Prof. M. S. Swaminathan
(07.08.1925 - 28.09.2023)

Prof. Mankombu Sambasivan Swaminathan, the Founder President of the National Academy of Agricultural Sciences, breathed his last on the 28th of September, 2023 at the age of 98 years. With that ended an era of agricultural research, policy, and management that was enriched with his sound scientific knowledge, concern for humanity, and a vision for public welfare. A leader, who led the country to victory against food scarcity and hunger, his life was not just long and well-lived, but was larger than what can just be measured in the number of years he lived. He was decorated by almost all top awards and honours that one can think of, which included the first World Food Prize, and Padma awards Padmashree, Padma bhushan and Padma Vibhushan. There would be many scientists who achieved more in agricultural research than Prof. Swaminathan, some perhaps will reach higher positions than him, few might be receiving more prestigious awards and recognitions, yet chances are slender for anyone to cross the number of lives touched and enriched by the wisdom, thoughtfulness and humanity of Prof. Swaminathan.

Volumes have been written and spoken about the enormous contributions of Prof. Swaminathan in making the country self-reliant in food by bringing in Green Revolution, reshaping the agricultural research, education and extension system, and spearheading a farmer-centric National Policy on Agriculture. His role in bringing gender equity in agriculture, and conservation of biodiversity are also much acknowledged, leaving not much to add. However, his leadership in giving shape to the visions of another doyen of Indian agriculture, Dr. B.P. Pal, in founding the National Academy of Agricultural Sciences (NAAS), with the help of a team of some equally distinguished and dedicated colleagues, and setting it on the right path, is of no less consequence.

Being closely associated with the policy making system in the country, Prof. Swaminathan realised the need to create a "Think Tank" in agriculture that could guide the policy makers in a holistic, knowledge-based and unbiased manner. As a person who headed DARE, the highest body in agricultural research and education, he could also have proposed to create a separate unit within the umbrella of DARE or ICAR, but instead NAAS was founded as an independent entity that provides a forum to agricultural scientists' cross-cutting all the Divisions. This is a platform to deliberate on critical national and international issues, present its collective views, and suggest action plans to the policy makers, planners, industry partners, farmer bodies and other stakeholders. As a result, since its inception, NAAS has been engaged in deliberating on important issues and has brought out over hundred and fifty Policy Papers, Policy Briefs, and Strategy Papers.

Though an FRS himself, and a Fellow of all national science academies in the country, he was much aware and concerned of the fact that agriculture scientists seldom got due recognition by the national science academies. Today, Agriculture (A) is now being promoted alongwith Science, Technology, Engineering and Mathematics (STEM) in all science and education related policies, making it STEAM, but things were different thirty years ago. In such a scenario, NAAS provided a much needed platform to recognize the excellence in agricultural sciences, increased the visibility and helped mainstreaming agriculture with other science streams. Better recognition of agricultural scientists today by all other scientific academies in the country as well as abroad, can be seen not only in increasing number of agricultural scientists as Fellows of other science academies, but also by holding top positions in these.

The void created with the demise of Prof. Swaminathan will never be filled, but by following the path shown by him, we can fulfill some of his dreams. That will be paying true tributes to this great soul!

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From the President's Desk

Artificial Intelligence to Energize Indian Agriculture

Introduction

Agriculture is the backbone of the India's economy. Rooted in centuries of tradition, agriculture holds a pivotal role in shaping India's progress and well-being of its people. It is a driving force behind our country's Gross Domestic Product (GDP), providing livelihoods to over half of the workforce and impacting the entire supply chain. Success in agriculture ensures food security, which is underlined by nourishing the nation's vast population with combination of staple food crops and other diverse produce. Its share in commerce and India's foreign exchange are also significant. However, sustainability is becoming a big challenge in recent times, considering the sector's close interactions with the environment. With multi-hued challenges abound, including climate change and fluctuating prices, the integration of cutting edge technologies offer promising solutions to holistically elevate Indian agriculture in a sustainable manner.
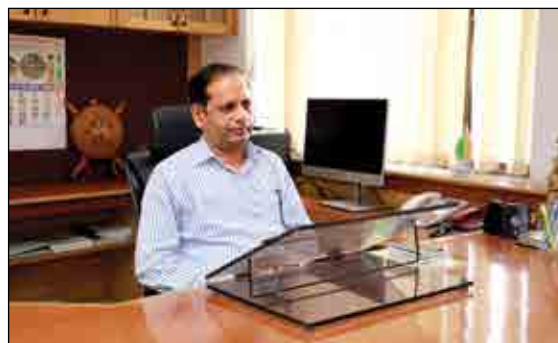
Since its establishment in 1929, ICAR has consistently worked to modernize Indian agriculture through research, innovation, and dissemination of evolving technologies. It played a pivotal role in the Green Revolution which made the sublime transformation of a food-deficit India to a global leader in grain production. ICAR continued to focus on developing advanced crop varieties that were disease-resistant, drought-tolerant, and suitable for various agro-climatic regions. Research expanded to include diverse areas such as biotechnology, integrated pest management, post-harvest technologies, precision machinaries, and soil health management in the post green revolution era. ICAR embraced biotechnology and adopted GM technology, as a powerful tool for crop improvement. The focus in the last decade had been on integrating Artificial Intelligence (AI) into agricultural research and practices through advanced machine learning and data analytics technologies . It applied AI forcrop yield prediction, disease detection, pest monitoring, and precision farming, enabling data-driven decision-making for farmers. Additionally, ICAR also utilizes AI in genetic research for accelerated crop breeding and to optimize resource allocation, thus enhancing agricultural productivity, sustainability, and resilience in the face of changing climatic conditions.

Challenges in Indian Agriculture

Indian agriculture confronts a spectrum of challenges that encompass the unpredictable impact of climate change, the strain of resource scarcity, limited market access, and persistent labour shortages. The cascading effects of climate change have disrupted traditional cropping patterns and

thus render agricultural planning an intricate puzzle, bordering enigma. Resource scarcity, particularly water scarcity, poses a daunting bottleneck as demand escalates and reserves dwindle. Labyrinthine distribution networks limit farmers' market access, constraining their income potential, while being challenges onto themselves. Concurrently, the sector grapples with the migration of youth to urban areas, resulting in a scarcity of rural labour. These challenges converge to shape a landscape of constraints that demands innovative solutions to sustainable propel and further fortify Indian agriculture.

