NAAS NEWS

RESEARCH EDUCATION AND TECHNOLOGY POLICY FORUM

Vol. 21 No. 2 April-June 2021

CONTENTS



Editors
Dr P.S. Birthal
Dr Malavika Dadlani

*From the President's Desk*

# Achieving Land Degradation Neutrality in India

Land degradation is decline in soil's inherent capacity to produce economic goods and services as a result of natural or human actions. It has become a serious threat to the sustainable development of agriculture. It is estimated to affect about 23% of the world's terrestrial area with an expansion of 5-10 million ha per year, affecting the livelihood of nearly 1.5 billion people.

In India, 120.4 million ha of the geographical area is degraded due to: water erosion (82.6 million ha), wind erosion (12.0 million ha), chemical degradation (24.8 million ha) and physical degradation (1.0 million ha). Of these, 104.2 million ha land is arable, resulting in a loss of 5.37 to 8.4 million tonnes of soil nutrients. India loses crop output worth Rs. 292 billion due to water erosion alone. Such a huge loss in nutrients and crop output has serious consequences for food, livelihood and environmental security. Land degradation is also a major cause of loss of biodiversity and changes in species abundance. The land is a scarce and non-renewable natural resource, and it is, therefore, imperative to arrest its degradation.

## Land degradation and SDGs

Land degradation is highlighted in the Sustainable Development Goals (SDGs) of the United Nations, and more specifically in SDG 15.3 that calls for restoration of the degraded lands and soils, including those affected by desertification, droughts and floods, to achieve land degradation neutrality. In addition, the SDG 2.4 aims at developing sustainable food production systems by implementing climate-resilient practices to maintain ecosystem health and strengthen adaptations to climate change that progressively lead to an improvement in land and soil quality, and the SDG 3.9 calls for reducing the number of deaths and illnesses from hazardous chemicals and air, and

soil and water pollution. The SDG 7 (affordable and clean energy), 11 (sustainable cities and communities) and 12 (responsible consumption and production) are also linked to the land-use changes, whereas SDG 1 (no poverty) SDG 6 (clean water and sanitation) is also important for the conservation of soil. Considering that soil constitutes the second-largest source of carbon sequestration after oceans, the SDG 13 (climate action) is also important in achieving land degradation neutrality.

India is aligning its New National Action Programme to Combat Desertification (NNAP-CD) with the 10-year strategy of the United Nations Convention to Combat Desertification (UNCCD), aiming to achieve the aspirational goal of land degradation-neutral India by 2030. An inter-ministerial effort to mainstream Desertification, Land Degradation and Drought (DLDD) related issues in development priorities is essential for sectoral planning, budgeting and implementation frameworks. A major constraint in balancing the trade-offs between competing land uses is the lack of understanding of the economics of land degradation.

**Land degradation neutrality**

The UNCCD defines *Land Degradation Neutrality (LDN) as a state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security remains stable or increases within specified temporal and spatial scales and ecosystems.* The concept was brought for global dialogue to stimulate policy response to land degradation, and it was included in SDG 15. This is applicable to all land types with a response hierarchy of *avoiding> reducing > reversing* the land degradation.

Being a signatory to the UNCCD, India targets *reducing land degradation and desertification by reclaiming 26 million ha of land by 2030*. Of this, about 21 million ha is forest land, and the rest lies outside the domain of forests. The degraded land loses its capacity to absorb carbon dioxide (CO2), the biggest cause of global warming. Nearly 37% of India's land is degraded due to deforestation, intensive cultivation, soil erosion and depletion of wetlands. Achieving LDN in 26 million ha by adopting the landscape restoration approach has the concomitant advantage of ensuring surface water availability, groundwater recharge, soil moisture improvement, climate change adaptation, and preservation of ecosystem services.

**Programmes and policies**

India has been addressing the challenge of land degradation in its rainfed regions by implementing watershed management programs for nearly four decades, which resulted in positive impacts in reducing the soil and water losses, improving crop yields by 50% and increasing cropping intensity by over 60%.

The soil and water conservation (SWC) technologies have the potential to reduce land degradation and address concerns of water scarcity, droughts, climate change, and biodiversity loss. The Indian Institute of Soil and Water Conservation (IISWC), Dehradun has developed several location-specific bio-engineering measures to prevent the loss of top fertile soil and deterioration of its physical properties. Similarly, the Central Arid Zone Research Institute (CAZRI), Jodhpur has developed sand-dune stabilization and shelterbelt technologies to arrest wind erosion. The Central Soil Salinity Research Institute (CSSRI), Karnal and the All India Coordinated Research Project (AICRP) on Salt Affected Soils have developed reclamation technologies, salt-tolerant varieties of rice (CSR-30, CSR-36), wheat (KRL-210, KRL-213) and mustard (CS-52, CS-54) and agroforestry interventions for rehabilitation of saline and sodic lands and sub-surface drainage and bio-drainage technologies to improve the productive capacity of saline waterlogged soils.

