Recommendations of the 58th ISAE Annual Convention and International Symposium

Indian Society of Agricultural Engineers (ISAE)
The 58th Annual Convention
on

Engineering Innovations for Next-gen Digital Agriculture
&
International Symposium on
Agricultural Engineering Education for Aspiring Youth in Transforming Agriculture

NOV -2024
12-14





Venue : Golden Jubilee Convocation Hall
VNMKV, Parbhani

• Jointly organized by •

Indian Society of Agricultural Engineers
&
Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani - 431402
Maharashtra, India

Recommendations of the 58th Annual Convention and the International Symposium of the Indian Society of Agricultural Engineers (ISAE) organized jointly by the ISAE and Vasantrao Naik Marathwada Krishi Vidyapeeth (VNMKV) during 12-14 Nov. 2024 at VNMKV, Parbhani, Maharashtra

Theme of Annual Convention: Engineering Innovations for Next-gen Digital Agriculture

Theme of International Symposium: Agricultural Engineering Education for Aspiring Youth in Transforming Agriculture

Padma Bhushan Dr R.S. Paroda, Chairman Trust for Advancement of Agricultural Sciences (TAAS) and Former Secretary, Department of Agricultural Research and Education, GoI & Director General, Indian Council of Agricultural Research (ICAR) graced the inaugural function of the convention as the Chief Guest and addressed all the participants and delegates about the challenges and opportunities of next-gen agriculture in the country. He also emphasized that agricultural engineers should be in front and take the lead in digital agriculture to transform the agriculture sector into a lucrative and sustainable profession in rural India. Dr S.N. Jha, President of ISAE and Deputy Director General, ICAR (Agril Engg), urged the state governments to create a dedicated Directorate of Agricultural Engineering in their respective States, along with agricultural engineering functional cadre from community development (CD) blocks to the state agricultural ministry. To match the agricultural production of the developed nations, Indian agriculture needs to be modernized in order to make advanced agricultural technologies/inputs/knowledge accessible to small and marginal farmers. Dr Indra Mani, Vice-Chancellor, VNMKV, stressed functional collaboration between academia and industry to enhance competitive entrepreneurship skills among the students and facilitate institutions for industry-ready students. Besides, industry experts shared their experiences and flagged the issues needed from academia in the agricultural engineering discipline. Thereafter, 21 parallel technical sessions were conducted under four major themes, *viz;* i) Farm machinery and power engineering, ii) Food processing and technology, iii) Land and water management technology, and iv) Green and alternative energy technology. Each session designed to address the identified sub-theme started with a lead presentation by an invited expert, so a total of 21 lead papers were delivered at the conference. Altogether 490 presentations (offline/online) were delivered in the technical sessions on various aspects. In addition, the international symposium and plenary sessions on farmers and students were major

attractions of the convention. Salient recommendations that emerged from the 3-day marathon deliberations and the discussions are given below.

A) International Symposium: Agricultural Engineering Education for Aspiring Youth in Transforming Agriculture

i) Design agricultural engineering courses, including applications of Artificial Intelligence (AI) and Machine Learning (ML) in all segments of Agricultural engineering with a special focus on precision agriculture. Augmented reality (AR) and virtual reality (VR) must be encouraged as learning tools in UG/PG teaching.

ii) Offer more elective courses that match industry demands and engage agricultural engineering students with the industry throughout the years. Industry personnel and the ICAR Agricultural Engineering division should be consulted, and input should be taken while revising the syllabus.

iii) Encourage the students to select industry-sponsored research projects and internships in Industry only.

iv) The National Institute of Agricultural Robotics & Al needs to be established in the National Agricultural Research Education and Extension system to fulfill the need for indigenous next-gen digital agriculture.

v) Digital agriculture, machine learning, deep learning, drone technology, Al, Internet of Things (IoT), software development, Mobile apps developments, bio-informatics, and statistics/modeling are purely engineering subjects and could be better implemented by the engineering division, and therefore institutions/ ICAR/SAUs should bring these activities/projects and developmental work under Agricultural Engineering.

B) Annual Convention

Theme 1: Farm Machinery and Power Engineering

i) One of the key topics discussed was machinery designed for cash crop cultivation - cotton and sugarcane. These machines should integrate technologies like FAAS, IoT, AI, ML, DML, and Big Data to meet the demands of mechanization 4.0. Additionally, the development of cost-effective, customer-centric robots and automated guided vehicles (AGVs) with suitable capacity for Indian farms were emphasized.

ii) Power tillers with Rubber track systems yielded improved performance, and tractive efficiency with reduced motion resistance in soft soils may be adopted.

iii) Efforts should be made to optimize energy utilization in small farm mechanization by utilizing multi-utility prime movers with a single chassis system for both front and rear-mounted equipment.

iv) There is a need to focus on the mechanization of labor-intensive operations, such as weeding and interculturing, particularly for small and marginal farmers. Small tractor-operated machinery, such as vegetable transplanters and sugarcane setting transplanters, can be well-suited for mechanizing small and marginal farms.