The ICAR has launched a comprehensive suite of initiatives to counter the multifaceted challenges facing Indian agriculture. From developing climate-resilient crop varieties to pioneering water-efficient techniques, ICAR's research is created and piloted to mitigate the impact of climate change and resource scarcity in all their intricate formulations. By fostering market linkages and embracing digital technology, ICAR enhances farmers' access to markets, while its capacity-building efforts empower them with modern skills and techniques. Collaborations with research institutions and a focus on women farmers further amplify its impact, reflecting ICAR's commitment to strengthen Indian agriculture against all odds.

Artificial Intelligence (AI)

AI, fundamentally, refers to the ability of machines, including computers, to perform tasks that would normally require human intelligence. It involves the creation of algorithms and models that allow computers to process information, learn from it by extracting inferences to the fullest, make decisions, and perform actions. It encompasses various techniques, including machine learning, which enable systems to improve their performance over time through experience. AI applications range from simple tasks, like recognizing patterns in data, to complex processes, such as language translation, image analysis, and autonomous decision-making. AI has the potential to revolutionize industries, enhance automation, and solve intricate problems by enabling machines to simulate human cognitive functions.

Artificial Intelligence (AI) - Timeline of progress

The evolution of Artificial Intelligence (AI) has been a remarkable journey spanning decades. Beginning in the 1950s with theoretical foundation and the coining of the term 'AI', early researchers aimed to create machines simulating human intelligence. The subsequent 'AI Winter' in the 1970s-1980s dampened the progress, but the emergence of expert systems

and symbolic AI in the 1980s revived interest. Machine learning gained traction in the 1990s-2000s, allowing systems to learn from data, while the 2010s saw the rise of deep learning and the integration of AI applications into daily life. Today, Narrow AI dominates various tasks, yet the aspiration remains to achieve General AI (AGI) with human-like cognitive abilities. Artificial Intelligence (AI) encompasses a diverse range of specialized subfields, collectively driving technological advancement and enabling machines to perform tasks requiring human-like intelligence. Natural Language Processing (NLP) focuses on enabling machines to understand and respond to human language, while Computer Vision interprets visual information from images and videos. Reinforcement Learning teaches agents(models) to make decisions to maximize rewards, while Machine Learning involves training algorithms to recognize patterns in data. Deep Reinforcement Learning combines deep learning and decision-making in complex environments. Generative Adversarial Networks (GANs) create new data samples, while Semantic Segmentation classifies pixels in images. Neural Style Transfer merges artistic styles, and Graph Neural Networks (GNNs) process graph-structured data. Transfer Learning adapts models to new tasks, Automated Machine Learning (AutoML) automates model creation, and Explainable AI (XAI) seeks to make AI decisions transparent. Quantum Machine Learning merges quantum principles with AI algorithms, promising novel problem-solving approaches. These subfields collectively contribute to the multifaceted growth of AI with applications spanning diverse industries and domains.

AI Initiatives in Indian Agriculture

Indian government has taken substantial steps to integrate AI into agriculture through a series of proactive initiatives. Notable among these are the formulation of a National AI Strategy that emphasizes collaboration across sectors. ICAR launched Krishi Megh, which provides a cloud-based platform for data-driven decision-making, although it requires further strengthening to meet the requirements. Several AI applications in Plant Protection have been developed and passed to the stakeholders. To provide a boost to AI Initiatives, ICAR has also initiated a Network Program on Precision Agriculture. The government supports start-ups and innovation in this domain through funding mechanisms like the Atal Innovation Mission and promotes collaboration with tech companies and academia to jointly develop AI solutions tailored to agricultural needs. National Academy of Agricultural Sciences has also deliberated on Artificial Intelligence and IoT in Agriculture as one

of its themes in it XVI Agricultural Science Congress held during 2023. ICAR/ DARE is a partner in Quad AI Engage programme and is preparing the framework for collaborations among Quad countries (US, Australia, Japan and India) for furthering the research and development on AI in agriculture. Additionally, research grants, e-governance plans, and partnerships are driving the strategic integration of AI to support agricultural productivity, sustainability, and overall development.

Like other cutting-edge technologies, pinpointing the exact time when AI was adopted within ICAR proves challenging. A considerable time span in recent decades witnessed the Indian agriculture extensively utilizing statistical modelling, predictive systems, decision support mechanisms, and expert systems for data driven decision making and generate significant advantages. During the first decade and half of this millennium, the agricultural sector witnessed several instances of integration and adoption of AI technologies. The initial phase saw limited AI adoption due to technological constraints and awareness gaps. Some research institutions began exploring these guided by the inquisitiveness to qualify these gaps. In Early Phase (Late 20th century - Early 2000s), early attempts at AI in Indian agriculture involved basic decision support systems. One example is the use of expert systems to provide crop disease diagnosis and pest management advice to farmers. During the initial phase (Mid-2000s - Early 2010s), AI applications started emerging for precision agriculture. Keeping with the changing technology, in 2018 ICAR along with NITI Ayog, organized a landmark workshop on 'Artificial Intelligence in Agriculture',which marked the formal integration of use of AI techniques within the realm of ICAR's initiatives. Indian agriculture has gradually embraced Artificial Intelligence (AI) technologies through a transformative journey.

Another example is the use of remote sensing and GIS technologies to monitor and manage soil quality, water availability, and crop health on a more localized level initially. The subsequent Expansion Phase (Mid-2010s), saw the expansion of AI applications across various agricultural domains. Machine learning algorithms were used to analyze historical weather data to predict future weather patterns, aiding farmers in making informed decisions about planting and harvesting times. In the Integration Phase (Mid-2010s - Mid-2020s), AI became more integrated into everyday agricultural practices. AI-powered sensors and IoT devices were deployed to monitor soil moisture levels, allowing farmers to optimize irrigation and conserve water resources. During the current Transformation Era (Mid-2020s and beyond), AI is expected to steer the core engine of development towards revolutionizing Indian agriculture. A typical spectacle during this era of exponential intertwining of AI and agricultural tools and technologies, could be the use of advanced AI models to analyze vast amounts of data from multiple sources, including satellite imagery, drones, and sensors, to provide real-time insights for precision farming, crop disease prediction, and yield optimization.

In the face of challenges, ICAR has managed to take numerous strides in establishing an AI-driven framework to enhance the agricultural landscape in India and is raring to breach the frontier further . To put the initiatives taken by the Council in a perspective, these can broadly be categorized into four domains. The first involves the integration of AI to detect early instances of biotic and abiotic stresses in crops and animals. The second avenue revolves around crop enhancement, utilizing Computer Vision and AI-supported High Throughput Phenotyping to identify superior genotypes and leverage Bioinformatics. The third dimension pertains to addressing farmer queries and providing advice through the application of Natural Language Processing (NLP). Lastly, ICAR is also exploring the integration of AI-assisted IoT devices to buttress for the realm of precision agriculture.

