

ICAR-CIAE NEWSLETTER
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Modernizing agriculture through engineering interventions
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From the Director's Desk

Indian agriculture is undergoing transformation due to technological innovations, sprawling urbanization, modern cultivation techniques and climate change. These changes offer unique challenges and opportunities to transform agriculture to more productive, economically remunerative, socially equitable and environmentally sustainable through adoption of smart mechanization technologies. The smart farm mechanization includes application of sensors, controllers, Internet of Things (IoT), artificial intelligence (AI) and robotics. The research work in the areas of precision agriculture, digital farming, precision irrigation, AI powered machinery, user friendly mobile applications, etc. has gained momentum in India during the last decade. Most operations in farming, such as seedbed preparation, sowing/planting, pest/disease detection, crop health monitoring and management, irrigation scheduling and watering and harvesting can benefit from these technological advancements. It also includes application areas such as monitoring of animal health, feeding and processing, on-farm storage and product quality assessment including monitoring within farm gate for initial storage.

The emerging smart agriculture mechanization combines precision farm management tools (GPS/GNSS, DSS, VRT), end user applications (apps, mobiles, machines, Agri-bots) and data solutions (data IoT, information, tech empowered tools). The institute has initiated research and development in these areas for development of automated spraying system for polyhouse, unmanned ground vehicle for various field operations, autonomous rice transplanter, image based hand held device for diseases identification in soybean, IoT based smart irrigation system for field crops, sensing system for safe storage of potato, onion and tomato, automated packing line for horticultural produces etc. These technologies not only make agriculture machinery smart and efficient but also help in saving inputs such as seeds, fertilizers, chemicals, water and energy and make agriculture more sustainable.

In future, agriculture is expected to be dominated by precision and cloud based data and supported by advanced infrastructure like smart tractors, unmanned aerial vehicles, wireless technology and unmanned autonomous vehicles for multi-purpose field works. There is need to simplify these technologies to rudimentary levels and make them cost-effective for maximum acceptance by the farming community.

This issue of the newsletter focuses on research and development of farm equipment and machinery like robotic transplanter for plug-type vegetable seedlings, tractor operated pigeon pea transplanter, small tractor operated EPN applicator, garlic harvester for raised beds, power operated baby corn dehusker, portable gasifier with in-built tar cracking system, micro-algae lipid extraction unit etc. Six technologies have been commercialized through licensing, while one patent has been filed in this quarter.

ICAR-CIAE organized a national webinar on 'Resilience and Cope-up Strategies in Pandemic through Agricultural Engineering Interventions: Women's Perspective'. Yoga Day (IYD)-2021 was jointly organized by ICAR-CIAE, Bhopal and ICAR-CIPHET Ludhiana through virtual mode on 21 June, 2021.

In this quarter, 3 staff members were promoted in administrative category, one transferred and five colleagues superannuated.

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

DIGEST

RESEARCH & DEVELOPMENT

Robotic transplanter for plug-type vegetable seedlings

Manual transplanting of vegetable seedlings in field is time consuming as well as labour intensive operation. Due to lack of availability of manpower during transplanting operation and to ensure timeliness in operation, a laboratory model of robotic transplanter has been developed for plug-type vegetable seedlings. The seedling pick-up mechanism consists of main frame for XY-axis, stepper motor, manipulator, end-effector and control unit. The robot movement system consists of IR sensor, control unit, 12 V battery and DC motor. The seedling pick-up mechanism is integrated with the manipulator with computer programming using Microchip-16F877. It uses stepper motor attached on main frame to move the manipulator in XY-axis. End-effector attached on the manipulator has a gripper which grasps the seedling, picks it up and moves to the delivery point. As soon as the seedling drops in the delivery pipe, the IR sensor detects the seedling and moves the robot to the next dropping point.

The developed robotic transplanter is operated by 12 V battery and can pick up and transplant about 3 seedlings/min. The success rate, leakage rate and successful transplanting were about 95%, 7.6% and 90%, respectively for 30 days old chilli seedlings. The potential use is to enhance input use efficiency for sustainable productivity and reduce drudgery by avoiding manual practice.