v) Interventions are needed to enhance the multi-functionality of individual machines, enabling them to perform multiple operations (e.g., using seed drill tines for weeding purposes). This would help increase the level of mechanization in sowing and weeding operations.

vi) The development of a low-cost precision pneumatic planter and precision calibration system for seed-cum-fertilizer drills are prerequisites for promoting precision in sowing and planting operations. Such machinery should be fine-tuned and made available to farmers.

vii) The growth of Indian agricultural machinery manufacturing could be supported through government policy interventions, modern manufacturing processes, and strong export policies.

viii) Bailing system integrated with a self-propelled combine harvester, battery operated mango harvesting tool with a telescopic pole, self-propelled high clearance vehicle for tea harvesting, high clearance self-propelled chili harvester, power-operated groundnut stripper, girdling tool and chemical injectors for litchi cultivation and brush type cotton stripper harvester, tractor operated hay rake, tractor operated banana stem shredder may be extensively tested and promoted further.

ix) Studies need to be conducted on the application of drones in spraying, seed broadcasting, granular fertilizer, and nano-urea application, remote control as well as autonomous vehicles for small farms and polyhouses, handheld devices for disease detection and fertilizer recommendations, and sensor-based fertilizer applicators. Standard Operating Procedure (SOP) of advanced technologies/machines/gadgets should be developed for their hassle-free application.

x) Real-time interventions like computer vision-based human postural analyzers and virtual interfaces for machinery operation monitoring have great scope to improve work efficiency and reduce human discomfort.

Theme-2: Processing, Dairy and Food Engineering

i. Emphasis should be given to develop technologies and machinery for processing and handling multi-commodities to ensure year long use of developed infrastructure.

ii. Colour and other bioactive components from the unexploited crops may be extracted besides value addition for better utilization of those crops.

iii. Utilization of by-products and wastes should also be addressed during the development of the process for value addition of crops to increase the profitability.

iv. Novel methods of processing should be adopted to a larger extent to increase efficiency and cost-effectiveness with focus on retaining nutrients.

v. Value addition technologies proven at laboratory/pilot plant scale need to be taken to the industry level for commercial venturing.

vi. Extending financial support through research grants for the refinement / scaling up of technologies proven at the laboratory for industry adoption is the need of the hour.

vii. Entrepreneurship development also need to be included in the development of the value addition process.

viii. In the development of postharvest processes and equipment, electronic controls and automation should be incorporated to increase safety and efficiency.

ix. The research activities also need to be initiated for acquiring and providing data/information for the development of national standards.

Theme-3: Land and Water Management Technologies/Soil and Water Conservation Engineering

i. Decision support system –'Predictive Analytics and AI Model' using historical and real-time data, AI-powered software/mobile app to predict crop yield, pest outbreaks, and ideal planting/harvest times, helping farmers to make proactive decisions are the most sought-after tool in next-gen agriculture.

ii. Aerial mapping and surveying using drones with high-resolution cameras map fields to create topographic maps and identify variations in soil, crop height, and plant density for more precise field management should be encouraged under R& D activities.

iii. These information needs to be generated at the watershed/basin scale using regional and global climate models coupled with agro-ecohydrological models for adaptive management strategies to make agriculture climate resilient. Research studies should be encouraged on such aspects.

iv. Emphasis should be given to the design of automated hydroponic structures with nutrient film techniques, and more research is required on the effect of pink light reinforced to increase photosynthesis during night time.

v. Energy-efficient aeroponic and aquaponic systems need to be popularized, considering their low operational cost and usefulness in energy constraint areas.

vi) Center Pivot Irrigation System should be promoted on a large scale through FPO for major crops, viz. wheat, rice, and sugarcane, and also more focused R&D on automated drip irrigation and fertigation systems is needed.

vii) Managed Aquifer Recharge (MAR) could be emphasized in R&D activities to enhance sustainable groundwater management, keeping the concept of a water-positive zone.

viii) Drying and dying of natural springs in the Himalayan mountains seriously threaten water availability in mid and high hills. To rejuvenate springs, rigorous studies are required to delineate the recharge zone of the springs and develop a systematic recharge plan for the spring sheds using water isotopes.

ix) For the next- Gen Watershed Development -i.e. 'Shift in Approach', emphasis on bioengineering based soil and water conservation measures and technologies need to be given to enhance the natural resource base, viz; water and soils in the watersheds.

x) In the tune of the flagship program - Digital Agriculture, a number of IoT and AI-powered devices/tools/ mobile Apps are being developed by various agencies to facilitate the farmers in decision-making to manage their farms with high water use and Agri-input efficiency. The effectiveness of such tools and gadgets needs to be evaluated, and the advantages/benefits of the gadgets should be quantified.

