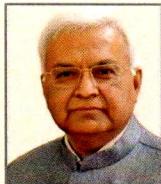




4th Dr D.S. Athwal Memorial Lecture

by



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Chairman,
Agricultural Scientists Recruitment Board
New Delhi

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TITLE

Bioresources to Bioenterprise: Building Value Chains for a Sustainable Bioeconomy

ABSTRACT

India's vast biological wealth offers an extraordinary opportunity to build sustainable, innovation-driven value chains that can strengthen rural livelihoods, reduce import dependence, and contribute meaningfully to a resilient bioeconomy. By 2024, India's bioeconomy grew to USD 165.7 billion, reflecting strong national momentum in biotechnology, agricultural innovation, and bio-based industries. With continued advances in science, enterprise development, and policy support, this upward trajectory positions India to become a global leader in bioresource-based economic growth.

This lecture presents how frontier biotechnologies and agrobiodiversity-driven interventions can be transformed into high-value enterprises. Advances in enzyme engineering, SOD-based platforms, enhanced nitrogen-use efficiency, biodegradable bioplastics, PHB materials, microbial composting, and waste-to-value systems demonstrate how scientific discoveries progress into scalable industrial solutions. Such innovations strengthen technological self-reliance and create new opportunities for entrepreneurs, farmers, and rural communities.

A strong emphasis is placed on high-value crops and biodiversity-based enterprises. The introduction and value-chain development of Heeng, Monk Fruit, True Cinnamon, Liquorice, saffron beyond Kashmir, aromatic crops, tulips, and diversified horticultural crops illustrate how targeted scientific interventions reduce imports, increase farmer

incomes, and open new export-oriented markets. These examples show how India's diverse ecosystems can power the next generation of rural enterprises.

The integration of traditional knowledge with contemporary biotechnology further expands this landscape. Vitamin D₂ -rich mushroom products, herbal formulations for immunity and cartilage health, and nutritional interventions for anaemia and protein supplementation showcase how indigenous knowledge can be validated and transformed into modern nutraceutical and wellness industries.

Partnerships with municipalities, start-ups, state agencies, and industries highlight how technology diffusion connects laboratory innovations to real-world impact. Modern farming approaches such as aeroponics, hydroponics, and advanced tissue culture enable efficient, year-round cultivation of high-value crops and strengthen resource-use efficiency. Collectively, these interventions represent a transition from isolated innovations to fully integrated value-chain solutions.

By linking biodiversity, biotechnology, and enterprise development, India stands at the threshold of building a sustainable and globally competitive bioeconomy. Converting bioresources into bioenterprise empowers farmers and entrepreneurs while advancing national self-reliance, environmental stewardship, and long-term economic resilience.

ABOUT THE SPEAKER

Dr Sanjay Kumar is a distinguished Indian scientist and research leader, currently serving as Chairman of the Agricultural Scientists Recruitment Board (ASRB), New Delhi, under the Department of Agricultural Research and Education, Ministry of Agricultural and Farmers Welfare, New Delhi. In this national role, he oversees the recruitment and assessment of scientific talent across India's agricultural research institutions, shaping the future cadre of researchers in the agricultural sciences.

Dr Kumar earned his Master's degree from G.B. Pant University of Agriculture and Technology, Pantnagar, and his Ph.D. from the Indian Agricultural Research Institute, New Delhi. He enhanced his expertise through post-doctoral training at Texas Tech University (USA), Rothamsted Research (UK), and Kansas State University (USA). In 1990, he joined the CSIR-Institute of Himalayan Bioresource Technology (IHBT), Palampur as a Scientist, rising through the ranks and ultimately serving as Director until his superannuation in February 2023 after more than three decades of service.

Dr Kumar's research portfolio spans plant physiology, metabolic engineering, high-altitude adaptation mechanisms, and bioresource utilization for sustainable bioeconomy. He is credited with the discovery and transplantation of a novel carbon fixation pathway to enhance photosynthetic efficiency, characterization of unique enzymes from high-altitude plants, and significant contributions to genomic and transcriptomic studies of Himalayan biodiversity. His work has led to numerous international patents and more than 220 scientific publications, and he has mentored almost 30 MSc/PhD students.

As Director of CSIR-IHBT, Dr Kumar championed the introduction of high-value crops such as asafoetida (Heeng), saffron, monk fruit, cinnamon, and aromatics in non-traditional regions and promoted waste management and nutraceutical technologies benefiting farmers and local economies.