Tractor operated pigeon pea transplanter

Transplanting of pigeon pea seedlings has been found as a new tool for increasing productivity, and there is a good demand for transplanter in the states of Maharashtra, Madhya Pradesh, Karnataka, Uttar Pradesh, Gujarat, Telangana, Andhra Pradesh and Tamil Nadu. A tractor operated pigeon pea transplanter has been developed and consists of main frame with three-point hitching arrangement, one ground wheel, two chisel type furrow openers, two compaction wheels, two operator's seats, and two depth control wheels along with metering mechanism. The metering mechanism obtains drive from ground wheel (600 mm diameter) through chain and sprockets. The auxiliary frames have been provided to mount furrow openers, furrow closures, operator's seats and depth control wheels. The row-to-row spacing can be set at 900 mm or 1050 mm and plant spacing can be changed by adjusting metering mechanism. The unit weighs 170 kg and can be operated by 35 hp tractor. The field capacity of the machine is 0.13 ha/h with field efficiency of 76% and wheel slip of 8%. The cost of operation is ₹ 8000/ha. The break-even point and payback period are 118 h/year and 0.8 year, respectively. This pigeon pea transplanter is recommended for small and medium farmers cultivating pigeon pea crop.

Small tractor operated EPN applicator

EPN (Entomo-pathogenic nematodes) application is recommended to manage white grub in sugarcane crop. At present, farmers follow spot application method which involves making 125 mm deep holes using crowbar and followed by dropping the EPN solution manually to control white grub. This results in non-uniform quantity of EPN solution in sugarcane root zones. Therefore, a small tractor (13.4-17.9 kW) operated EPN applicator has been developed to reduce the drudgery of workers and uniform application of EPN solution.

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It consists of main frame, EPN solution tank, agitator, water pump, furrow opener and standard three-point hitch. The 150 l capacity tank consists of an agitator and two outlets for EPN solution. The agitator consists of two baffles at the end of vertical shaft. The agitator shaft is operated by 12 V high torque DC motor. The speed of the agitator shaft and discharge rate can be adjusted using control units. The agitator provides continuous agitation to EPN solution and avoids suspension of particles so that it results in uniform delivery of EPN solution. Pumping of EPN solution is done by two water sprayer motor diaphragm pumps of 4.0 l/min capacity and powered by 12 V battery.

The equipment has been tested at farms of ICAR-Sugarcane Breeding Institute, Coimbatore and M/s. Bannari Amman Sugars Ltd., Sathyamangalam, Erode district in Tamil Nadu. It applied EPN solution at the rate of 30-32 Infective juveniles/ml (IJs/ml) from each outlets at root zone of sugarcane crop to control white grub and has an effective field capacity of 0.18 ha/h. The cost of operation of the equipment is ₹ 2550/ha and results in cost saving of 47% as compared to manual method.

Garlic harvester for raised beds

Harvesting is one of the most laborious and time consuming operations in garlic production which requires about 50-60 man-days/ha. It is done manually by pulling the plants by hands in bending posture. To overcome the problem, a tractor operated garlic harvester has been developed for harvesting of garlic crop grown on raised beds (150 mm height, 1200 mm top width and 300 mm furrow width). The machine consists of main frame, circular disc, blade, conveying unit, gear box, belt-pulley drive and depth control wheel. Two cutting discs are provided to cut the furrow slice vertically. The triangular point blade having 10 knives is attached in front of conveying unit for its use in black

cotton soil to loosen the soil and easy penetration. The machine has chain type conveying mechanism which rotates through belt and pulleys with drive from tractor PTO. The garlic harvester has been evaluated in the garlic crop sown at 100 mm row to row and plant to plant spacing at 1.93 km/h forward speed and working depth of 60-80 mm. Effective field capacity of the machine is 0.21 ha/h at field efficiency of 72%. The harvesting efficiency and bulb damage during the operation are 97% and <0.5%, respectively.

Power operated baby corn dehusker

Baby corn is the ear head of maize (Zea mays L.) plant harvested at young age, especially when its silks have just emerged and no fertilization has taken place. Dehusking is one of the major post-harvest operations in baby corn processing which is labour intensive and time consuming. To reduce the drudgery in dehusking of baby corn, a power operated baby corn dehusker has been developed. It consists of slitting section and dehusking cum desilking section. Slitting section is provided with a feed inlet pipe made of stainless steel and two pairs of swinging arm rollers having a pair of knives, made of high-grade SS (70 mm diameter, 0.6 mm thickness, 5 mm projection length), in between. One knife is fixed between top set of rollers and the second knife is fixed between bottom set of rollers. To ensure a delicate handling/ dehusking of baby corn, a rubber fitting is provided over the remaining rollers and thus it facilitates the flexibility to bend inwards in the feed section to accommodate different contour and geometry of baby corns. The swinging arm mechanism provided to the rollers facilitates ease in cleaning of trashes trapped in between while feeding. Husk is slitted on both sides longitudinally in the slitting section. After slitting, it passes to dehusking cum desilking section. This section comprises of four rollers (300 mm length and 75 mm diameter) with brush made of food grade

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nylon. Husk and silks are removed in this section. Dehusked baby corns are collected at the main outlet and husks and silky portions are collected in the husk collector set beside the machine. The slitting section and dehusking cum desilking section are operated by 0.5 hp and 1.0 hp electric motors, respectively. It has capacity of 25 kg/h. Slitting efficiency, dehusking efficiency and desilking efficiency of this machine are 100, 92 and 100%, respectively.

