Recommendations

1st Indian Rice Congress

Rice Research and Development for Achieving Sustainable Development Goals

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ICAR-NRRI, Cuttack, Odisha

Organized by

Association of Rice Research Workers
Cuttack, India

in collaboration with

Indian Council of Agricultural Research, New Delhi
ICAR -Indian Institute of Rice Research, Hyderabad
ICAR-Indian Agricultural Research Institute, New Delhi
Odisha University of Agriculture & Technology, Bhubaneswar
Society for Advancement of Rice Research, Hyderabad
IRRI South Asia Regional Centre, Varanasi
ICAR -National Rice Research Institute, Cuttack

Rice (*Oryza sativa* L.) is the major source of food for 40% of the world's population. In Asia 1.6 billion people takes rice as their staple food. Rice production is an important source of livelihood for around 144 million rice-farming households and for millions of poor people working on rice farms as hired labourers. Rice farming and poverty could be bracketed together in many areas. About 900 million of the global population, mostly poor and under-nourished is associated with rice farming. Out of these, 400 million people are directly engaged in rice production. India is self-sufficient in rice production and the production system is slowly becoming resilient to climate variables in recent years. The area of rice cultivation is also stable for last few years. But per capita rice consumption is declining, while rice export is increasing. Large water footprint, high greenhouse gas emissions and large amount of stubble burning are associated with rice production system in some regions of the country. There are apprehensions on "How much to produce" and "the quality of produce" in rice.

Rice and related activities will be able to address 9 of the 17 United Nations Sustainable Development Goals (SDG). SDGs of *No Poverty (Goal 1), Zero Hunger (Goal 2)* are only possible with overall rice development. In addition, rice production relates with *Gender equality (Goal 5), Clean water and sanitation (Goal 6), Decent work and economic growth (Goal 8), Responsible consumption and production (Goal 12), Climate action (Goal 13), Life on Land (Goal 15) and Partnerships (Goal 17).* The SDGs could only be achieved through systemic rice research, distribution of technologies, empowering the women and sustainable resource management. This requires partnerships among the government institutions, public and private organizations, farmers and policy makers and other stakeholders.

Association of Rice Research Workers (ARRW) at ICAR-National Rice Research Institute, Cuttack; established in 1961, is one of the oldest societies in India. The Association in collaboration with Indian Council of Agricultural Research, New Delhi; ICAR-National Rice Research Institute, Cuttack; ICAR-Indian Institute of Rice Research, Hyderabad; ICAR-Indian Agricultural Research Institute, New Delhi; Odisha University of Agriculture & Technology, Bhubaneswar; Society for Advancement of Rice Research, Hyderabad and IRRI South Asia Regional Centre, Varanasi organized the first "Indian Rice Congress" to provide a platform for researchers, industries, policy makers and farmers to discuss the national and international developments in rice science. The theme of Congress was "Rice Research and Development for Achieving Sustainable Development Goals". The objective of this congress was to discuss recent advances in science to come out with action points to meet the global needs on SDGs.

The salient recommendations emerged in the Congress are presented below.

1. With large water footprint, high greenhouse gas emissions and large amount of stubble burning; rice production is unsustainable at current price and production in some parts of India and elsewhere. Rice research needs to be reoriented to address the issues of profitability, equity, quality, climate resilience, environmental safety and sustainability.

2. In recent years, powerful tools like genomics-assisted breeding, transgenic and genome editing technologies have brought a paradigm shift in crop improvement efforts. Emphasize should be given to incorporate recently discovered genes *OsSPL14*, *SCM2*, *GS5*, *GW5*, etc. Cis-genic genome editing technology to impart herbicide tolerance, tiller number, and grain number need to be utilized in direct-seeded rice (DSR). The traits targeted through transgenic route can well be achieved through genome editing. It is high time to loosen the regulatory stringency and focus more on public acceptance to harness the potential of genome editing and transgenics.

3. Most of the concerns regarding first- and second-generation rice hybrids such as poor grain quality, poor seed-set and lower level of heterosis have been overcome in the recently released rice hybrids. Public-

private partnership is the way forward for up scaling hybrid rice technology. The research on thermo-sensitive genic male sterility (TGMS) should be strengthened to reduce the cost of seed production in hybrids.