The Department of Land Resources has provided financial assistance to 6382 watershed development projects under the Integrated Watershed Development Programme (IWMP), which is now the Watershed Development Component under Pradhan Mantri Krishi Sinchayee Yojana (WDC-PMKSY). The activities under watershed development projects include ridge area treatment, drainage line treatment, soil and moisture conservation, rainwater harvesting, afforestation, horticulture, nursery raising, and pasture development. Since 2014-15 over 7.5 lakhs of water harvesting structures have been created and/or rejuvenated under the WDC-PMKSY, and an additional 16 lakh ha has been brought under protective irrigation, benefitting nearly 34.64 lakh farmers. The Department under Rainfed Farming System is implementing Reclamation of Problem Soils (RPS) as a sub-scheme of Rashtriya Krishi Vikas Yojana (RKVY) since 2016-17 in 15 states to reclaim problem soils (alkali/saline & acid) for agricultural use.

Sustainability of the natural resources and valuation of ecosystem services are important research concerns of the ICAR. The system intensification approach based on LDN indicators is one of the best tools to address these. The ICAR-IISWC has devised several indicators like Land Levelling Index (LLI), Crop Diversification Index (CDI), Cultivated Land Utilization Index (CLUI), Crop Productivity Index (CPI), Induced Watershed Eco-Index (IWEI), and People's Participation Index (PPI) to evaluate impacts of watershed development programs. The ICAR- IISWC is working on different themes such as categorical erosion appraisal and control measures, resource conservation and capacity building for achieving LDN. Through the adoption of appropriate technologies, it is possible to sequester 19-27 Tg CO2 per year from the eroded soils, and consequently reduce the greenhouse gas emissions by 24.5%. The ICAR-IISWC has prepared a district-level master plan for achieving LDN in 18 districts across 9 states. A macro plan for reclamation of one million ha of ravine affected land in Uttar Pradesh, Madhya Pradesh, Gujarat and Rajasthan has also been prepared. It has provided technical input to the Indian Council of Forestry Research and Education (ICFRE) for preparation of National Action Plan of achieving LDN target of 26 million ha by 2030, and partners with the Ministry of Environment, Forests and Climate Change (MoEFCC) to provide technical inputs and to impart training for LDN.

The ICAR-CSSRI Karnal has reclaimed 2.14 million ha of the salt-affected soils (2.07 million ha sodic soils and 0.07 million ha waterlogged saline soils) in Haryana, Punjab, Uttar Pradesh, Rajasthan, Karnataka, Maharashtra, Gujarat and Andhra Pradesh. The ICAR-CAFRI, Jhansi and AICRP on Agroforestry have developed agroforestry models for different agro-ecological regions under the sub-Mission on Agroforestry. The ICAR-CRIDA has prioritised rainfed districts for the restoration of degraded lands. The ICAR-CAZRI has prepared a desertification map of Rajasthan and delineated areas affected by wind and water erosion, and evolved measures like sand-dune stabilization, shelterbelt plantation and agroforestry for controlling wind erosion.

**Emerging challenges** Notwithstanding the advances made by the scientific institutions and development programmes of the government, many challenges are yet to be addressed and appropriate solutions to be found.

- Land inventory maps based on the soil, climatic and hydrological characteristics and vegetation cover, the land capability/suitability needs to be prepared and updated regularly.
- A major challenge for integrated land resource management is maintaining a balance between supply and demand for land in various sectors and improving biomass productivity. For sustainable management of land-water-forests/plants complex, it has to be land-centric.
- Land quality, which is the sum total of physical, chemical, hydrological and biological properties, needs to be preserved and enhanced to keep pace with increasing demand for land.
- Reversing the trend of land degradation, and reclaiming degraded/wastelands are big challenges. The perspective plan needs to be prepared for treating degraded lands following the concept of participatory watershed management.
- Inadequate infrastructure and low level of technological penetration are major constraints to rural development. Under-development poses additional threats to ecological balance and sustainability of livelihood systems due to indiscriminate use of land, water and other natural resources. Land-use planning should, therefore, also take into account the problems of under-development.
- Land use planning should be based on local agro-climatic conditions and techno-economic potentials of each region.
- Lack of adequate focus of the R&D efforts prioritizing issues related to sustainable use of land, water and other natural resources, and studying the long-term implications of changing land-use patterns.
- A comprehensive methodology at the national level is needed to be developed to compute losses in ecosystem services due to different types of land degradation.

**Strategies for combating land degradation**

A two-pronged action is needed to prevent land degradation and reduce erosion within permissible limits. First, there is a need to properly assess the degree, type, extent and severity of soil erosion and its effect on production and nutrient loss. Second, there is a need to evolve appropriate technologies

and conservation measures to arrest and reverse the process of land degradation. Some important strategic points are:

- Creation of an integrated land-use policy.
- Monitoring the impact of different land management indicators.
- Identification of sustainable land management options (SLMOs) for different forms of degradation for different regions.
- Inclusion and incentivization of the identified SLMOs in the national, state and district level plans.
- Planning and land treatment at landscape level in "like for like" approach (the aggradation or improvement of one type of land has to be accounted only for the degradation of the same type of land in terms of land potential).
- Developing location-specific, cost-effective, eco-friendly, and socially acceptable packages with relevant technologies, namely soil & water conservation measures, land reclamation techniques, integrated water & nutrient management, agroforestry interventions, climate-resilient practices, and conservation agriculture to address the problems of land degradation. These packages need to be implemented holistically and cohesively through the convergence of different schemes/components (which are presently being implemented in isolation) adopting a cluster approach in farmers' participatory mode to have greater impact.