Agriculture and AI: The synergy

The integration of Artificial Intelligence (AI) into Indian agriculture stands to yield transformative benefits. AI's predictive models and data analytics enable precise resource allocation optimizing planting, irrigation, and fertilization for increased productivity. Swift disease detection through AI-powered image analysis minimizes crop losses and reduces pesticide use. Accurate yield prediction empowers farmers with market insights, enhancing decision-making and planning. Labour optimization, access to real-time market trends, and reduced environmental impact through sustainable practices further bolster profitability and resource efficiency. By mitigating risks, enhancing skills, and advancing research, AI contributes to food security, and sustainable growth, positioning Indian agriculture for a more resilient and prosperous future.

AI's integration into agricultural biotechnology marks a significant advancement, revolutionizing the way we approach crop improvement and plant breeding. By leveraging machine learning algorithms and data analytics, AI-driven biotechnology offers immense possibilities in crop genomics, trait identification, and genetic modification,enabling development of novel plant varieties that are better suited for changing environments. With AI's prowess in handling large-

scale genomic data, agricultural biotechnology is poised to usher in a new era of sustainable and efficient crop production, for food security and environmental conservation.

Future of AI in Agriculture

The future of AI in agriculture will much depend on the adoption of generative techniques. Generative AI could revolutionize Indian agriculture by leveraging data-driven insights for enhanced precision in agriculture through real-time analysis of contributing factors, Moreover, generative AI facilitates direct market access, reducing inefficiencies in the supply chain and ensuring fair compensation for farmers. With precision farming techniques driven by AI, farmers can optimize resource allocation down to individual plants, ensuring maximum productivity while minimizing waste. Automated machinery and robotics will streamline labour-intensive tasks, climate-resilient practices will adapt to changing weather patterns, and disease and pest management will become more precise through AI predictions. Data-driven decision-making will empower farmers with real-time insights, enhancing market access and reducing post-harvest losses. Livestock monitoring, supply chain optimization, and sustainable resource management will all benefit from AI's capabilities, fostering more efficient, resilient, and environment-responsible agricultural systems. Akin to crop farming, aquaculture both in fresh and sea waters, stands to reap a windfall of efficacy, entropy and enhancement by adopting the Generative AI guided practices.

Responsible AI

AI's evolution showcases both its potential and the challenges of advancing technology in alignment with human values. Ethical and societal concerns are now crucial, driving research in responsible AI The Global Partnership on Artificial Intelligence (GPAI) stands as a pivotal collaborative initiative at the intersection of technology, ethics, and global governance. Established to address the multifaceted challenges posed by AI, GPAI brings together leading experts, policymakers, and industry stakeholders from around the world. By fostering international cooperation, information exchange, and the development of best practices, GPAI strives to ensure that AI technologies are deployed responsibly, ethically, and with a focus on human-centric values. As we navigate the evolving landscape of AI, GPAI will play a crucial role in shaping the trajectory of AI development, promoting transparency, and safeguarding against potential risks.

Global guidelines for artificial intelligence (AI) haven't been established yet. However, various organizations and regions are actively working on shaping ethical principles and responsible practices for AI development and deployment. The Organisation for Economic Co-operation and Development (OECD) has set forth principles emphasizing inclusive growth and trustworthy AI systems, while the European Commission has provided guidelines focusing on transparency, accountability, and fairness. While the Institute of Electrical and Electronics Engineers (IEEE) has contributed standards for ethical considerations in autonomous systems, the UNESCO is in the process of drafting recommendations on AI ethics aligned with human rights. Additionally, national and regional initiatives, such as those in Canada, the United States, China, and the UAE, have shown their intent by their approaches to AI development in totality. A comprehensive global regulatory framework for AI is work in progress.

As India embraces these technological advancements, addressing issues of accessibility and promoting digital literacy will be essential to unlock the full transformative potential of generative AI in agriculture. The integration of Artificial Intelligence (AI) in agriculture, while promising substantial benefits, presents many challenges and considerations. These include issues of data quality and accessibility, particularly in areas with limited connectivity, the need for customization to local agricultural contexts, and concerns over data privacy and ownership. Skill development of farmers and other stakeholders to effectively use AI tools is essential, as is addressing biases and ensuring fairness in AI-driven decision-making. Initial costs, potential displacement of traditional practices, ethical concerns, and the environmental impact of AI's energy consumption are factors that demand careful attention. Establishing a regulatory framework, addressing cultural acceptance, and maintaining the long-term viability of AI solutions are crucial for its balanced and successful integration in agriculture.

Himanshu Pathak
President

Executive Council Meetings

133th meeting of the Executive Council

The 133th Meeting of NAAS Executive Council was held in hybrid mode at 02.30 P.M. on 16th September, 2023 under the Chairmanship of Dr. Himanshu Pathak, President NAAS. Besides the EC members, Chief editor, Agricultural Research, Organising Secretary, 16 ASC, and Conveners of the Sectional Committees participated on specific items, after which the agenda items were deliberated upon by the EC.

Some of the important issues discussed included

- progress on the publication of (a) State of Indian Agriculture and (b) Indian Agriculture in the Amrit Kaal: The Road Map';

- review and revision of the Objectives, Bye-laws of the Academy for proposed Fellowship to Teachers, Industry Leaders and Innovative Farmers. It was decided that the existing procedure of awarding NAAS Fellowship would continue;

- an update on generating revenue for the Academy from various sources;

- consideration of Recommendations of Sectional Committees and the Conveners' Group for finalization of Academy Fellowships/ Associates and Young Scientist Awards for the year 2024, and suggestions for further improvement in the selection process;

- preparation of panel for election of the Office-bearers and Members of the Executive Council 2024, based on the proposals received from the Fellowship.

Dr. A. Gopalakrishnan, Director, ICAR-CMFRI, Kochi, and the Organizing Secretary, XVI ASC provided an update on the logistic preparations and budgetary considerations. Following thorough discussions, necessary decisions were taken for a smooth and successful conduct of the Congress, where more than 1000 participants were expected.

The President conveyed to the Council that the Academy's Agricultural Research Journal has achieved an International Impact Factor of 1.4, resulting in NAAS score of 7.4, for which he congratulated the Editor-in-Chief Dr. Anupam Varma and his team and thanked Springer Nature (I) for support in publication.