Theme 4: Green and Alternative Energy Technologies

i) The techno-economic evaluation of Agro-voltaic technology with reference to location, crop, structural, and overall solar geometry parameters needs to be studied and promoted for wider adaptability.

ii) The energy saving opportunities by enhancing the energy efficiency in agro-processing industries need to be promoted.

iii) Energy education within the agriculture education system in India needs to be strengthened and encouraged by scientists and industry professionals who are involved in R&D activities in the agricultural engineering domain.

iv) The life cycle assessment of renewable energy technologies, along with a reduction in carbon footprints in the agriculture ecosystem, needs to be promoted.

v) Smart Solar Irrigation systems need to be developed in integration with IoT and sensors to enable precise water delivery based on real-time soil moisture and weather data. Precision farming with solar energy based on solar sensors monitors environmental conditions and optimized agricultural inputs like water and fertilizers need to be studied.

C) Plenary Session

The plenary session was graced by several luminaries of Agricultural Engineering, industry personnel, farmers of repute, and students. The vice president presented the technical recommendations that emerged from all technical sessions. Thereafter, policy issues for faster growth of agricultural mechanization were discussed, and all appreciated the Honorable Parliament Standing Committee which set targets of 75% mechanization level by 2047 and also recommendation for establishing the Directorate of Agricultural Engineering in all States and Union Territories, appointment of Agricultural Engineers in each Panchayat, blocks, districts and state levels in sufficient number. After thorough discussion, the following **Policy recommendations** emerged:

i) All States and Union Territories should establish a Directorate/Department of Agricultural Engineering, bringing farm machinery, post-harvest technology & value addition, soil & water conservation, integrated watershed development programs (IWDP), PMKSY- More crop per drop of water/*Har-khet ko pani*/ minor irrigation, energy in agriculture, etc., under one umbrella, under the Ministry of Agriculture.

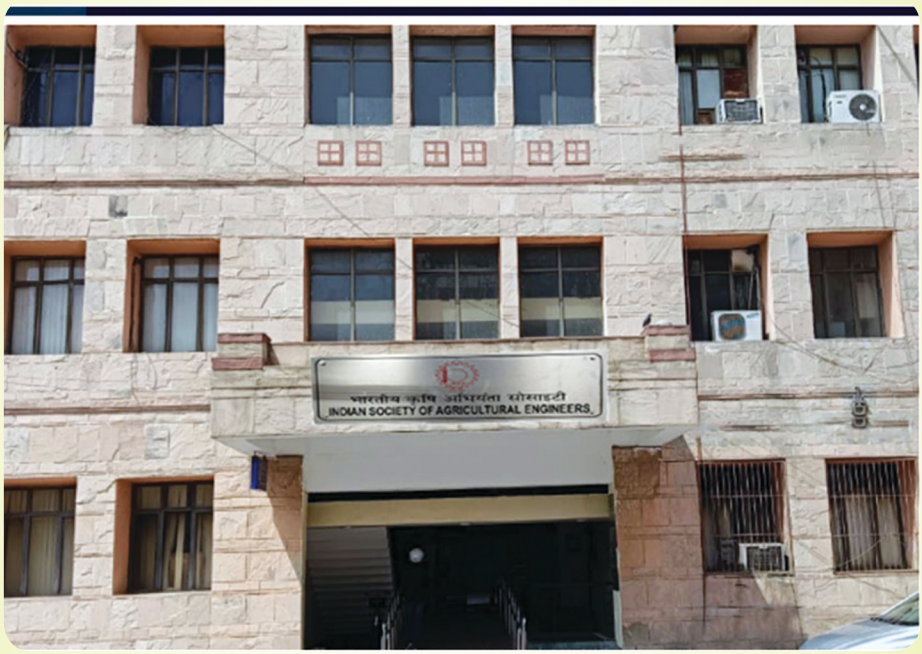
ii) Nowadays, everyone is doing digital agriculture, deep learning, and machine learning. Scarce resources and funds are thinly distributed, which may prove unproductive in the long run. The convention, therefore, recommends bringing all activities of digital agriculture and precision agriculture, including AI, DL, ML, app developments, bio-informatics, statistics/modeling, sensors, robotics, etc., under Agricultural Engineering in each institution/university/ICAR.

iii) ICAR/Ministry of Agriculture & Farmers Welfare must open a National Institute of Agricultural Robotics and AI in the country to fulfill the need for next-gen Agriculture indigenously.

iv) There are lot of talks and initiatives on industrial use of sugarcane, maize, spoiled grains, fibre crops including cotton, rural agro-industrialization for higher employment of youth and income to farmers. Governments therefore should also think to open a new department, may be called as **"Department**

of Industrial Agricultural Research (DIAR) on line of DSIR in ministry of Science and Technology.

v) Agricultural Engineering is a single discipline of study in the world that deals with all kinds of engineering in agriculture, including food processing & value addition, soil and water conservation, irrigation and water management, and energy in and from agriculture. The relevant ministries/ departments such as the Ministry of Jalshakti, Food Corporation of India, Ministry of Consumer Affairs, Ministry of Food Processing Industries, tractor and machinery industries, and food processing industries should appoint Agricultural Engineers and Technologists in large numbers for faster and better growth of the Indian Economy to make India a developed country by 2047.



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