**(T. Mohapatra)**
President

# Foundation Day Lecture

The Foundation Day Lecture was delivered by Dr Shakuntala Haraksingh Thilsted, the 2021 World Food Laureate and Global Lead for Nutrition and Public Health at the WorldFish of the Consultative Group of International Agricultural Research. She received the prestigious award for her ground-breaking research, critical insights, and landmark innovations in developing holistic, nutrition-sensitive approaches to aquatic food systems, including fisheries and aquaculture. She is the first woman of Asian origin to be awarded the World Food Prize. The Prize is the most prominent global award recognizing an individual who has contributed to a reduction in global hunger through improving the quality, quantity, and availability of food for all.

In the Foundation Day Lecture, Dr Thilsted dwelt on the role of aquatic foods in nourishing nations. Globally, 690 million people are undernourished; 2 billion do not have access to safe, nutritious and sufficient food; 3 billion are unable to afford a healthy diet—57% of whom live in sub-Saharan Africa and South Asia, and 1.9 billion adults are overweight/obese. Children below the age of 5 years are facing severe nutrient deficiencies in Africa and Asia. Unfortunately, despite concerted efforts, global trends of malnutrition (undernutrition, over-nutrition, and micronutrient deficiencies) are on the rise. Covid 19 has further aggravated the problem. The projections show (1) 132 million more people have become hungry due to COVID-19 in 2020; (2) 124 million people have been pushed into extreme poverty; (3) 114 million people lost jobs; (4) 6.7 million children below the age of five were wasted, 80% of whom live in sub-Saharan Africa and South Asia.

Dr Thilsted emphasized that aquatic food could play an immense role in overcoming the problem of undernutrition and related problems. Traditionally, aquatic foods consist of (1) fish (finfish, crustaceans, molluscs and other aquatic animals, excluding reptiles, seaweeds, etc., and (2) seafood (edible marine fish and shellfish). She stressed that the changing scenario call for aquatic food systems for sustainable development. It covers (i) social because a large number of rural poor are engaged in small-scale fisheries and aquaculture for their livelihoods; (ii) economic as for many rural poor, the most affordable and preferred animal-source foods may be aquatic foods; and (iii) environmental considerations as the aquatic animal-source foods are produced more sustainably than terrestrial animal-source foods, especially lower-trophic aquatic foods are produced more sustainably.

Aquatic foods have multiple benefits; these are rich in micronutrients and essential fatty acids. All nutrients in aquatic foods are highly bioavailable and enhance micronutrient bioavailability from plant-source foods when consumed together. These also bring greater dietary diversity through meal preparation and consumption. From a nutritional perspective, aquatic foods contain multiple micronutrients

and essential fatty acids. These include minerals (iron, iodine, zinc and calcium) and vitamins, (B12, D, and A). These help in brain development and strong bones, reduce stunting, prevent preeclampsia, preterm delivery, low birth weight and support cognitive development in children.

Aquatic foods have considerable potential to nourish people. Nutrients for nourishing people are lost when fish is used for fish meal and fish oil; one kg of dried fish (approx. 4 kg of fresh fish) can provide sufficient essential nutrients for one child for more than two months (15 g dried fish per child per day). The projections from Zambia show that a one percent reduction in fish loss amounts to ten kg fish per person per year for 250,000 people. She emphasized that fish meal and fish oil must be replaced with alternatives, namely seaweed, crop waste, etc.

Reference was made to Food-based Dietary Guidelines of India on Aquatic Foods, which recommend eating fish more frequently (at least 100–200 g per week). In India, people in Kerala eat more fish; 62% of the Keralites eat fish daily. Andaman & Nicobar Islands and West Bengal are other high fish-eating states. Its consumption is also growing in the non-traditional fish consuming states.

There are several benefits of consuming fish regularly. Some of these are: (i) fish intake reduces mortality risk from heart disease; (ii) diets low in fish and seafood responsible for disease-related to disability-adjusted life years (DALYs); and (iii) daily consumption of fish reduces mortality. She referred that the diets low in seafood omega-3 fatty acids account for 1.4 million deaths in 2010.

Aquatic foods provide multiple essential micronutrients and essential fatty acids (EFA) that are important, particularly for the first 1000 days of life. Studies have shown that women consuming seafood (> 113 g per week) in pregnancy resulted in positive neurocognitive development in their children, including an average increase of 7.7 IQ points. It was also found that low seafood consumption during pregnancy increases the risk of sub-optimal neuro-developmental

outcomes, including lowered cognition and fine motor skills.

Dr Thilsted described that aquatic foods have huge potential to be processed as nutritious, safe and accessible food products. These can be a ready-to-use supplement (RUFS) / ready-to-use therapeutic food (RUTF). The new products, which are developed by WorldFish and its partners in different parts of the world are accessible in smaller quantities, have a long shelf life, are easy to transport, and their consumption is extended during lean production periods. For example, one tablespoon of fish chutney (60 g of raw fish) can effectively nourish pregnant and lactating mothers. Its composition includes dried small fish (37%), oil (15%), onion (37%), garlic (7%) and red chillies (4%). Similarly, fish powder as a superfood can complement family foods.

