

XIIIth Dr S. Pradhan Memorial Lecture

Report from ICAR-Indian Agricultural Research Institute, New Delhi, India

Dr S. Pradhan, a doyen among entomologists, during his 33 years of professional career made such an impact on entomological research and teaching that Entomology and Plant Protection Science came to the forefront of agricultural research in India. His success story would continue to encourage Plant Protection Scientists of the country for generations to come.

Dr Pradhan joined the Indian (then Imperial) Agricultural Research Institute in 1940 and became the first Professor of Entomology in 1958 when the Post-Graduate School was established at the Institute and became Head of the Division soon afterwards in 1962.

Dr Pradhan was the first to visualize the country's need for integrated pest management instead of the conventional method of chemical control alone, which though successful at the time had started showing adverse effects. He always emphasized on the fact that '*protection research was more needed than production research in the tropics*'. Therefore crop protection research should have its rightful place in the overall agricultural research efforts of the country. His forceful arguments for adopting Integrated Pest Management to fully realize the production potential of new high yielding strains of different crops, had

their impact and the country adopted IPM as a national strategy, although after his demise.

To remember his contributions to Indian Entomology, a corpus fund was put in place with contributions from his family, individual entomologists, ex-students and his well-wishers and as part of the golden jubilee year of our country's independence, Division of Entomology started Dr S. Pradhan Memorial Lecture series. Till date 12 lectures have been delivered by eminent entomologists in this prestigious lecture series on various aspects of Entomology.

The XIIIth Dr S. Pradhan Memorial Lecture Organized by the Division of Entomology, ICAR- Indian Agricultural Research Institute was held on November 8, 2021 on Zoom platform. The lecture was delivered by Dr Zeyaur R. Khan, Principal Scientist and Programme Leader, International Centre of Insect Physiology and Ecology, (ICIPE)), Nairobi, Kenya & Adjunct Professor, Department of Entomology, College of Agriculture and Life Sciences, Ithaca, USA on “**Exploiting Chemical Ecology and Plant Signaling for Developing Sustainable Crop Protection Strategies for Smallholder**

Farmers” - A Lifetime Journey of an Indian Scientist from Lab to Land.

Prof. Zeyaur Rahman Khan is one among the distinguished alumni of Indian Agricultural Research Institute, New Delhi, receiving both his M.Sc. (1977) and Ph.D. (1980) degrees from the institute. Soon after completing his Ph.D he taught for a brief period at Rajendra Agricultural University (1980–1983) in Bihar, India. Thereafter he worked in various capacities at the International Rice Research Institute (IRRI), Philippines (1983–1985; 1986–1991), University of Wisconsin, Madison (1985-1986), Kansas State University (1991–1993) before finally joining International Centre of Insect Physiology and Ecology, Nairobi, Kenya in 1993.

During his student days Dr Khan impressed by Dr. Pradhan’s vision on India’s need for integrated pest management instead of the conventional chemical control alone, went ahead and explored the many facets of insect-plant interactions for his Ph. D. Degree and continued to do so through his entire career.

After joining ICIPE in 1993, Dr Khan moved to its field station in rural Western Kenya, to lead ICIPE’s flagship project ‘Push-Pull’ to control stem borers, fall armyworm and Striga weed, all of which are major constraints to maize production while protecting the environment and improving soil fertility. He has

dedicated more than 30 years of his career for advancing the science and practice of entomology by studying and applying chemical ecology, insect behaviour, plant–plant, insect–plant and plant-soil interactions etc.

Dr Khan is internationally lauded for his development and Africa-wide dissemination of the innovative system of "push–pull farming," which simultaneously addresses issues of crop pests, soil improvement, food security, climate change and sustainability. His work in developing the push-pull technology is a wonderful example demonstrating that creativity and innovation in agricultural sciences can provide practical solutions for the real problems of poor smallholders by removing constraints of their farming and ultimately leading to better food security and sustainable livelihoods.

He was awarded the **Louis Malassis International Scientific Prize for Outstanding Career in Agriculture in 2015** for his exemplary and promising contribution in promoting innovation through research, development and capacity building in order to improve food and sustainability in agricultural systems as well as contributing towards addressing food security and poverty reduction. Among the many other recognitions received by Dr Khan noteworthy ones include : Honorary Fellow of the Royal Entomological Society,

London, Fellow of Entomological Society of America; Fellow of African Academy of Sciences; Council Member, International Congress of Entomology; and President of International branch of Entomological Society of America (2019). Dr Khan has authored more than 170 scientific papers, and 20 books and book chapters

Dr Khan spoke about the challenges he had faced and also ways and means devised to overcome them. The successful use of 'Push-Pull' to control stem borers, fall armyworm and Striga weed, all major constraints in maize production on one hand and while on the other hand protecting the environment and improving soil fertility in sub-Saharan Africa wherein most of the smallholder farmers are resource-constrained and unable to afford expensive chemicals for crop protection.

All his research efforts led to the development of novel strategies for integrated pest and weed management involving selection of appropriate plants which naturally emit signalling chemicals (semio-chemicals) and influence plant-plant and insect-plant interactions in other words development of a cropping strategy, known as 'push-pull' (www.push-pull.net), which exploits the phytochemicals released by the companion plants grown in between and around the main cereal crops.

Principles of the chemical ecology involving insect-plant and plant-plant interactions formed the basis of the push-pull technology could not only achieve intensification of crop and livestock production but also generate sustainable beneficial impact on food sufficiency/security, nutrition, farm income without any detrimental effect on soil health and environment. All of which supported resource poor households under their existing socio - economic and agro - ecological conditions.

Some of the benefits of Push-pull technology highlighted by Dr. Khan are:

- It does not depend on external inputs such as pesticides and mineral fertilizer, which is a boon, especially to small farmers.
- Is environmentally friendly, as fewer synthetic chemicals are put into the environment and agro-biodiversity is increased, which benefits ecosystem services
- In addition to raising cereal productivity, the technology restores soil system fertility through nitrogen fixation, better moisture retention, lower soil temperatures, decreased loss of topsoil, and more soil system capacity to sequester carbon.
- It results in positive environmental and soil health impacts: increased nitrogen and soil

organic matter reserves, less soil erosion, and improved soil microbial community composition with long-term application of the method.

- These changes make smallholder farming systems less dependent on external inputs.

- Each of the benefits accrued itself, and also when undertaken collectively reinforce one another, contributing to more sustainable soil system productivity.

The write up of the lecture can be accessed at <https://www.iari.res.in/Entomology>

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