NAAS Programs

EXPERT CONSULTATIONS

Ethics and Current State of Research Publication (Inter-Academy) (Convener: Dr. G. Taru Sharma)

The contributions in the field of Science and Technology (S&T) and its impact is primarily measured by Research Publications. The researchers, scientists, faculty members, students, industry personnel and academicians mainly showcase their work and achievements by publishing into the high impact Journals. The impact factor and citations of these journals are driving the scientific community to publish their research work/innovations, resulting in emergence of new journals and publishers with different options mainly the open access, publish as pre-prints, arXiv-free distribution etc.

In few cases, professional and scientific ethics are compromised in-order to publish their work in high-impact Journals to receive greater recognitions. Therefore, with a fast-changing publishing landscape around the world, a relook into how the research is discovered, published and communicated was needed.

In view of this Academy organized an *Expert Consultation on Ethics and Current State of Research* Publication on August 31, 2023 under the chairmanship of Dr. Himanshu Pathak, President NAAS. The following points emerged during the discussion.

- Existing guidelines available with the ICAR institutes and State Agricultural Universities on ethics in publication should be reviewed and necessary improvement or changes in the guidelines may be made after consultation with experts.

- Similarly ethical guidelines for publishers, journals, editors and reviewers may be developed.

- Journals which come for the NAAS ratings must be evaluated for their link with COPE and commitment from the chief editor/editor.

- Ethical parameters and publishing policies shall be included in all NAAS journals. Editors and editorial board members of peer reviewed Indian journals may be included in the committee while developing the scorecard for NAAS rating.

- (This already exists with many journals and may not be required)

- Impact factor of the journal, which is used as an important evaluation parameter for recognition of author, career advancement or award/honours, cannot be overlooked, however, the societal

impact of the publication addressing major national initiatives of the government should also be given due importance.

- The guidelines related to number of publications mandatory for Masters and Doctoral degree awards should be revaluated.

- In a multi-authored publication, authorship should accurately reflect the contribution of each author. It is unethical to accept or offer 'honorary' or 'gift' authorship based on someone's administrative/ scientifically higher position.

- Training programmes shall be conducted by ICAR-NAARM for scientists/teachers regarding ethics in research publication. Similarly, Directors and Vice-chancellors should be sensitized about the same during the Executive Development Programme.

- A separate budget should be allocated for the researchers through project funds (particularly extramural project) to submit their research work in peer-reviewed open access journals.

- Pre-print archives (arXiv, Researchsquare) may help in curbing 'idea plagiarism' that can happen in the process of conventional publication in peer-reviewed journals.

- The publishing standards of Indian journals can be improved by free e-subscription, time bound review/ publication process, diversity in editorial board.

COP 28 -Preparedness for Indian Agriculture (Convener: Dr. P.K. Aggarwal)

NAAS organized a consultation meeting of national experts on 25 Sep 2025 under the chairmanship of Dr. Himanshu Pathak, President, NAAS to provide support from an agriculture perspective to India's negotiators for COP 28. Senior officers from the Ministry of Agriculture and Farmers Welfare, Ministry of Environment Forest and Climate Change, and Experts from different national and international organizations in India attended it. The main objective of this discussion was to review the overall needs, strengths and weaknesses from an agricultural perspective to support potential discussion in COP around loss and damage, green carbon credits, and implications of government schemes on adaptation and mitigation. The following recommendations emerged from the detailed discussion.

1. Low emissions from agriculture: It should be reiterated that India's emissions from the agriculture sector (livestock, fertilizers and rice paddies) are not luxury emissions but survival emissions and are necessary for the livelihood security of the medium and smallholding farming community. Also, India's per capita emissions are low compared to global standards.

2. Valuation of current government investments in agriculture from adaptation and mitigation angle: Most of the Government schemes/ initiatives such as PM- KUSUM, Ujwala Yojna, soil health card, micro irrigation, neem coated urea policy, natural farming initiative, millet initiatives, etc. are aligned with adaptation to climate change and also have mitigation co-benefits. According to an estimate by IFPRI, direct public expenditure in specific policies/schemes that promote adaptation and mitigation is almost 3.3 billion \$/year or 15% of the GoI' agriculture budget (which may be an underestimation). Additional public expenditure on infrastructure, irrigation, disaster relief, credit, etc, makes this figure much higher. This needs to be highlighted at COP28 by the Indian negotiators.

3. India's Initiative and leadership in the solar and biofuel alliance and their contribution to reducing GHG emissions and building resilience in agriculture must be highlighted.

4. Climate finance needs of Indian agriculture: Despite large investments to increase adaptive capacity by farmers, governments, and other stakeholders, much of Indian agriculture is still very vulnerable to climatic risks. This vulnerability is projected to increase in time to come due to climate change. A massive amount of climate finance is required (the amount is unknown but is expected to be in trillions of dollars) to build the resilience of Indian farmers.

Recommendations for research and analysis to support COP 28 and beyond.

To strengthen our future stand and preparedness for future COPs, India should generate data on the following aspects for which limited information are currently available.

- Loss and damage estimates: We should initiate activities to quickly estimate spatial and temporal losses and damage in the agriculture value chain, including infrastructure and trade in the current climate as well as in future scenarios. Estimates of climate finance required for adaptation linked to the above loss and damage estimates also need to be worked out. These estimates will help in submitting our response to Global Stock take.

- Adaptation and mitigation potential of current investments: Even though India has not committed to mitigation in agriculture, a comprehensive estimate of the adaptation and mitigation potential and its realization arising out of investments being made through various central and state government schemes should be made. These estimates will also help in submitting our response to Global Stock take.

- Valuation of Green caron credits: Studies should be done to evaluate the relevance of the green credit

scheme in agriculture for carbon credit generation to benefit farmers, considering the uncertainty of the green caron market and complex issues related to monitoring, evaluation and verification of credits in agriculture systems at the farm scale.

- Capacity strengthening of India's policy planners and COP negotiators: A short course should be developed and offered to raise the capacity of government officials to understand the adaptation and mitigation aspects of their investment decisions and plans in the agriculture sector.