She suggested that aquatic superfoods can be included in the food-based social safety net programs and those programs adhering to the 'right-to-food' to nourish the poor and vulnerable, especially mothers, children, and school feeding. There is a need for national-, and state-level comprehensive policies and investments for aquatic foods to nourish India and incorporate diverse aquatic foods in national-, and state-food-based dietary guidelines. Insufficient and unreliable data is constraining in formulating effective policies and institutions to promote the production and consumption of aquatic food.

## NAAS Programmes

### Brainstorming Session on Gender and Nutrition Based Extension in Agriculture

The prevalence of the triple burden of malnutrition, that is the coexistence of over-nutrition, under-nutrition and hidden hunger (micronutrient deficiency), is alarming. Keeping this in view, a brainstorming session was organized on 28 June 2021 to explore the prospects of integration of nutrition-rich technological options with government schemes and gender-neutral extensions to improve nutritional security. The discussion revolved around the following:

- Bio-fortification, fortified foods and composite foods integrating millets, fish and milk, to address nutritional requirements of the target population.
- Greater focus on the traditional food system and indigenous recipes.
- Education of rural people, farm women and folk(?) mothers on the dietary diversity, nutrition requirement and culinary methods to ensure better nutrition.
- Promotion of livestock products especially milk and eggs in the food pyramid.
- Development of suitable extension models for enhancing livelihood.
- Inclusive agricultural policy embedding the gender component with dimensions of equitability, opportunity and sustainability

## Presentation of the Newly Elected Fellows

The newly elected Fellows of the Academy made their presentations online during June 15-18, 2021 in five sessions. The presentations of Elected Fellows from Crop Sciences, Horticultural Sciences, Animal Sciences and Fisheries Sciences were chaired by Dr J.C. Katyal, Vice President and co-chaired by Dr K.C. Bansal, Secretary, NAAS. The elected fellows from Natural Resources Management, Plant Protection, Agricultural Engineering and Technology, and Social Sciences made their presentations under the chairmanship of Dr A.K. Singh, Vice President and co-chairmanship of Dr P.K. Joshi, Secretary, NAAS. The newly elected Pravasi Fellows and Foreign Fellows also made their presentations online on June 18, 2021.

# Activities of Regional Chapters

## Bhopal Chapter

**Webinar on Nanotechnology in Agriculture: Opportunities and Challenges**

Nanotechnology is receiving significant attention in several fields of scientific applications, including agriculture and food sciences. However, there are several key concerns related to the use of nano-fertilizers in agriculture. Keeping

this in view, the Bhopal Chapter of the Academy organized a National Webinar on "Nanotechnology in Agriculture: Opportunities and Challenges" on 21 June 2021 in collaboration with the ICAR-Indian Institute of Soil Science. Dr Anil Kumar Singh, Vice-President of the NAAS chaired the technical session. Dr J.C. Tarafdar, former Principal Scientist, ICAR-CAZRI delivered a lecture on the promise of nano-fertilizers in agriculture and highlighted the use of nano-products like biosynthesized nano-nutrients and nano-induced polysaccharide powder for agricultural use. He advocated the integrated use of conventional fertilizers with nano-fertilizers to minimize soil nutrient mining. Dr Satykam Patnaik, Senior Scientist, CSIR-Indian Institute of Toxicology Research, Lucknow, presented studies on the toxicity of nanomaterials on soil and plant systems. Dr Onkar Tiwari, Program Officer, DBT, elaborated on the biosafety and policy framework developed by the Government of India to handle nanomaterials in agriculture, for which there is a need for establishing high-end laboratories.

## Coimbatore Chapter

ICAR-SBI, Coimbatore and the Society for Sugarcane Research and Development, Coimbatore organized an International Conference on Sugarcane Research: (CaneCon 2021) during June 19-22, 2021, at Coimbatore, during which the Coimbatore Chapter of NAAS organized a scientific session on 'Advances in the Management of Sugarcane Pests and Diseases'. Six lead papers, including four from foreign experts, were presented in which the global scenario of devastating diseases, continental shifts in diseases, and fungal disease spread, and the emergence of new disease epidemics due to host shifts were deliberated on. Alternatives to synthetic insecticides, use of biological agents and mass production technologies for beneficial insects for the management of sugarcane pests were also discussed.

## Hyderabad Chapter

The Hyderabad Chapter of NAAS organized two sensitization programs for the students of Vignan University, Guntur, Andhra Pradesh on June 5, 2021, and Horticulture University in Telangana on June 14, 2021. About 200 students participated in these programmes which focused on opportunities in agriculture, value addition to agricultural commodities, water management, soil health innovations, micro-irrigation, water use efficiency, fertigation, crop residue conversion into green energy, farmer producer organization (FPOs), women self-help groups (SHGs), market linkages, artificial intelligence (AI) and machine learning.