Portable gasifier with in-built tar cracking

A portable downdraft gasifier has been developed for production of low tar producer gas without active use of water for scrubbing. The main reactor is of throat type having diameter of 250 mm. Slope of the conical throat has been kept at 60° for easy downward movement of feed material. A grate with an area of 0.16 m^2 has been provided below the throat to support the fuel bed as well as to segregate ash. A stirrer is used for intermittent stirring of feed material as well as to prevent clinker formation. The catalyst bed is placed at the periphery of the oxidation zone and immediately after the reduction zone. Height and depth of the catalyst bed is maintained at 300 mm and 150 mm, respectively. Two ports of 200 mm × 200 mm size have been provided at either sides of the gasifier for loading of the catalyst. Thus, the producer gas generated from oxidation and reduction zone immediately comes in contact with hot catalyst bed where cracking of tar takes place. The fine char particles in producer gas are separated in the cyclone. The gas is then cooled using two cooling cylinders which also reduces amount of tar through condensation. Moisture is separated in a packed bed filter loaded with saw dust. The final cleaning of gas has been done in a fabric filter. The gasifier has been fed with 60 kg fuel pellets per batch and a suitable facility has been provided for intermittent fuel loading for continuous operation. Testing of the gasifier has been conducted using 8 mm chickpea pallets. The final range of tar in the gas has been observed at 56-150 mg/Nm^3 having heating value of 5.1–6.9 MJ/m^3. The observed fuel consumption in the gasifier is 12 kg/h. The producer gas is composed of CO (16-24%), H_2 (18-20%), CH_4 (2.7-6.7%) and O_2 (3.4-7.7%). The final gas temperature of 55°C has been achieved in the cooling cylinders.

Micro-algae lipid extraction unit

Micro-algae biomass has been produced from crop residue and bio-gas slurry based growth media in an open race way pond. A lipid extraction unit has been developed for recovering lipids from micro-algae biomass through solvent extraction process. The unit can handle up to 3 kg per batch of fine ground and dried micro-algae biomass with 15 - 20 l of solvent. The dried and ground micro-algal biomass is kept in the 400 mesh nylon filter cloth bag and used as a thimble. A heating mantle is provided in the round bottom flask to heat and vaporize the solvent. A tap has been provided at the bottom of flask to take out the solvent. Solvent used for the process is n-hexane. The process to extract lipid has been carried out at 70°C temperature for 2 h in five cycles. After extraction, lipid has been separated from solvent and rotary evaporator has been used for recovery of solvent at 70°C temperature. About 65% of the solvent has been recovered during the process. The recovered solvent has been used in the next extraction operation. The lipid content in micro-algae obtained using crop residue hydrolysate media has been observed in the range of 16-18% by dry weight.

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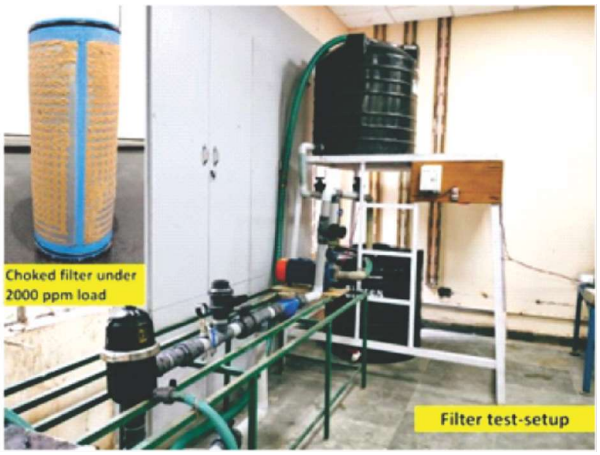
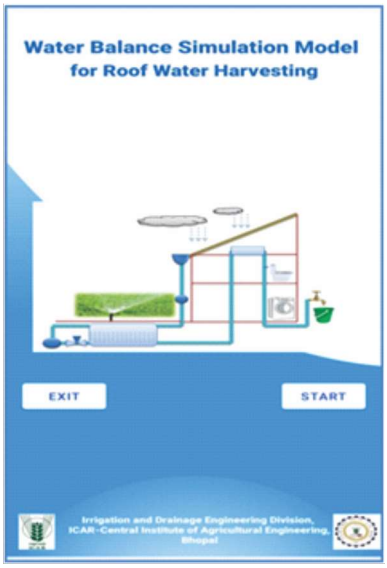
Testing of micro-irrigation filters