BRAINSTORMING SESSIONS (BSS)

BSS on "Greening of Livestock and Poultry Sector: Policy Options for Developing Sustainable Approaches" (Convener: Dr. Naveena B. Maheswarappa)

The livestock sector is a pillar of the global food supply chains and a major contributor to poverty reduction, food security, and agricultural development. Globally, livestock contributes 40% of the value of agricultural output and supports the livelihood and food and nutrition security of almost 1.3 billion people. Globally, food production is responsible for 26% of the world's greenhouse gas (GHG) emission and within this livestock, poultry and fisheries contribute 14.5% (i.e. 56% of total). Livestock sector uses 40% of arable cropland globally, whereas in India 4.7% of total cultivable land is used for growing livestock feed. Livestock and poultry feed production results in 97% of total water footprint and food sector consumes 200 Exajoules of energy per year mainly from processing and distribution activities. Dairy, meat, and poultry processing are the most energy-intensive, and fish culture is a water-intensive activity requiring much higher energy and water. Meat and poultry sector waste significantly adds to GHG emissions and greening of this sector must be ensured for efficient utilization and valorisation of waste. The expected surge in demand for animal proteins by 2050 presents ecological and environmental challenges for the livestock industry. Despite low per-capita emissions (1.8 tons CO_2), India is the 3rd largest GHG emitter globally, emitting a net 2.9 $GtCO_2e$ every year as of 2019 and is targeted to become a net-zero emitter by 2070.

On the other hand, extensive grazing practices and natural pastoral production system used in India mainly uses rain water/green water resulting in smaller water footprint while local production and consumption habits are leading to lower food miles. Nevertheless, mapping of energy and water usage in the animal-sourced food sector has not been attempted With this background, the National Academy of Agricultural Sciences, New Delhi organized a brainstorming session (BSS) on "*Greening of Livestock and Poultry Sector: Policy*

Participants of NAAS BSS held on 1st September, 2023

Options for Developing Sustainable Approaches" in hybrid mode on September 1, 2023 under the chairmanship of Dr. Himanshu Pathak, President, NAAS and Director General, ICAR.

The following key recommendations emerged from the deliberations:

- Nutritional interventions required to induce changes in enteric fermentation characteristics of livestock to lower methane production. Feed ingredients and additives that can be used to inhibit methanogenesis need to be selected.

- Assessing environmental and economic impact of low-producing animals and developing comprehensive model specific to each agro-economic zone.

- Harnessing renewable energy sources and developing technologies for valorization of waste (co-generation, bio-gas, zero-discharge technologies) representing new avenues of income and carbon credits facilitating climate financing.

- Low-carbon or zero-carbon labelling guidelines may be evolved for meat, dairy and poultry products with existing leads through policy dialogue with line departments like BIS, FSSAI, EIC, APEDA etc.

- Holistic institutional approach and cross-sectoral integration for enabling national policy framework ensuring greening of livestock and poultry sector while addressing all the SDG's.

- A network project may be initiated to estimate livestock's carbon footprint and quantifiable data generation through 'Lifecycle Assessment' by identifying respective ICAR Institutes and SAUs.

BSS on "Prospects of dsRNA based Biopesticides for Crop Protection in Indian Agriculture" (Convener: Dr. Bikash Mandal, ADG (IC)

The National Academy of Agricultural Sciences (NAAS) organized a brainstorming session in hybrid mode on "*Prospects of dsRNA based Biopesticides for Crop Protection in Indian Agriculture*" on 26th September, 2023, which was attended by more than

150 participants including experts and researchers from national and international institutes. The topic was introduced by Prof. Anupam Varma, followed by a comprehensive presentation by Dr. Bikash Mandal, on the status of potential application dsRNA technology against insect, fungus, virus, nematode, and weeds. The topic was further elaborated by a panel of experts including Dr Neena Mittar, UQ, Brisbane, Australia and Dr. Basavaprabhu L. Patil, ICAR-IIHR, Bengaluru.

During the discussion, the central theme revolved around devising the appropriate terminology for this technology differentiating from chemical pesticides. The session also delved into the prospects of expanding dsRNA production for field applications at a significantly reduced cost, and scrutinized the array of technological challenges that must be surmounted to enable its practical deployment in the field, including bolstering the efficient uptake and enduring stability of applied dsRNA within the plant system. Various delivery techniques, notably through nanoparticle and microbial carriers for creating a stable formulation that augments its stability and efficacy against the targeted pests must be evaluated for safety evaluation and risk assessment prior to its commercial release in the farmers' fields.

In India, so far the dsRNA work is centered around plant viruses, but there is great possibility using it against other target pathogens, insects and weeds. It is necessary to establish biosafety norms and regulations to facilitate the usage of dsRNA technology in India as an alternative to chemical pesticides.

Strategy Workshop on "Honey Bees - the Harbinger for Sweet Revolution" (Convener: Dr. S.C. Dubey, ADG (PP&B); Co-Convener: Dr. Dr Pardeep Kumar Chhuneja, Dean, PAU)

A Strategy Workshop on 'Honey Bees - the Harbinger for Sweet Revolution' was organized on September 29, 2023 in hybrid mode under the chairmanship of Dr A.K. Singh, Vice President, NAAS. Many distinguished scientists and concerned government officials, including Dr Prabhat Kumar, Horticulture Commissioner, GOI; Naveen Patle, Executive Director, NBB and some entrepreneurs participated physically or online.

Dr S.C. Dubey highlighted the significance of the context of the topic of the workshop and emphasised that a comprehensive policy document for holistic apicultural development is needed. Dr Pardeep Kumar Chhuneja presented the base paper highlighting the roles of wild bees and honey bees in honey production including its characteristics; value of other hive products and their usage, season and region specific scientific husbandry for the bee resources; api-therapeutical benefits; scope of developing api-tourism; pollination services; and their interface with socio-economic, cultural and natural heritage, and environmental integrity.

Dr Prabhat Kumar emphasized on generating a reliable and realistic database of beekeepers, number of colonies and honey production. He also stressed upon advancing the Science of Apiculture, check adulteration, Indian branding, establishing a Centre of Excellence, bee breeding, pre-registration assessment of pesticides for their toxicity to bees, quality profiling of all Indian honeys, promotion of pollination under protected cultivation, and assess the scope of Api-tourism.