## Karnal Chapter

A webinar was conducted on "Response to COVID-19 Crisis for Improving Animal and Human Health among Rural Households" on April 24, 2021. More than 120 participants took part in the webinar. Dr M. L. Madan, Convenor, NAAS

Haryana Chapter & Former DDG (Animal Science), ICAR explained the genesis for organizing this webinar and elaborated on the theme. Dr T. Mohapatra, President NAAS in his inaugural remarks discussed the impacts of COVID-19 on the farming community and the role of veterinarians and scientists in protecting the lives of rural people. He suggested that with emerging pandemics and 70% of the diseases being zoonotic in nature, there is a need for genome sequencing of viruses and developing big data analytics and predictive modelling to face future challenges. The participants deliberated on the role of veterinarians and various strategies that need to be adopted to improve animal and human health.

A webinar on 'Revisiting the MSP - Remunerative Pricing for Crops and Livestock Products in Haryana and Rajasthan' was organized on May 22, 2021, in a virtual mode. Dr J. S. Sandhu, Vice-Chancellor, SKN Agriculture University, Jobner (Jaipur) coordinated the proceedings. The webinar was attended by over 110 participants from the crop, animal and social science streams. Dr M.L. Madan, Convener of the Regional Chapter welcomed the participants. He explained the genesis of this webinar and elaborated on the theme highlighting the relevant issues and major concerns in

determining the remunerative prices of agricultural produce. He also discussed the measures that need to be adopted to make crop and livestock farming profitable. Dr M.S. Chauhan, Director, ICAR-National Dairy Research Institute, Karnal in


his welcome address said that the MSP regime needs to be revisited to expand it to livestock products. Dr P.K. Joshi, an eminent agricultural economist and Secretary, NAAS delivered the inaugural address and detailed the measures to be taken to make agriculture profitable, particularly for smallholder farmers. He informed that a majority of the farmers remains deprived of the benefits of MSP, hence the need to revisit the MSP regime cannot be ignored. He said that MSP was introduced during the era of food- deficit when high yielding varieties of rice and wheat were being introduced to motivate the farmers to adopt high yielding varieties and to protect farmers from price volatility. This has helped the country to come out of the situation of food deficit to food surplus. However, in the present context, high-value agriculture, including horticulture, livestock and fisheries, together contribute 60% to the gross value of agricultural output, remains excluded from the MSP regime. The other lead presentations were made by Dr J.S. Sandhu, Vice-Chancellor, SKN Agricultural University, Jobner, Rajasthan; Dr O.P. Yadav, Director, ICAR-CACZRI, Jhodpur; Dr Sukhpal Singh, Professor, Department of Agricultural Economics, PAU, Ludhiana; Dr Suresh Pal, Director, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi; Dr P.S. Birthal, ICAR-National Professor, ICAR-National Institute of Agricultural Economics and Policy Research, New Delhi; Dr Anjani Kumar, Senior Research Fellow, International Food Policy Research Institute, New Delhi; Dr N. Kondaiah, Former Director, ICAR-National Research Center on Meat, Hyderabad; Dr Ranjay K. Singh, Principal Scientist, ICAR-CSSRI, Karnal; Dr B.S. Chandel, Principal Scientist, ICAR-National Dairy Research Institute, Karnal. Suggestions on the pricing of livestock produce were also given by Dr Suresh S. Honnappagol, former Animal Husbandry Commissioner, Government of India and Dr Ajay Kumar Gehlot, Former Vice-Chancellor, Rajasthan University of Veterinary & Animal Sciences, Bikaner. Dr R.B Singh, Former President, NAAS in his concluding remarks gave an exhaustive summation of the evolution of MSP as a support price and the need for new initiatives and policy structures for efficient and remunerative farming.

## Ludhiana Chapter

conducted 7 awareness programs for school students through the Krishi Vigyan Kendras (KVKs) during April to June, 2021.


The awareness programs focused on smart practices and technologies for climate-resilient agriculture, judicious use of water, conservation of natural resources, nutritious summer beverages, and preservation of fruits and vegetables. These programs covered seven districts of Punjab and a total of 190 students participated. A programme on the preservation of fruits and vegetables was conducted for girls at Mansa.

## Lucknow Chapter

The directory of fellows and associates of the Lucknow chapter was printed. The following policy papers were translated into Hindi:

- Policy Paper No. 92 - Tropical Wilt Race-4 Affecting Banana Cultivation
- Policy Paper No. 93 - Enhancing Science Culture in Agricultural Research Institutions.

# 118th Executive Council Meeting

The 118th meeting of the NAAS Executive Council was held on April 16, 2021 (in virtual mode) under the chairmanship of Dr T. Mohapatra, President of the Academy. The progress of preparation of the XV Agricultural Science Congress to be held at Banaras Hindu University on November 13-17, 2021 was reviewed. The Technical Program of the Congress including Plenary Lectures to be delivered was presented to the Council. The EC was also apprised of the finalization of the report on “Screening of Actionable Points from NAAS Policy/ Strategy papers and preparation of Roadmap for Further Action”.