A test-set up has been developed for testing of secondary filters used in micro-irrigation system. It is equipped with a volumetric flow measuring device, ultrasonic flow meter, and pressure monitoring devices besides devices for electrical energy metering. The calibration of pressure gauges and flow meters have been carried out to obtain true values and to evaluate the head loss and other hydraulic parameters through the filter and in pipelines. The system is equipped with a back-washing mechanism for cleaning and flushing of chocked filters. A sampling point has been provided to collect the samples of filtered water during the operation of the system. A screen filter of 100 micron screen size having capacity of 20 m^3/h flow rate has been installed and tested under different TSS loads of 2000, 1500, 1250, 1000, and 750 ppm. The maximum flow rate through the system has been observed as 19 m^3/h by an ultrasonic flow meter. The screen filter is cleaned manually when the head loss across the filter reaches 70 kPa. The average filtration efficiency of the screen filter for TSS loads of > 1000 ppm and < 1000 ppm has been observed as 22 and 31%, respectively at 70 kPa. The time required for chocking of screen filter increases with decrease in TSS load in the water.



Water balance simulation model for roof water harvesting (Mobile App)

A mobile application titled "Water Balance Simulation Model for Roof Water Harvesting" has been developed to simulate the performance of rain water harvesting (RWH) system under different climatic regions. This Android based mobile application has been developed using Java programming language. The app considers daily rainfall, losses due to leakage/spillage, roof area and daily water demand as input parameters. The inputs could be manually entered on-screen and through text file. It calculates the optimum tank size and analyses the reliability and water saving effi-ciency of rain water harvesting system. It also estimates various para-meters such as inflow volume, storage, release, spillage (tank overflow), deficit, cumulative defi-cit, cumulative demand and deficit rate. The out-put could be obtained both on-screen as well as in text files. The developed app will be helpful for decision makers to give recommendations for design of roof water harvesting system for water saving and water security.



Spectral vegetation indices for water stress assessment in wheat crop

Water stress in field crops leads to reduction in crop yield. Hence, it is important to detect water stress before it causes permanent and irreversible damage in plant attributes. Conventional methods of water stress measurement are laborious, time consuming, point based and not suitable for automation in precision irrigation. Therefore, spectral reflectance technique has been used to estimate water stress of wheat crop using a hand held spectro-radiometer one week before the critical growth stages. The normalize difference water index (NDWI), water index (WI) and moisture stress index (MSI) have been calculated which give indirect estimation of water stress. The values of NDWI for wheat

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crop varied from 0.06 to 0.18 under sprinkler irrigation and from 0.04 to 0.12 under flood irrigation, respectively. The maximum value of NDWI has been observed at flowering stage for both irrigation treatments. The value of MSI for sprinkler irrigated crop at 100% ETc was minimum (0.28-0.35) whereas maximum (0.77) in the flood irrigation at 25% ETc level. Further, these indices calculated at diffe-rent growth stages were used to predict wheat grain yield. The R^2 value for yield prediction in wheat crop using MSI at different growth stages has been maximum (0.78) followed by NDWI (0.65) and WI index among the different treatments. Therefore, moisture stress index (MSI) can be effectively used to correlate between grain yield and water stress.

Bullock drawn 4-row seed drill for millets

In Odisha, small and marginal farmers generally use manual broadcasting method for sowing of small seeds (finger millet, small millet, sorghum; mustard, sesa-mum, linseed) after ploughing twice with bullock drawn deshi plough under upland condition. Hence, AICRP on UAE (OUAT, Bhubaneswar centre) developed a four row bullock drawn seed drill for millets. It consists of a main frame, hitching arrangement, seed box, four vertical slit type furrow openers, inclined plate metering mecha-nism, delivery tubes, a pair of transport cum depth adjustment wheels, and a ground wheel with chain sprocket. There are flexible furrow covering devices fixed behind each furrow opener for covering of soil over the furrows following the drilling of seeds in the furrow. The weight of seed drill is 67 kg with overall dimension of 1150×1300×900 mm. The seed rate and cost of seed drill are 5.5 kg/ha and ₹ 22,000/-, respec-tively. The effective field capacity of seed drill is 0.12 ha/h at 1.85 km/h speed of operation with field efficiency of 63% for sowing of finger millet. The draft and power requirement of the equipment are 378 N and 0.206 kW, respectively, which are within the draughtability of a pair of bullocks.

