TRIBUTE

Piloting International Rice Research

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The golden era of the International Rice Research Institute (IRRI) was between 1982 and 1988, when Professor M. S. Swaminathan was its Director General. Swaminathan built the IRRI into a centre of scientific excellence, and quickly brought the IRRI to prominence among the centres of the Consultative Group on International Agricultural Research (CGIAR). As a renowned plant breeder and geneticist, Swaminathan's primary focus was on developing high-yielding and insect- and disease-resistant rice varieties. Under his leadership, the IRRI made significant strides in rice breeding, genetics, biotechnology, biochemistry, physiology, and supportive agronomic practices. During his period as Director General, the IRRI developed and deployed improved rice varieties that significantly increased yields and helped to combat hunger and malnutrition.

Swaminathan had also been attempting hybrid rice breeding in India independently, and had, in fact, presented a paper at the International Rice Research Conference at IRRI in 1971 on the subject (Swaminathan, Siddiq, and Sharma, 1972). His deep understanding of the relative advantages of hybrid rice technology and his significant efforts at the IRRI to ensure that this technology took root not only in China, but also in different parts of the world, were of lasting international significance.

Swaminathan was a great proponent of biotechnological tools for the genetic improvement of rice crops, and of genetic transformation and tissue culture work at the IRRI. He also supported the anther culture work at the IRRI that led to the development of doubled haploids. This, in turn, helped rice biotechnologists accelerate research in transgenics and gene editing.

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A Pioneer of Genetic Conservation and Use

His enormous contributions to strengthening the IRRI's Gene Bank by making it a global treasure trove for use by global rice breeders led to a steady flow of international funds to protect and conserve valuable rice germplasm. He emphasised the importance of conserving biodiversity and preserving indigenous knowledge. Many of the world's wild rice accessions were collected and conserved during his tenure as IRRI Director General. He laid the foundation of the gene collection in 1969 when he visited the IRRI and highlighted the importance of preserving rice germplasm to ensure food security for future generations. Swaminathan proposed a "living gene bank" for rice, where the germplasm would be conserved as living plants in the field. As a result, the IRRI established the International Rice Germplasm Centre (IRGC) in 1970 to collect, conserve, and distribute rice germplasm worldwide. Swaminathan served as the chairperson of the IRGC's Advisory Committee from 1976 to 1981, playing a crucial role in shaping the Centre's policies and priorities. Under his guidance, the IRGC collected and conserved more than 110,000 rice accessions, including traditional and wild varieties worldwide. These accessions were used for breeding and research, and helped develop rice varieties of increased productivity and resistance to pests and diseases. Now known as the IRRI's International Rice Genebank, it is the largest rice gene bank in the world, with more than 134,000 accessions of rice germplasm. It plays a vital role in global food security by conserving and distributing rice germplasm to researchers and breeders throughout the world. Swaminathan's leadership played a crucial role in establishing the IRGC and in leading it to success.

Professor Swaminathan strengthened the International Network for Genetic Evaluation of Rice (INGER), a global network for evaluating advanced pre-variety breeding lines developed by the rice breeding programmes at the IRRI and in national agricultural research and extension partner-organisations. Swaminathan also played a significant role in the International Rice Testing Programme (IRTP), the predecessor of INGER, which was established by IRRI in the early 1970s. The objective of IRTP was to evaluate and identify high-yielding rice varieties from different countries and make them available to farmers to increase productivity and improve food security.

Building Partnerships and Collaborations

Swaminathan was instrumental in establishing the Consultative Group on International Agricultural Research (CGIAR), and promoting collaboration among research institutions worldwide. With respect to rice research, Swaminathan worked to foster collaborative research and the exchange of advanced rice varieties between countries. He participated actively in IRTP, contributing his expertise and knowledge to the programme. He emphasised rigorous testing and evaluation of rice varieties under various agro-ecological conditions to ensure their adaptability and

performance in different regions. Through his involvement in IRTP, he helped establish solid partnerships and collaborations among rice scientists and researchers internationally, encouraging them to exchange information and expertise and work together to identify suitable rice varieties for specific regions. The programme helped farmers gain access to high-yielding and stress-tolerant cultivars, thus increasing rice production and enhancing food security. Swaminathan's vision of collaboration and knowledge-sharing continues to shape international efforts to improve rice productivity and address global food security challenges.

The International Rice Information System, which aimed to collect, analyse, and disseminate information on rice research and development, was established when Swaminathan was Director General of IRRI. This later became the foundation for the International Crop Information System. This initiative facilitated global collaboration and knowledge-sharing among researchers. Today it is called the Enterprise Breeding System, a CGIAR-wide initiative to better understand global agricultural research data with the most modern analytical, statistical, and molecular tools.

Swaminathan recognised the significance of traditional farming practices and the need to incorporate them into modern agricultural systems. He promoted farm mechanisation to reduce production costs and free women from the drudgery of heavy farm work.

Social Sciences

Throughout his career, Prof. Swaminathan emphasised the social and ethical dimensions of agricultural development. He recognised that technology alone would not solve farmers' problems, and therefore advocated approaches that encompassed rural development, women's empowerment, and cultural heritage preservation. He highlighted the importance of integrating socio-economic research in the IRRI's work, initiating studies to assess the impact of the Institute's research on the socio-economic conditions of farmers and rural communities. These studies aimed to evaluate the effectiveness of new rice varieties and farming technologies in boosting yield, diminishing poverty, and addressing problems of food security. He promoted research methods that involved collaboration with farmers in order to develop solutions suited to the needs and priorities of rural communities. He recognised the critical role of women in rice farming, and the need to overcome gender disparities in agricultural development. He emphasised the importance of gender-responsive research and policies that empower women and help remove barriers to women's participation in rice production.

Swaminathan paid particular attention to enhancing the adoption of new farming technologies and practices among smallholder farmers, and to providing training and support to farmers to that end.

Public-Private Partnerships

In 2009, Swaminathan called for public-private partnership to facilitate the gene revolution, which the private sector is currently leading.[1] He urged CGIAR institutions such as IRRI to work with the private sector to ensure that the benefits of the gene revolution reach resource-poor rice farmers. Since then the IRRI has made systematic efforts through the Hybrid Rice Development Consortium, Direct Seeded Rice Consortium, and International Rice Informatics Consortium to bring momentum to public-private partnerships. Swaminathan also encouraged IRRI to strengthen its digital agricultural platforms and use multimedia communication tools to reach out to farmers.

An Institution Builder

Prof. Swaminathan infused life into the institutions he built, creating vibrant opportunities for inquisitive minds. He understood the training needs of rice-growing countries. He also identified and mentored many scientists, who then furthered his global vision of a sustainable and hunger-free world, keeping food at affordable prices and accessible to all at all times. The IRRI owes much of its success and impact to Swaminathan. IRRI remembers him fondly, and has named the campus building that houses IRRI Education and a dormitory after him. IRRI staff revere his contributions, and retired staff who were directly associated with him cherish the experience. He called the IRRI and the Philippines his second home because of the warmth and affection that he received from the Filipino people.

Swaminathan's legacy inspires generations of scientists, researchers, farmers and policymakers. His dedication to science, sustainable agriculture, food security, and poverty alleviation remains a shining example of the transformative power of scientific innovation.

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[1] See IRRI Pioneer Interviews (2009).