## Fellow's Views

### Fish Slime – Unexplored Reservoir for Bioprospecting and One Health Concept

Antimicrobial resistance (AMR) is one of the biggest health challenges, that threatens the effective prevention and treatment of an ever-increasing range of infections caused by bacteria, parasites, viruses and fungi. There is an urgent need for more investment in research and development for addressing and alleviating antimicrobial resistance. Fish epidermal slime - the interface between fish and the aqueous environment is the key component of fish's innate immune system as it combats the complex environment of potential pathogens from the very moment of their first contact. This gloopy slime that coats the surfaces of fish and is constantly secreted and replaced, serving as a natural barrier to pathogens is a very important substance and particularly interesting function for protecting fish in multiple ways from bacteria, fungi, and viruses in their environment, trapping the microbes before they can cause infections. Some fish even secrete toxins into the slime to deter predators. Fish slime is one potential goldmine of the fish microbiome containing microorganisms with a unique capacity for biosynthesizing natural bioactive compounds. However, the fish slime microbiome and metabolome remain largely unexplored, as comprehensive information on the antimicrobial activity of epidermal slime in fishes of different habits and habitats is scanty. The integration of different microbiomes and metabolomes will contribute greatly to the advancement of fish slime research in the discovery of novel molecules and the understanding of fish's protective mechanisms of the entire mucosal system. It is worth exploring the possibility of using fish's protective mechanisms to discover novel antimicrobials for application in crop plants, aquaculture, animal husbandry and also in human health-related problems. This may also help in implementing One Health Concept, which is gaining importance to attain optimal health for humans, crops, livestock, fishes and related environment.

**Kishore Kumar Krishnani**
kishor.krishnani@icar.gov.in

## Forthcoming Programmes of NAAS

- Strategy Workshop on 'Waste-to-Wealth: Use of Food Industry Waste as Animal Feed' (Convener: Dr N.K.S. Gowda)
- Brainstorming Session on 'WTO and Indian Agriculture' (Conveners: Drs Sachin Sharma and P.S. Birthal)
- Strategy Workshop on 'Sericulture for Enhancing Farmers' Income' (Conveners: Drs Shailaja Hittalmani and Dr S.B. Dandin)
- Strategy Workshop on 'Agriculture and Entrepreneurship Models for Quality Fodder Production' (Convener: Dr Ajoy Kumar Roy)
- Strategy Workshop on 'Drudgery Free Agriculture' (Convener: Dr K.P. Singh)
- Strategy Workshop on 'Quality Planting Material for Promoting Agricultural Diversification' (Convener: Dr V.K. Baranwal)
- Experts Meet on 'Road Map to Rehabilitate 26 Million ha Degraded Lands by 2030' (Conveners: Drs Ch Srinivasa Rao, J.C. Katyal and Anil K. Singh)
- Strategy Workshop on 'Impact of COVID-19 on Animal Health and Dairy Industry' (Convener: Dr R.K. Singh).

## Change of Address

- Dr Sanjeev Gupta, Asst. Director General (OP), Indian Council of Agricultural Research, Room No. 214, Krishi Bhawan, New Delhi 110001; Tel.: Off. (011) 23385357; Cell: 9336119397; Email: saniipr@rediffmail.com; sanjiipr@gmail.com; adgop.icar@nic.in
- Dr K.S.M.S. Raghavarao, Professor, Department of Chemical Engineering, Indian Institute of Technology Tirupati, Tirupati 517506 A.P., Cell: 9483540988; Email: ksmsraghavarao60@gmail.com; raghava@iitt.ac.in
- Dr A.K. Shasany, Director, ICAR-National Institute for Plant Biotechnology, LBS Centre, Pusa Campus, New Delhi 110012; Tel.: Off. 011-25848783; Cell: 9415027245; Email: akshasany@yahoo.com; ajit.shasany@icar.gov.in

# Obituaries

**Dr Hukum Chandra**

Dr Hukum Chandra, the brilliant agricultural statistician, was born on November 7, 1972, in a village in Pratapgarh district of Uttar Pradesh. He obtained his Bachelors and Masters in Statistics from the University of Delhi, India; PhD in Social Statistics from the University of Southampton, United Kingdom; and Post-doctoral Research from the University of Wollongong, Australia.

Dr Chandra was an outstanding statistician and in his illustrious career, he made immense contributions in the field of small area estimation, sample survey design and analysis, poverty mapping, statistical methodology for the improvement of agricultural statistics including livestock statistics. He was a recipient of several awards including the National Award in Statistics in Honour of Professor CR Rao, Cochran-Hansen Award; Lal Bahadur Shastri Outstanding Young Scientist Award; Professor and PV Sukhatme Gold Medal Award. Dr Hukum Chandra was an Elected Member of the International Statistical Institute, The Netherlands; and Council Member, International Association of Survey Statisticians.

Dr Hukum Chandra left for his heavenly abode on April 26, 2021. In his loss, the scientific community has lost a brilliant scientist and wonderful human being. The Fellowship of the Academy deeply mourn his sad demise and prays the Almighty to give peace to the departed soul.

**Dr Ram Roshan Sharma**

Dr Ram Roshan Sharma was born on March 14, 1962, in Hamirpur district of Himachal Pradesh. He did his graduation at HPKV, Palampur and post-graduation in Horticulture from the Indian Agricultural Research Institute, New Delhi and CCS University, Meerut, Uttar Pradesh.

