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SEEDS

HARBINGER OF FOOD SECURITY



FUTURE OF SEED RESEARCH IS VERY BRIGHT

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in the drylands of Asia and sub-Saharan Africa. ICRISAT and its partners help empower the poor people to overcome poverty, hunger and a degraded environment through better agriculture. Headquartered in Hyderabad, Telangana State, in India, with two regional hubs (Nairobi, Kenya and Bamako, Mali) and country offices in Niger, Nigeria, Zimbabwe, Malawi, Ethiopia and Mozambique, ICRISAT conducts research on five highly nutritious drought-tolerant crops: chickpea, pigeonpea, pearl millet, sorghum and groundnut. In a rendezvous with Agriculture Today, Dr. David Bergvinson – Director General, International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) discussed about India's seed priorities and the direction of research.



India has been more inclined towards developing seeds of major food crops and not the millets/coarse cereals. How will it affect India's capability as a food producer in the long run?

Due to the chronic food deficit, the first green revolution focused on increasing production of rice and wheat in the 1960s and both continue to be the staple food for the nation. The rural sector is now more attracted to rice and wheat crops (given their increasing affordability), which has left little scope for growth of the millets and coarse grain markets. Thin profit margins for these crops mean they are less attractive to the private sector, and therefore they have no interest in exploiting this segment. So these crops are heavily dependent on public research institutions. In the long run, India needs to invest and promote millets and coarse cereals not only for their nutritional attributes, but also for the fact that these are climate smart crops and under the scenario of unpredictability of climatic conditions, they are much better adapted to drought and high temperatures.

What is the level of research going on in India in the millets segment?

Realizing the need for promoting millets and sorghum, several activities are currently ongoing in both research and seed production, and several good seed varieties are available. The geographical focus of pearl millet improvement program in India has been on A and B zones where strong public sector breeding programs and private sector programs have been established. Although the area under this crop fluctuates between 7-9 m ha, the production levels have remained relatively stable at around 7-8 million tonnes due to the introduction of high-yielding hybrids and a strong network of private sector participation



in the seed system. Hybrids occupy about 4.5 million ha with over 120 hybrids, mostly from the private sector. The productivity improvement has especially been remarkable during the last 15 years where pearl millet yield has improved at the rate of 7% per annum. Pearl millet research in India is conducted through the All India Coordinated Research Project of the Indian Council of Agricultural Research (ICAR). ICAR along with its partners, including ICRISAT, took up the challenge to improve pearl millet productivity to ensure food and nutritional security in rainfed regions through strategic research and genetic diversification of cultivars and its parents. At ICRISAT, the hybrid-parent diversification and dissemination is ongoing with continued support from over 30 private sector partners in India. Seed production and delivery chain is well developed in the private sector, while public-supported state seed corporations (SSC) are gradually expanding their seed production network towards the public bred cultivars.

In recent times, partnership-based breeding of high-iron and zinc cultivars are addressing the need for improved nutrition, and a first wave of high-Fe (iron) cultivar (Dhanashakti) has been adopted by over 35,000 farmers and several hybrids with higher iron are in the final stages of testing at the national level for nutritional impact. Nutri-Farm project, a pilot program of the Indian Government, has opened up opportunities for large-scale procurement of bio-fortified cultivars (grains) and possible inclusion in the PDS in millet consuming states and expected to spread across the country. This encourages private sector investment and involvement in developing high mineral dense cultivars in the near future.

How can we include small and marginal farmers in the next phase of India's green revolution?

Technology dissemination and

adoption need to focus on small and marginal farmers which can bring-in change in the income levels of these farmers. The participatory approaches of these farmers in R&D can also play a crucial role in the adoption process. Specific schemes of the Government of India with focus on small and marginal farmers and its effective reach, can pull these farmers towards the 2nd green revolution. There will also be a need to link these marginal farmers to the markets so that they can be transformed from subsistence to sufficiency, thereby enhancing their incomes and ability to withstand risks. In India, most land holdings are small and therefore, small and marginal farmers will play an important role in achieving the next green revolution. Large scale encouragement through policy support for cultivation of millets, availability of quality seed of improved varieties and hybrid cultivars through an efficient seed system, mechanization of agriculture, improved extension services, and judicious use of natural resources such as irrigation water for these crops, will go a long way in achieving the next green revolution in India.

India hasn't made much progress in the area of pulses as we are still dependent on imports to meet our requirements. Is the lack of new varieties or research a reason behind this? How can we improve the situation?