Success Story

Adoption of Drip-tape technology paves way for coriander profitability in Coimbatore district of Tamil Nadu

Drip tape is a thin walled drip line, collapsible hose made of special grade polyethylene material used in drip irrigation system. Once pressurized, it becomes round (12 - 25 mm diameter) and collapses on depressurizing. It is widely used for surface and sub-surface applications. Generally, it is suitable for 2 to 3 seasons (can also be used for longer period, if it is used in sub-surface condition) and reduces initial investment cost of drip irrigation system. Drip-tape technology was demons-trated by CIAE- Regional Centre to about 260 SC BPL families who are cultivating the coriander crop by providing various inputs viz., seeds, fertilizers, drip kits and farm tools at Irumporai Panchayat villages, Karamadai Block of Coimbatore district.

Mr. P. Palanisami, a progressive farmer from Pethikuttai village, adopted the drip-tape technology for coriander cultivation in 0.3 ha area. With the implementation of technology during rabi season 2020, he experienced improved benefit as compared to traditional irrigation method viz., labour reduction in irrigation, fertilizer application, weeding cost etc. The adoption of technology helped in harvesting a good quality coriander (greenish, tenderness and fragrance) leaf produce, which fetched better market price (₹2.67/100 g bundle) as compared to traditionally cultivated coriander (₹2.41/100 g bundle) in the market of Coimbatore.

Mr. Palanisami obtained higher profit of ₹ 34000/ha with the adoption of drip-tape technology by enhancing the coriander yield to 865 kg/ha and reducing the total cost of cultivation by ₹ 4,075/ha as compared to traditional irrigation practice. The higher benefit cost ratio of 2.95 indicated that the farmer gained higher return from drip-tape technology of irrigation.

AWARDS & RECOGNITIONS/ TECHNOLOGY TRANSFER

Awards & Recognitions

Name & Designation	Award details
Dr. Bikram Jyoti Scientist	2nd prize of ₹ 3.00 lakh in hackathon ' Kritgaya' organized by NAHEP and ICAR
Dr. Debabandya Mohapatra Principal Scientist	Fellow of "The Institution of Engineers (India)"
Dr. Ravindra Naik Principal Scientist	Best Short Oral Presentation Award for the paper entitled 'Evaluation of ICAR – CIAE - SBI power operated sugarcane rind removing equipment for juice' in the International Conference on Sugarcane Research: Sugarcane for Sugar and Beyond (CaneCon2021)"
Dr. Chirag Maheshwari Scientist	Best poster award in the International Symposium on "Advances in Plant Biotechnology and Genome Editing" (APBGE-2021)
Dr. MK Tripathi Principal Scientist	"Certificate of Excellence" by Defence Life Science Journal (Defence Research Development Organization, DRDO, Govt of India) for reviewing papers during the year 2020.

License Agreements signed

Sl. No.	Name of Firm	CIAE Technologies transferred	Date of License	Revenue earned (₹)
1.	M/s GV Industries, Dhar, MP	ICAR-CIAE Modular onion storage structure	04.06.2021	40000/-
2.	M/s Swastik Agro Industries, Rajnandgaon, CG	1. ICAR-CIAE Dal mill 2. ICAR-CIAE Multi-purpose mini grain mill	10.06.2021	20000/-
3.	M/s Celebrating Farmers Edge International Pvt Ltd, Nashik, Maharashtra	ICAR-CIAE Sugarcane rind removing equipment for juice making	29.06.2021	45000/-
4.	M/s Sri Balaji Industries, Coimbatore, Tamil Nadu	ICAR-CIAE-SBI Motorized double headed sugarcane single bud cutting machine	29.06.2021	40000/-
5.	M/s Trytex Machine Company, Coimbatore	ICAR-CIAE-NRCB Mechanized package for rope making from outer sheath of banana pseudo-stem	08.06.2021	
6.	M/s Amit Agro Associates, Rampur, UP through M/s Agri Innovate India Ltd. (Agin), New Delhi	ICAR-CIAE-SBI Sugarcane sett treatment device	17.06.2021	
			Total revenue	**1,80,000/-**

TECHNOLOGY TRANSFER

MoU signed

ICAR-CIAE, Bhopal & Madhya Pradesh Vigyan Sabha, Bhopal, M.P. signed an MoU on 24 June, 2021 for 'Establishment of Millet Processing Centre' at Patalkot tribal area at Harshdwari, Tamia Block, Chhindwara, Madhya Pradesh.