He is a Fellow of the Indian National Science Academy (INSA), National Academy of

Sciences, India (NASI), National Academy of Agricultural Sciences (NAAS), and several other scientific bodies. His honors include the VASVIK Industrial Research Award, INSA Young Scientist Award, and multiple distinguished lectureships and leadership awards.

Dr Kumar's career exemplifies scientific excellence translated into societal impact, bridging fundamental research with technology transfer and agricultural development.

ABOUT DR D.S. ATHWAL

Padma Bhushan **Dr Dilbagh Singh Athwal** (born 12th October 1928) was an Indian geneticist, plant breeder and agriculture scientist, who conducted pioneering research in plant breeding and played a pivotal role in initiating Green Revolution in the country. He was a Professor and Head of the Department of Plant Breeding at Punjab Agricultural University, Ludhiana and an associate of Dr Norman Borlaug, with whom he collaborated for introduction of high-yielding dwarf varieties of wheat.



Popularly known as Father of Wheat Revolution, Dr Athwal was instrumental in developing 'PV 18' in 1966 and the most popular amber-grained wheat variety 'Kalyansona' in 1967, named after the village 'Kalyanpur' in Punjab where he was born. Dr Athwal developed world's first grain pearl millet hybrid 'Hybrid Bajra 1' in 1965 that heralded a new era in cultivation of this important crop.

In 1967, he joined International Rice Research Institute, Philippines, and also served as the Institute's first Deputy Director General. His research led to innovations in rice breeding. His work has been documented in a number of books and articles published in peer reviewed journals. The University of Sydney conferred him with the degree of Doctor of Philosophy in 1955 for his contributions to agriculture. In 1964, he was bestowed with the prestigious Shanti Swarup Bhatnagar Prize by the Council of Scientific and Industrial Research, the highest Indian award in the Science category. In 1975, he was conferred the honour the 'Padma Bhushan' by Government of India, for his immense contributions to biological science. He died in New Jersey on 14 May 2017. The 'Dr D.S. Athwal Memorial Lecture' has been instituted by ISPGR and NBPGR since 2018 to recognize his immense contributions to agriculture in general, and in particular for development of the National Genebank at ICAR-NBPGR, New Delhi, in his role as Vice President, Winrock International, the implementing agency of USAID project in India.

ABOUT ISPGR

The Indian Society of Plant Genetic Resources (ISPGR) was founded in 1987 as a multidisciplinary scientific body involved in the various issues of plant genetic resources (PGR) and related fields. It currently has >1000 members, nearly 900 of them being life members. The ISPGR was formally registered under the Indian Societies Act (1860) on November 3, 1987 with the Registrar of Societies, Delhi (Registration No. S/18336 of 1987). Membership is open to all persons interested in the field of PGR in India and abroad. The genesis of the society was from the initiative taken by the scientists at the National Bureau of Plant Genetic Resources (NBPGR), New Delhi, under the leadership of Dr R.S. Paroda, the then Director of NBPGR and presently Chairman, Trust for Advancement of Agricultural Sciences (TAAS) and also the current President of ISPGR (2025-27). A 'National Symposium on Plant Genetic Resources' was organized by the NBPGR, on March 3-6, 1987 to commemorate completion of a decade of NBPGR's establishment. During the symposium, Dr R.S. Paroda proposed the creation of ISPGR,

which was welcomed by all the delegates of the symposium. The Constitution of ISPGR was drafted under which the General Body (GB) comprising all members of the Society was designated the supreme authority and elected an Executive Council (EC) biannually for management of all the activities. The Constitution was revised in 2007 and since then EC tenure has been changed to three years.

Objectives of ISPGR

- To promote research in the field of PGR and related disciplines such as plant exploration/collecting, characterization, evaluation, conservation, utilization, introduction and exchange, quarantine and data documentation and information management. Broadly, it will involve in an integrated way various disciplines, viz., Economic Botany, Ecology, Genetics, Plant Breeding, Ethnobotany, Taxonomy, Biosystematics, Biotechnology, Plant Physiology, Horticulture, Seed Science, Chemistry, Agronomy, Plant Pathology, Entomology, Nematology, Agricultural Statistics, Information Technology and allied disciplines.
- To provide a forum to the scientists for expressing their critical views based on the scientific knowledge and rational thinking on important national policies and programmes related to PGR research and development.
- To collect, collate and disseminate information on PGR.
- To encourage and promote close association/collaboration among members belonging to various disciplines.
- To work in association and collaboration with other national and international societies/organizations having similar objectives.
- To publish a journal at regular interval, as decided by the Executive Council (EC), as an official publication of the Society.

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