The UN declared 2016 the International Year of Pulses to give more visibility to these important crops that offer high levels of protein to improve human and livestock nutrition, improve soil health and offer a diversified source of income for smallholder farmers around the world. India is the largest producer (18.2 million tons), consumer (over 22 million tons) and importer (3-5 million tons per year) of pulses, thereby necessitating an urgent need to bridge this gap. The target set is for the production of 23.5 million tonnes of pulses by 2020 and 27.5 million

tonnes by 2025, while the target for an average yield has been set at 900 kg per ha by 2020 and 1,000 kg per ha by 2025 against the current average yield of 750 kg per ha. A roadmap to achieve pulses self-sufficiency for India by increasing production, yield and area under pulses and by setting up seed hubs and demonstration of best technologies was recently drawn up by the central government in consultation with national and international research institutes. The government announced the implementation of the Pulses Program, with an outlay of INR 4.05 billion (US\$ 60.44 million) over the next four years to achieve self-sufficiency in pulses. To achieve all this, besides setting up 150 seed hubs across India to produce quality seed, plans are also in place to conduct 100 clusters of demonstrations on best-bet technologies across the country, with each cluster covering an area of 100 ha. This will include crop varieties for all cropping seasons, cropping systems, mechanization, integrated crop management practices, grain processing and storage, value addition, marketing etc.

ICRISAT is well placed to support this initiative through accelerated seed production of improved varieties, facilities and model upscaling through existing partnerships with key state governments. We hope to achieve this through our work on the science of delivery and application of business intelligence platforms to coordinate on-the-ground activities and implement key performance indicators to track progress and make course corrections. Besides, ICRISAT has the additional strength to involve private sector partners to vertically integrate farmers into value chains as well as value addition and marketing through Farmer Producer Organizations (FPOs) and associations like the Self Employed Women's Association (SEWA). With these interventions, ICRISAT, ICAR and partners expect to usher in the era of pulses self-sufficiency in India during this decade.



What seed traits should we emphasize in today's agriculture?

Given the rapid and vast changes in weather variability associated with climate change, R&D in seeds needs to focus on extreme weather conditions and the capability to respond to changing production environments to help smallholder farmers manage risks. ICRISAT is working on the stay green technology for many of the dryland crops. Besides developing crop varieties with tolerance to abiotic constraints like drought, high temperature and salinity, there is an urgent need to develop crop varieties with sustainable resistance to various biotic constraints like insect pests, fungal pathogens and viruses. For example, developing resistance to the legume podborer, *Helicoverpa armigera* in important pulse crops like pigeonpea and chickpea is very high on the agenda, and biotechnological interventions may be the only way to develop varieties with resistance to this constraint. Enhancement of the nutritional profile of our crop plants to address the problem of malnutrition should also be high on the agenda for crop improvement. Nutritional seed quality traits such as protein, iron, zinc, calcium contents and improved amino acid profile of protein are important seed traits to emphasize in today's agriculture to make India nutritionally secure.

What are your thoughts on commercializing cultivation of GM food crops?

While the availability of a few GM crops like soybean, corn, canola and cotton (including only cotton in India) have already established the potential of this technology in agriculture, the commercialization of important GM food crops like pigeonpea, chickpea, rice etc., especially from the public sector, will have a long lasting impact on sustainable agriculture in India. However, for this, the public sector research will have to be promoted in a mission mode. This will ensure the accessibility of

this technology to resource-poor farmers, especially in the open pollinated crops. However, to accomplish this, the public sector must develop its capabilities in taking the proof-of-concepts from GM technology all the way through to commercialization. This will require the development of adequate infrastructure, capacity building in biosafety assessments, business models for product deployment and stewardship. In line with this, with support from the Department of Biotechnology, Government of India, ICRISAT has established a Platform for Translational Research in Transgenic Crops (PTTC). The PTTC will provide an opportunity for public-sector research institutes and private sector biotechnology companies to work together for translating transgenic research into products.

What would be the future of seed research?

The future of seed research will lie not only in continuing to develop new and improved crop cultivars, but also ensuring that good quality seeds are made available to the farmers with high adoption rates. For this, the Government of India's proposal to establish seed hubs and demonstration of best bet technologies across the country, besides modern mechanization, integrated crop management practices, grain processing and storage, value addition and marketing etc. will have to be well established and implemented. India is a vast country with a wide range of climatic conditions suitable for cultivation of a range of crops. It has well established research programs for almost all crops and with availability of skilled personnel; the future of seed (crop improvement) research is very bright as we unlock the full potential of crop diversity to empower smallholder farmers realize their full potential as they produce nutritious and safe food for all.