Points presented by the speakers and participants were deliberated at length and following recommendations emerged:

- A National level Apiculture Directorate/ Research Centre and State Apiculture Development Boards need to be established with specialized human resource
- Developing school curricula with topics on apiculture, training modules for skilling, and listing Apiculture as a subject at PG level.
- Creation of reliable database on number of beekeepers, honey bee colonies and honey production based on the information furnished by the concerned state agencies.
- Creation of Funds for Competitive Grants (by NBB) to undertake research projects in cutting-edge areas of apiculture.
- Research should be scaled up to ensure pollination in protected cultivation.
- To facilitate upstream research in bee breeding, AICRP scientists to be trained in new technologies.
- Profiling of region- and crop-specific honey to be undertaken for GI tagging/branding.
- Research and development activities need to focus on indigenous spp. of honey bees and pollinators for stability and sustainability.
- Impetus needed to processing and value addition of all hive products and developing FSSAI standards for hive products of Indian niches
- Insurance Regulatory and Development Authority of India (IRDAI-MoF), can facilitate in developing beekeeping friendly insurance policies
- There must be evaluation of insecticides against honey bees for assessing its safety before their registration by the CIB&RC.
- Promoting and supporting manufacturing industry in scaling-up of fabrication of standard honey bee hives and other apicultural equipment.
- Facilitating capacity building and infrastructure for bee disease diagnosis at KVK level.
- Expansion of area under bee pasture by planting bee-friendly flowering trees in fallows

- Central Warehouse Corporation to extend infrastructural facilities at field/ district/ state level for collection and storage of honey.
- State Agriculture Departments through the support from NABARD should facilitate in the development of FPOs, such that the unorganized sector of

- landless, marginal, small farmers and weaker sections takes shape into an organized system
- NBB/ NDDB/ APEDA/ State Agri. Export Corporation, etc. to create awareness about the benefits of honey and to support development of export system for new entrepreneurs

Other Activities

Pedagogy Development Programme

The Academy initiated a Pedagogy Development Programme (PDP). Under this the first session took place from July 31 to August 5, 2023, the second occurred from September 25 to 30, 2023. These training programs were designed with the objective of elevating the competencies of educators in effective teaching by integrating the participants.

The Participants for these training sessions comprised from various institutes, including IARI Hubs and ICAR Institutes from Karnal, Bengaluru, West Bengal, Jodhpur, Patna, and more. In the first training, 45 participants, representing diverse institutions, engaged in an enriching exploration of topics such as the teaching-learning process, psychology of learning, curriculum development, lesson planning, pedagogical approaches, modern technologies, classroom management, and fostering professional values. The second training witnessed the active participation of 40 individuals, hailing from different ICAR Institutes. These sessions served as valuable forums for knowledge exchange and skill enhancement in the realm of agricultural education.

The Pedagogy Development Programme successfully addressed the evolving needs of teachers in the changing dynamics of education. It provided a platform for professional development, incorporating modern pedagogical techniques, technology integration, and fostering a learner-centered approach. The diverse range of topics and hands-on experiences ensured a comprehensive learning experience for the participants.

A Special Lecture

Prof. Fredy Altpeter (University of Florida, USA) was organised by the Academy on the topic "Towards Oilcane: Fueling the bioeconomy with metabolic engineering and gene editing of sugarcane", on August 31, 2023. The event was chaired by Dr. Himanshu Pathak, President, NAAS.

NAAS-PAAS Meeting

An interactive meeting of the Professional Association of Agricultural Societies (PAAS) with National Academy of Agricultural Sciences (NAAS) was organized by the Academy in hybrid mode on September 26, 2023 under the Chairmainship of Dr. Himanshu Pathak,

President, NAAS. Sixty five participants representing 48 professional societies attended the meeting.

In his opening remarks, Dr. Pathak explained the purpose of the meeting, emphasizing the need for greater involvement of PAAS in NAAS activities and improvement in the quality of society journals. Dr. Pathak's key points for the meeting were to encourage collaborative identification of common areas, acknowledge the merging of disciplines, emphasize self-sustainability for societies with mutual support due to reduced government funding, and highlight the Academy's role as a supportive think tank for all the societies involved.

Thereafter, the participants were invited to present their views about NAAS-PAAS linkage and collaboration. It was unanimously agreed that a strong NAAS-PAAS linkage will help in strengthening academic activities of the PAAS.

The following areas were identified for the future course of actions:

- A common theme should be selected annually, and to bring it to fruition, all professional societies and the Academy should collaboratively create a joint proposal for hosting 1-2 sessions or organizing joint conferences.
- One or two representatives from a few chosen Professional Societies will be invited to participate in the NAAS Executive Council meetings as invited members.
- The websites of different societies can be interconnected with hyperlinks to facilitate the exchange and sharing of publications/documents.
- Societies can collaborate on joint publications, which may include books, policy papers, and other such documents.
- To enhance communication and the sharing of high-quality publications, the idea of forming a WhatsApp group was proposed. This group would consist of NAAS office bearers and 1-2 representatives from each professional society.
- Professional societies are strongly encouraged to propose innovative ideas for activities like BSS or Expert meetings and can engage with the Academy by sharing their suggestions. In support of this,

the Academy will appoint one of its office bearers to oversee this activity and provide updates. Whenever any matter of national importance comes up, NAAS can be approached for assistance.

- The President proposed to have a discussion at the Academy with the societies aimed at

enhancing the quality of journals to attain higher NAAS ratings.

- The Academy will establish a committee comprising 5-6 members, including some of the NAAS Local Office Bearers and 2-3 representatives from other societies, as identified by NAAS for follow-up actions.

Activities of the Regional Chapters

Bengaluru Chapter

NAAS Regional Chapter, Bengaluru organized a guest lecture on "Transformational Agriculture: Livestock for Nutritional Sustainability" on September 25, 2023 at ICAR-NIANP Mini Auditorium. The lecture was delivered by the esteemed Fellow of the Academy, Padma Shri Prof. Moti Lal Madan. During the deliberations, Prof. Madan mentioned that the livestock sector plays a crucial role in ensuring food security. The importance of animal proteins and products for human health and the tremendous growth of the

Indian livestock sector since independence were acknowledged. He pointed out that with rapid changes in all areas of science, imparting knowledge and skills with visibility has become more important than information. The Indian livestock sector also needs to be modernized, which requires the use of the latest technologies such as sensors and artificial intelligence. More emphasis should be placed on fine-tuning the domestic system rather than The event was attended by 75 scientists, students and research associates of ICAR-NIANP and ICAR-NDRI.