Dr Sharma was an outstanding scientist and administrator. In his illustrious career, he made immense contributions in the field of pre- and post-harvest management of horticultural produce.

Dr Sharma was an outstanding teacher,scientist, and science communicator and received several awards including Dr Rajendra Prasad Award, Rajiv Gandhi Award, and IARI Best Teacher Award. He was in the Editorial Board of several international journals, and a Fellow of the National Academy of Biological Sciences; the Indian Academy of Horticultural Sciences; the Boived Research Society.

Dr Ram Roshan Sharma left for heavenly abode on April 30, 2021. In his loss, the scientific community has lost a brilliant scientist and wonderful human being. The Fellowship of the Academy deeply mourn his sad demise and prays the Almighty to give peace to the departed soul.

**Dr Sushil Kumar**

Dr Sushil Kumar was born on December 14, 1940, in Delhi. He did his BSc from the University of Delhi, Delhi; and MSc and PhD from Indian Agricultural Research Institute, New Delhi. He was a Postdoctoral Fellow at Cold Spring Harbor Laboratory, Long Island, New York; University of Wisconsin, Madison, and the University of Toronto.

Dr Sushil Kumar left an indelible impression in the minds of agricultural scientists in various roles as Scientist and Professor of Molecular Biology and Biotechnology, Indian Agricultural Research Institute, New Delhi; Scientist G, Council of Scientific and Industrial Research; Director, Human Resource Development Group, CSIR; Director, National Botanical Research Institute, Lucknow; Director, Central Institute of Medicinal and Aromatic Plants (CIMAP), Lucknow; CSIR Emeritus Scientist and INSA Senior Scientist, National Institute for Plant Genome Research (NIPGR), New Delhi. Dr Kumar was recognized for his various roles as a brilliant teacher and scientist by IARI Gold Medal, 1962; Indian Society of Genetics and Plant Breeding Prize, 1965; Shanti Swarup Bhatnagar Award, 1981; National Academy of Sciences Distinguished Scientist Award, 1986, and B.P.Pal Memorial Lecture Award, 2003; FICCI Science Award, 2000; Bhasin Award, 2000; INSA Lecture Award, 2002; INSA Desikachari Award 2020. Dr Sushil Kumar was also a Fellow of the Indian National Science Academy; the Indian Academy of Sciences and the National Academy of Sciences, India.

Dr Sushil Kumar left for his heavenly abode on May 2, 2021. In his loss, the scientific community has lost a brilliant scientist, teacher, administrator and wonderful human being. The Fellowship of the Academy deeply mourn his sad demise and prays the Almighty to give peace to the departed soul.

**Dr Chakrapani Misra**

Dr Chakrapani Misra was born in Digapahandi, Ganjam, Orissa, on March 4 1933. He obtained his BSc from Science College, Puri, Orissa; MSc from Indian Agricultural Research Institute, New Delhi, and PhD from the University of California, Davis. Dr Misra served the Department of Agriculture, Government of Orissa and later the Orissa University of Agriculture and Technology, Bhubaneswar as Lecturer, Reader, Professor, 1982-92, and Dean of Research.

Dr Chakrapani Misra was recognized for his various roles as a brilliant teacher and outstanding scientist. He was a Member of the Editorial Board, Indian Society of Soil Science, and Soil Science Panel of ICAR. He was also a Fellow of the Indian Society of Soil Science, and the Rice Research Workers Association of India. In his illustrious career, he made immense contributions in the field of Soil Physics.

Dr Chakrapani Misra left for his heavenly abode on May 18, 2021. In his loss, the scientific community has lost a brilliant scientist, teacher, administrator and wonderful human being. The Fellowship of the Academy deeply mourn his sad demise and prays the Almighty to give peace to the departed soul.

**Dr M Udaya Kumar**

Dr M. Udaya Kumar was born on September 15, 1946. He obtained his MSc and PhD from GKVK, Bangalore. Dr Kumar was recognized for his various roles as the Best Teacher Award by ICAR; Meritorious Invention Award by NRDC; Rotary Gold Medal; and ITC Best Scientist Award. He was also a Fellow of the Indian National Science Academy; Indian Academy of Sciences; National Academy of Sciences; International Society for Plant Molecular Biology; and Indian Society of Plant Physiology Dr Udaya Kumar left an indelible impression in the minds of agricultural scientists in various roles as Professor and Head of the Department of Crop Physiology, and Head, Division of Plant Sciences. He was Visiting Professor at Wageningen Agriculture University, Netherlands. In his illustrious career, he made immense contributions in the field of crop physiology, photosynthesis and crop productivity; stress responses of plants; and physiology of water use efficiency.