4. Efforts should be made to include traits to improve the plasticity of rice plant for its better adaptation under climate change, nutritional quality of rice grain, resource use efficiency, weed competitiveness and the emerging biotic and abiotic stress tolerances. Concerted research efforts on the development and identification of drought stress-tolerant and water use efficient rice varieties need to be explored for sustaining rice production.
5. Soil sustainability of rice farming can be improved by the inclusion of appropriate microbial consortium, use of biochar, agro-wastes, optimal micronutrient management viz., Fe pulsing for DSR, and use of responsive varieties. Technologies such as DSR, alternate wetting and drying (AWD) and aerobic rice should be promoted wherever feasible. Possibilities of conservation agriculture with residue retention and drip irrigation in rice needs to be explored.
6. Yield gap is as high as 68% in the rainfed ecosystem and even in the irrigated ecosystem it is about 40%. In order to reduce the gap, it is necessary to make them more competitive through soil fertility management, timely distribution of quality seeds, GPS-based mapping, deployment of varieties suitable for different ecosystems and various institutional reforms for timely delivery of extension and other critical services.
7. Rice farming is having varying ecosystem services in different ecologies, which needs to be factored in to arrive at overall benefits of rice farming. Even if we consider the utilitarian value of rice field in terms of provisioning services only, some kind of royalty or payments for ecosystem services (PES) can be devised to incentivise the farmers. It is high time to quantify the requirement of rice to meet the domestic and export needs and their environmental costs. Disaggregated analysis of environmental cost of rice production will be of better indicator for addressing sustainability of rice production system.
8. New methods of application of pesticides and fertilizers along with nano-formulations of the chemicals, can enhance the use efficiency and reduce contamination and residual effects. Further, soil health cards, geocoding, bar coding, etc. may help to reduce fertilizer requirement. A suitable policy change for the use of agro-chemicals will be highly desirable.
9. There is an urgent need to re-examine integrated pest management (IPM) in rice. New ecology-based approach needs to be explored. Pest monitoring and forecasting need to be developed using sensor, drone and satellite-based technologies. Identification of multiple resistant sources against two important insect pests of rice i.e., brown plant hopper (BPH) and yellow stem borer (YSB) are need of the hour. Focussed research is required to tackle the emerging diseases like false smut and bakane.
10. Making seeds and other technologies available to farmers at affordable prices through public-private partnerships using appropriate model is highly essential. The present extension system is designed to address the deficit in production. Policy reforms towards a market-led extension of rice production technologies are required. Institutional innovations and partnerships through network of self-help groups (SHGs), skilled labour banks, custom hiring centre, farmer producer organizations (FPOs), etc. should be developed and strengthened. Capacity building and training of farmers to use new technologies is essential for successful upscaling.
11. Women's participation in the rice value chain is a sequential process to change the manifestations of gendered vulnerabilities. Multiple strategies are necessary to make transformatory and sustained changes in gender relations at the household and society levels while promoting climate resilience measures among small producers.

12. Even though a large area is under high-yielding varieties; traditional varieties, landraces and speciality rice occupy a niche area in the country, and there is significant scope for enhancing their genetic potential and market availability. India can emulate the strategies to increase the profitability of rice farmers by encouraging the cultivation of specialty rice, sticky rice, Jasmine rice and fragrant rice by tweaking the rice export policy.
13. Rice export policy should be reoriented by evaluating the comparative advantage of the area and products considering the global value chain. Export of value-added rice and new rice products such as rice bran or bran oil, healthy rice-based snacks, organic rice and bio-fortified rice should be promoted for enhancing profitability.
14. Future rice farming should be digital and smart for timely application of inputs so that the crop requirements are met at the right time and right amount with appropriate technologies including sensors, artificial intelligence, meta-data usage etc. Mapping rice-growing areas in the country for their suitability and vulnerability through geo-spatial and simulation tools will help to assess the impact of vulnerability reduction strategies, so that resource allocation can be targeted accordingly.
15. Investment intensity in rice research needs to be enhanced, particularly for the eastern region of India. Investment in research needs to be linked with economic, environment and social sustainability. The priority areas of investment should be high-throughput genotyping and phenotyoping platforms, crop residue management, conservation agriculture, issues of over-utilization of water, improving input efficiency, climate resilience and human resource development.

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