Lucknow Chapter

With an objective to connect the FPOs/ FPCs and the farmers of Uttar Pradesh with the start-ups supported by a-IDEA ICAR NAARM, Hyderabad organized FPOs/ Farmers – Start-up Immersion cum AGRI UDAAN® 6.0, a Food & Agribusiness Accelerator Programme Road show at Lucknow in collaboration with NAAS, Lucknow Chapter, ICAR-IISR, & ICAR-CISH, Lucknow on 08th August 2023. About 20 start-ups and 75 FPOs and

farmers from different places across Uttar Pradesh participated in the programme. Senior officials from NABARD, SBI, Agriculture Scientists and officials from BIRD Lucknow and other reputed organizations graced the event. Shri Sanjay K Dora, Chief General Manager of NABARD, was the chief guest of the inaugural session Dr. Dilip Kumar, Principal Scientist, ICAR-IISR coordinated the programme as organising secretary. Dr. S. Senthil Vinayagam conducted the interaction programme along with the team from NABARD and SBI.

- ICAR-Indian Institute of Farming System Research (IIFSR), Modipuram has organized TEEB for Agriculture and Food - Uttar Pradesh Stakeholder Consultation: Discussion on Draft Findings on 1st August, 2023 in association with ICAR-IISR, Lucknow and NAAS Chapter, Lucknow Chapter. The one-day programme started with inaugural session, in which Dr Sunil Kumar, Director, ICAR-IIFSR, Dr T. Damodaran, Director, ICAR-CISH, Lucknow, Dr R. Viswanathan, Director, ICAR-IISR,

Lucknow, Dr. Alka Bhargava, Senior Policy Advisor, TEEBAgriFood-India, UNEP offered their opening remarks. Later, the special invitees, Shri. Franklin Khobung, Joint Secretary, Ministry of Agriculture and Farmer's Welfare, Government of India (TBC) and Shri. B. Prabhakar, Additional Principal Chief Conservator of Forests (PCCF), Government of Uttar Pradesh (TBC) offered their remarks. Mr. Reuben Gergan, Project Officer, TEEBAgriFood India, UNEP TEEB Initiative in India delivered a talk on objectives, milestones and scalable potential outcomes of the program.Dr N. Ravisankar, Principal Scientist & PC, ICAR-IIFSR narrated TEEB Initiative in Uttar Pradesh: Scope of the study. Dr. Salman Hussain, Head, Economics of Nature Unit and Coordinator TEEB, UNEP delivered Keynote address as Chief Guest (Virtual). Dr. Meraj Alam Ansari, Senior Scientist & PI, TEEB-UNEP Project TEEB delivered a talk on Initiative in Uttar Pradesh: Presentation of draft outcomes of the study. Later sessions were held on 'Discussion on results pertaining to natural and produced capital elements estimated and valued under TEEBAgriFoodUttar Pradesh', 'Discussion on results pertaining to social and human capital elements estimated and valued under TEEBAgriFood

Uttar Pradesh' and 'Discussion on entry points and challenges of upscaling organic farming and agroforestry in Uttar Pradesh'. Dr Mohd. Shamim, Mr Reuben Gergan, TEEB, Dr KJ Raghavendra, IIFSR and Dr Alka Bhargava, TEEB, UNEP moderated the discussion sessions.

Pune Chapter

The NAAS Pune Chapter organized two programmes in collaboration with ICAR-NRC Grapes, Pune and Society for Advancement of Viticulture and Enology.

1. A Special Lecture on **'Precision Breeding of Vitis for Improved Traits'** by **Dr. Sadanand A Dhekney**, Professor, Department of Food and Agricultural Sciences, University of Maryland Eastern Shore was organized in hybrid mode on **January 24, 2023** at **ICAR-NRCG, Pune.**

2. A **National Conference on "Generative AI in Practice for Empowering Agricultural Research Productivity"** was organized in online/virtual mode on **September 11-12, 2023**. There were six keynote addresses and 30 presentations highlighting diverse potential of Generative AI in agricultural research productivity. The conference delved deep into the use of Generative AI for creativity and innovation in agricultural research, developing customised applications based on generative AI, drafting research methodologies, interpreting results, and even writing manuscripts. In addition to the NAAS family, the online event attracted 130 registered researchers, nationwide.

Kolkata Chapter

A Workshop on the occasion of the National Nutrition Week was organized with school children at the Ramkrishna Mission Ashrama, Sargachi, Murshidabad on Septemebr 12, 2023. About 450 students (class IX to XII) from two local schools (one boys' and the other girls') were participated. Dr. Himanshu Pathak, President, NAAS inaugurated the Workshop. A few eminent persons including two Nutritionists delivered lectures to empower the students regarding balance nutrition and how to achieve it with simple food stuffs available at their home. It was a highly successful program. A 'SAVE SOIL' campaign was organized on October 17, 2023 with ~300 students at the Jiaganj Raja Bijoy Singh Vidyamandir, Jiaganj.

Dr. Pradip Dey, Director, ICAR-ATARI-Kolkata and Dr FH Rahman, Head, Regional Station, ICAR-NBSS&LUP, Kolkata along with a few experts from KVK, Murshidabad and BCKV participated in the programme. They highlighted the importance of soil to society and ways for upkeeping it for posterity. The awareness campaign created lot of interest not only among the students (Class IX to XII) but also the teachers and local dignitaries who participated in the program.

Hyderabad Chapter

NAAS Hyderabad Chapter in collaboration with ICAR-NAARM organised a Special online lecture by Dr. Maitrayee Das Gupta, Professor, University of Kolkata on **10th August, 2023**. Dr. D. Damodar Reddy, Principal Scientist, ICAR-NAARM and Fellow of NAAS welcomed the dignitaries and guests on the occasion and highlighted the significance of nitrogen fertilizer consumption in India. Dr. Maitrayee Das Gupta, Chief Guest of the program, delivered a special lecture on **"Challenges in Extending Symbiotic Nitrogen Fixation Beyond Current Host Range"** wherein she gave a detailed account of nitrogen fixation. Chairman of the session, Dr. Anil K. Singh, Vice President, NAAS, in his remarks, highlighted the importance of nitrogen element in global food production and stressed on the need for increasing the efficiency of nitrogen fertilizers. Dr. Ch. Srinivasa Rao, Director, ICAR-NAARM and Convener of the NAAS Regional Chapter-Hyderabad appreciated the speaker for an elaborate coverage of the topic and stressed on the need for the country to work towards net zero emissions in line with the discussions held during global climate change negotiations. **100 participants** from various ICAR institutions, SAUs, NAAS, Regional Chapter-Hyderabad fellows and associates participated virtually.