Patent application

A precision pneumatic seed metering mechanism for hill dropping and the like (Investors- ML Jadhav, BM Nandede, M Din, PS Tiwari and Dilip Jat) E-application No. 202121017313, TEMP-1/19600/2021-MUM dated 16 April, 2021.

Training organized by KVK

KVK, Bhopal organized following training programmes during the quarter, attended by 521 farmers.

- जल शक्ति अभियान अंतर्गत वर्षा जल संग्रहण एवं उसका उपयोग
- जल की उपयोगिता एवं संरक्षण
- संरक्षित खेती करके जल बचाव
- ग्रीष्म ऋतु में पशुओं की देखभाल एवं बीमारियों से बचाव
- Production of milk and its products
- Sowing of maize crops

On Farm Testing (OFT) and Cluster Frontline Demonstration

On Farm Testing of following technologies were conducted by KVK at Sagonia and Kachhi Berkheda villages during rabi/kharif season (2020-21). The brief details are given below.

Sl. No.	Crop/ Technology	Villages	No. of farmers	Area (ha)	Yield (kg/ha)
1.	Strip Till Drill Machine for sowing wheat variety HI-1544	Sagonia Kachhibarkeda	10	4.0	255
2.	Broad Bed and Ridge Furrow machine for sowing soybean variety JS-2034	Sagonia	04	1.0	-
3.	Integrated Diseases Management (IDM) in soybean crop	Kachhibarkeda and Sagonia	04	1.2	-
4.	CFLD on Soybean JS-2034	Sukaliya, Kacchi Barkheda and Sagonia	31	14.3	



TECHNOLOGY TRANSFER/ HRD

Demonstration at Farmer's Fields

Sl. No.	Demonstration	Villages	No. of farmers	Area (ha)	Yield (kg/ha)
1.	Inclined plate planter for sowing of wheat (Var. PusaTejas) under SWI technology with PD-ATMA, Bhopal	Khamkheda, Barrie Bagraj and Rani Khajuri	04	2.0	2550
2.	Tractor operated strip till drill for Green Gram Varity- PDM-139	Kachhi barkheda	01	0.40	735
3.	Tractor operated strip till drill for Green Gram	Barrichirkheda	01	2.85	761

Human Resource Development (attended through virtual mode)

Name and Designation	Course Title	Duration	Organized by
Dr. Chirag Maheshwari Scientist	Niche Area of Excellence Project	1-12 March, 2021	ICAR-IARI, New Delhi
Dr. Satya Prakash Kumar Scientist	Fundamentals of UAVs	15 March to 4 April, 2021	ICAR-National Agricultural Higher Education Project (NAHEP), MPKV Rahuri centre
Dr. Adinath Kate Scientist	Characterization of Food and Beverages Through Tribology, Rheology, and Other Techniques	25 May, 2021	IIPM, Bengaluru and Anton Paar India Pvt. Ltd
	Onion Processing and Value addition	11 June, 2021	IIFPT, Thanjavur
Dr. Ashutosh Pandirwar Scientist	Rapid Prototyping and Reverse Engineering by 3D Scanner and 3D Printer in Agriculture	7-18 June, 2021	NAHEP Centre of Excellence, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani
Dr. Ravindra Naik Principal Scientist	Management Development Programme on Business Plan Development and Accelerating FPOs/FPCs	21-26 June, 2021	ICAR-NAARM, Hyderabad
Dr. Punit Chandra Principal Scientist	Standardization, BIS	22-23 June, 2021	National Institute of Training for Standardization (BIS), Noida

PUBLICATIONS

Publications

Research papers

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Kumar SP, Pandey KP, Kumar M and Kumar R. 2021. Performance evaluation of hydraulic normal loading device on varying soil conditions for indoor tyre test rig. Pantnagar Journal of Research, 19(1): 90-95.

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Shriniwas DJ, Mathur SM and Khadatkar A. 2021. Design and evaluation of portable compound cattle feed pelleting machine for farm-level feed production. Journal of Scientific and Industrial Research, 80(2): 105-114.

Books

Kumar A, Tripathi MK, Joshi DC and Kumar V. 2021. Millets and Millet Technology. Edited book, Springer Nature, Singapore, ISBN: 978-981-16-0676-2, pp. 438, doi:10.1007/978-981-16-0676-2.