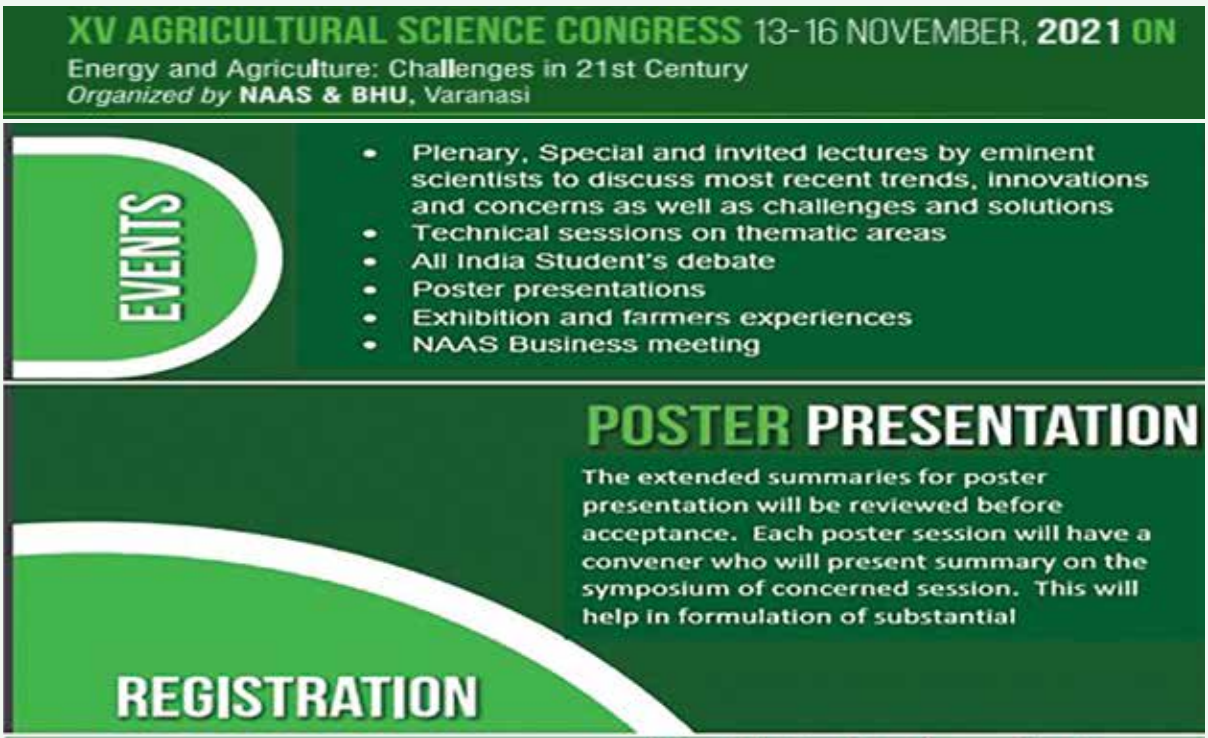
Dr M. Udaya Kumar left for heavenly abode on June 26, 2021. In his loss, the scientific community has lost a brilliant scientist, teacher and wonderful human being. The Fellowship of the Academy deeply mourn his sad demise and prays the Almighty to give1 peace to the departed soul.

**Mr Umesh Rai**

The Fellows of the National Academy of Agricultural Sciences deeply condole the sad demise of Mr Umesh Rai who left for heavenly abode on 14 May 2021. Mr Rai was a valued staff member of the Academy's Secretariat since 1999. He was one of the strong pillars in the Secretariat, who used to be involved in multiple activities and credited for his administrative contributions to the smooth functioning of the Academy's activities. His commitment, dedication and sincerity towards multiple activities of the Academy were exemplary.

On his demise, the Academy has lost a very humble, dependable, pro-active, and wonderful friend and colleague. He and his smiling face will always be in our thoughts. The Academy will miss Mr Umesh Rai. The Fellowship of the Academy prays the Almighty to give peace to the departed soul.

## Announcement




| Delegates | Registration Fees Offline mode | Fee in Online mode |
|---|---|---|
| International | US$ 250 | US$ 100 |
| International-Students & Research Scholars | US$ 150 | US$ 60 |
| International accompanying person | US$ 150 | — |
| National | ₹ 8,000 | ₹ 3,000 |
| National-accompanying person | ₹ 4,000 | — |
| National-Students & Research Scholars | ₹ 3,000 | ₹ 1,200 |
| Corporate Registration | ₹ 20,000 | ₹ 8,000 |
| On Spot Registration | ₹ 10,000 | ₹ 10,000 |

| S.No. | Theme Area | S.No. | Theme Area |
|---|---|---|---|
| 1. | Food-Energy-Water-Climate Security Nexus and the Challenges | 8 | Innovation in Crop Improvement |
| 2. | Energy Smart Resource Use | 9 | Emerging Technologies in Horticultural Sciences |
| 3. | Agricultural Engineering and Technology | 10 | Role of Industry |
| 4. | Post-Harvest Technology | 11 | Farmers' Session |
| 5. | Policies and Institutions for Energy Smart Management in Agriculture | 12 | Panel Discussion |
| 6. | Harnessing Energy Efficiency in Fisheries Sector | 13 | Students' Elocution Contest |
| 7. | Energy and Livestock & Poultry Production System | 14 | Posters |

**Editors:** Dr P.S.Birthal and Dr Malavika Dadlani

Published by: Executive Director, on behalf of the National Academy of Agricultural Sciences, NASC, Dev Prakash Shastry Marg, New Delhi 110012; Tel. (011) 25846051-52, Fax. 25846054; Email: naas-mail@naas.org.in; Webside: http://www.naasindia.org