT, Kharagpur.

STAFF SUPERANNUATED



Dr. R.S. Singh
Principal Scientist
30 January, 2021



Shri H.C. Mondal
T-5 (Technical Officer)
28 February, 2021



Shri Ashish Roy
AAO
31 March, 2021



Shri A.L. Sharma
T-5 (Technical Officer)
31 March, 2021

Chief Editor: Dr. RK Singh, Principal Scientist

Editors: Dr. Aleksha Kudos, Sr Scientist; Dr. PC Jena, Dr. Ashutosh Pandirwar, Dr. Adinath Kate and Dr. Mukesh Kumar, Scientists

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Publisher: Director, ICAR-Central Institute of Agricultural Engineering, Nabi Bagh, Berasia Road, Bhopal - 462 038 Phone: 91-755-2737191, Fax: 2734016