Book Chapters

Hota S, Tewari VK, Singh G, Kumari S. 2021. Technical intervention for assessment of physiological characteristics as function of operating force in traditional agricultural operations. In: Muzammil M, Khan AA, Hasan F (eds) Ergonomics for Improved Productivity. Design Science and Innovation, Springer, Singapore, 391-399.

Senthil KK, Flora G, Gunasekaran S, Ali H, Vimalan M, Balasubramanian S. 2021. Extraction of silver nanoparticles (Ag-nps) by green synthesis from aqueous extract of seaweeds and their consequences on hela cell line and their utility on soil by spectroscopic tools. In: Maddela NR, Chakraborty S, Prasad R (eds). Nanotechnology for Advances in Medical Microbiology, Environmental and Microbial Biotechnology. Springer, Singapore. 119-138, https://doi.org/10.1007/978-981-15-9916-3_5.

PUBLICATIONS

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The following papers have been published in proceedings of International Conference on Sugarcane Research: Sugarcane for Sugar and Beyond organised by ICAR-Sugarcane Breeding Institute, Coimbatore during June 19-22, 2021.

- Arumuganathan T, Senthilkumar T, Sankaranarayanan C, Manikandan GR, Krishnan S, Imran SS and Rajeshkumar M. 2021. Entomopathogenic nematodes (EPN) applicator for white grub management in sugarcane. pp. 680-683.
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- Naik R, K Hari, SJK Annamalai and Bakshi Ram. 2021. Evaluation of ICAR – CIAE - SBI power operated sugarcane rind removing equipment for juice. pp. 655-660.
- Sankaranarayanan C, Singaravelu B, Pandey SK, Arumuganathan T, Senthilkumar T and Rajeshkumar M. 2021. Evaluation of different application methods of subtropical and tropical isolates of entomopa-

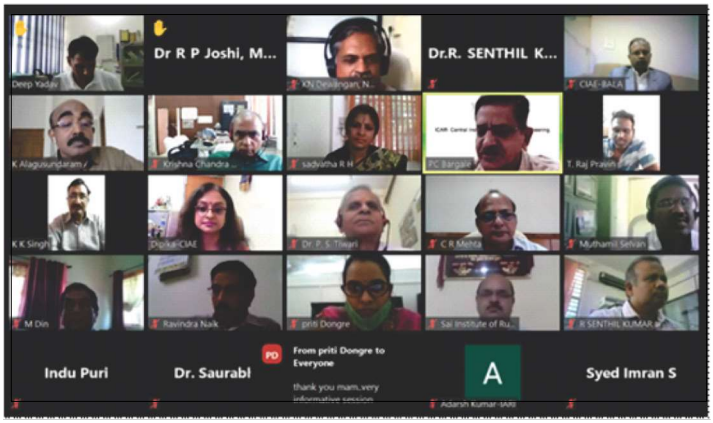
thogenic nematodes (EPN) against white grub holotrichiaserrata on sugarcane under field condition. pp. 619-620.

- Senthilkumar T, Arumuganathan T, Imran SS, Sankaranarayanan C, Manikandan GR. Krishnan S and Rajeshkumar M. 2021. Development and evaluation of mini tractor operated entomopathogenic nematodes (EPN) applicator for white grub management in sugarcane. pp. 642-645.

National Webinar on 'Resilience and Cope-up Strategies in Pandemic through Agricultural Engineering Interventions: Women's Perspective'

ICAR-CIAE organized a national webinar on 'Resilience and Cope-up Strategies in Pandemic through Agricultural Engineering Interventions: Women's Perspective' on 9 June 2021 with an objective of augmenting the women-friendly agricultural engineering technology adoption and mitigate the farm crises during Covid-19 pandemic towards enhancing their livelihoods. The webinar was chaired by Dr. K Alagusundaram, DDG (Agril Engg), ICAR and co-chaired by Dr. KK Singh, ADG (FE), ICAR; Dr. CR Mehta, Director, CIAE and Dr. D Dutta, Advisor and Head, SEED Department, DST, New Delhi. The webinar was attended by 140 participants from ICAR institutes, SAUs and SEED Division (DST) having a background in Agricultural Engineering.

Eight lectures were delivered by the experts on the topics e.g. women centric schemes - funding opportunities by DST, women friendly ergonomic tools and implements for inclusive development, drudgery reduction and women empowerment in agriculture during post Covid-19, ICAR-CIAE technologies for entrepreneurship through processing and value addition, ICAR-CIPHET technologies for entrepreneur-ship through processing and value addition, gender sensitive agri technologies to combat post Covid-19, women empowerment through women technology park - success story of KVK and tribal women custom hiring business model. The presentations were followed by discussion on the theme. Dr. K. Alagusundaram stressed the need of unlocking India's potential in agriculture sector for women empowerment. He predicted a boom in women entrepreneurs in the coming years and concluded his address by requesting delegates to closely follow government's initiatives to tap into new areas to resonate the identity of rural women. Dr. Debapriya Dutta, Advisor and Head, SEED Division, DST emphasized the need of women entrepreneurship and their business leadership for rural prosperity. Dr KK Singh, ADG (FE), ICAR shared his thoughts on key improvements in women friendly tools and implements through the contribution of ICAR, SAUs, and AICRPs, and appreciated the remarkable growth seen in start-ups by women.



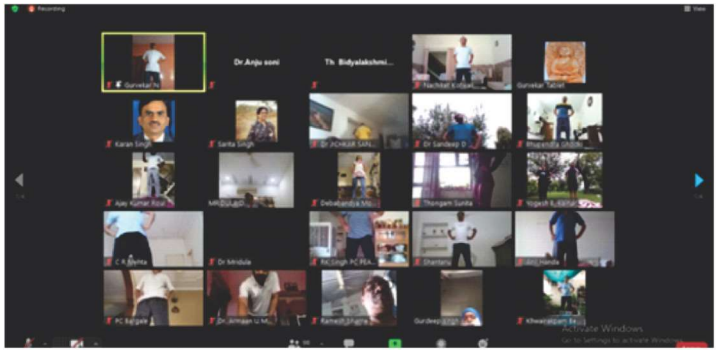
In the closing remarks, Dr. CR Mehta, Director, CIAE hoped that the sessions were productive and helpful for the attendees. Dr Mehta urged the delegates to concentrate on the emerging areas on development of women centric technologies in three ways - reactively, proactively and actively. He hoped that this webinar would pave way to create a dynamic women-friendly environment in agriculture through engineering interventions. The session concluded with the vote of thanks proposed by Dr R Senthil Kumar, Senior Scientist and Convenor of the webinar.

International Yoga Day

Seventh International Yoga Day was jointly organized by ICAR-CIAE, Bhopal and ICAR-CIPHET Ludhiana through virtual mode on 21 June 2021 from 7.00 to 9.00 am. This year's theme was "Yoga for Well-being". The session was attended by 122 participants, which included staff and students of CIAE, CIPHET, doctors, senior officials, lawyers and engineers from different parts of the country. Yoga Guru Sri Sanjay Gurvekar, who has been teaching yoga for past 20 years conducted the yoga session and also provided information on benefits of yoga. The pranayama session was followed by a talk by Dr. Anju Soni, a leading gynaecologist, on women's health issues and remedy through regular exercise, yoga and meditation.

EVENTS/ NEWS FROM PERSONNEL

Dr. CR Mehta, emphasized the importance of yoga in this pandemic situation and urged regular practise for immunity and well-being. Yoga Guruji answered the queries raised by the participants. Dr. Nachiket Kotwaliwale, Director ICAR-CIPHET, Ludhiana shared his experience and benefits of yoga in his concluding remarks. A formal vote of thanks was delivered by Mr. Anil Handa, retired IAS officer. The session was organized by Dr. Debabandya Mohapatra, Principal Scientist through video conferencing.



Ph.D. Awarded

Mr. Chirag Maheshwari, Scientist has been awarded Ph.D. degree in Plant Biochemistry for his thesis entitled 'Impact of Ribulose - 1, 5-bisphosphate carboxy-lase/oxygenase (RUBISCO) knockdown on photo-synthesis and growth characteristics of rice plants" from ICAR-Indian Agricultural Research Institute, New Delhi.

Staff Promoted

Following staff members were promoted to Personal Assistant wef 29 June, 2021.

K. Shankar

Bindu Prasad

Lokendra Soni

Staff Transferred

Smt. Suruchi Bhagchandani, Assistant was transferred to ICAR-Indian Agricultural Research Institute, New Delhi and relieved from the institute on 21 June, 2021.

Staff Superannuated

Shri S.K. Bagde
AAO
31 May, 2021

Shri S. Dilip Kumar
UDC
31 May, 2021

Shri RK Shrivastava
Senior Technician
31 May, 2021

Shri SK Shroti
Technical Officer
30 June, 2021

Smt Vijaylata Minj
Assistant
30 June, 2021

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