- NAAS Hyderabad chapter in association with ICAR-NAARM organized a 3-day Skill Development Training on **"Integrated Farming System - Climate smart dryland technologies"** at Agricultural Research Station, (ANGRAU), Anantapuramu, Andhra Pradesh for Farmers from **11-13th August 2023**. A total of 60 men and women farmers from the most weather vulnerable Mandals (Kuderu and Atmakur) of Anantapuramu District were trained on the aspects of Conservation agriculture, Integrated nutrient and pest management, livestock production and most importantly weather-based farming practices. In his inaugural address, Dr. Ch. Srinivasa Rao, Director, ICAR-NAARM and Convener, NAAS Hyderabad chapter highlighted the importance of IFS in agricultural production for promoting economic, social and environmental well-being. He also stated that by integrating various agricultural components farmers can create resilient and efficient farm systems that benefit both the farm household and the larger community. He urged women farmers to form into groups and start their own business on vermicomposting, millet value addition etc. which can significantly contribute to boost the rural economy.

- NAAS Hyderabad chapter in association with ICAR-NAARM organized a Sensitization Programme for B.Sc. (Agriculture) Students from two private educational institutes on **11th and 12th Aug 2023** at Agricultural Research Station, (ANGRAU), Anantapuramu, Andhra Pradesh. The opportunities for higher education in agriculture sector, nutrition sensitivity and climate change issues were discussed with the students. Students were sensitized on aspects of value addition, food

processing, etc. to reduce food losses due to extreme climatic events.

- NAAS Hyderabad Chapter associated with ICAR-NAARM in organizing a **4-day Skill Development Training Programme on Integrated Crop Management in Chilli** for SC Farmers at SAIRD-Krishi Vigyan Kendra (KVK), Gaddipally, Suryapet District of Telangana during **28-30 August, 2023**. **Twenty five Farmers** from nine villages of Suryapet district participated in the training programme. Farmers were sensitized on the aspects of export opportunities for quality chillies through integrated crop management practices, adoption of integrated nutrient management practices for better yields.

- NAAS Regional Chapter-Hyderabad, in collaboration with ICAR-NAARM & NAHEP, ICAR organised a Policy Dialogue on '**Agricultural Education System in USA and Potential Collaboration with India**' on **7th September, 2023** in hybrid mode. Two Eminent Speakers Dr. Anup K Johny & Dr. Kumar Venkitanarayanan presented agricultural education system in USA followed by discussion on possible collaboration between US Universities and NARES.

Dr. Ch. Srinivasa Rao, A large number of participants offline and online participated from various ICAR institutions, SAUs.

- NAAS Hyderabad chapter collaborated Post Graduate Diploma in Management-Agribusiness Management (PGDM-ABM) at ICAR-NAARM in organizing the Sankalp 8.0, the national-level B-fest including the competition among students in the field of entrepreneurship development **during 22nd and 23rd, September, 2023**. The event received impressive response with over 9300 registrations from more than 1000 institutions, culminating in 200+ finalists in eight distinct events. The winners and runner ups shared their experience about the event and hospitality at ICAR-NAARM. The event also received an overwhelming support from many agri-based industries

Forthcoming Programs of NAAS

1. Brainstorming Session on Revisiting Soil Health Mission (Dr. B.S. Dwivedi)

2. Brainstorming Session on Water Auditing in Indian Agriculture (Dr. K. Palanisamy)

3. Brainstorming Session on Export Potential of Agricultural Commodities and Challenges (Dr. Naveen P. Singh)

4. Enhancing Investment in Research for Indian Agriculture (Dr P.S. Birthal)

5. Multiple uses of Solar Energy in Agriculture (Dr N.S.L. Srivastava)

Obituaries

Dr. Brahma Singh
(1941-2023)

The Fellows of the National Academy of Agricultural Sciences deeply mourn the sad demise of Dr Brahma Singh, a visionary leader and scientist par excellence. He will be remembered for his contributions in developing agro-technologies for the high altitude areas of the Himalayan region.

Dr Singh left an indelible impression among his colleagues in various senior positions at CCS Haryana Agriculture University, Hisar; Defence Agricultural Research Laboratory, DRDO, Almora/Pithoragarh, Uttarakhand; Defence Food Research Laboratory, Mysore; Defence Research Laboratory, Tezpur, Defence Institute of High Altitude Research, Leh (J&K); DRDO HQ, New Delhi, Defence Institute of Physiology and Allied Sciences, DRDO, New Delhi; Uttaranchal Seeds and Tarai Development Corporation (Pant Nagar Seeds), Pant Nagar; and President's Secretariat (Horticulture), Rashtrapati Bhawan, New Delhi.

The contributions of Dr. Singh were widely recognized with several awards, fellowships and distinctions from academic bodies and the government departments, including Padma Shri, 2014. and Dr. A.P.J. Abdul Kalam Memorial NABS Life Time Achievement Award, 2018.

The scientific community has lost an outstanding agricultural scientist, administrator, teacher and a wonderful human being. The Fellowship of the Academy prays to the Almighty to grant peace to the departed soul, and solace and strength to the bereaved family to bear this great loss.

Professor Edward Cocking
(1931-2023)

The Fellows of the National Academy of Agricultural Sciences deeply condole the sad demise of Professor Edward Cocking, a brilliant Plant Cell Biologist, and renowned scientist in the field of Plant Biotechnology, especially in symbiotic nitrogen fixation in cereals. He was also known for his insights in the public understanding of science.

Prof. Cocking left an indelible impression among agricultural fraternity in various positions especially as Civil Service Commission - Research Fellow in Microbiology; Lecturer, then Reader in Plant Physiology; Professor and Head of Deptt. of Botany, University of Nottingham; Dean of Science 1983-86; Professor Emeritus of Botany; Lever Hulme Trust Research Fellow. Dr. Cocking will be remembered by a large number of researchers from across the globe, who were mentored and associated with him in his long scientific career.

He was a Fellow of Royal Society, UK. The contributions of Prof. Cocking were globally recognized with several awards, fellowships and distinctions including the Lifetime Research Achievement Award, University of Toledo, USA.; Member, Academia Europea; Hungarian Academy of Science; and World Innovation Foundation, besides being a Fellow of NAAS.

The scientific community has lost a brilliant scientist, mentor, teacher and a wonderful human being. The Fellowship of the Academy prays to the Almighty to give peace to the departed soul, and solace and strength to the bereaved family to bear this great loss.

Dr. S.D. Tripathi
(1935-2023)

The Fellowship of the National Academy of Agricultural Sciences deeply condoles the sad demise of one of its most distinguished fellows, Dr. Satyendra Datt Tripathi, a visionary leader and a scientist *par excellence* who made significant contributions in fisheries research, particularly in fish

breeding & seed production, gender in aquaculture, and community-based aquaculture.

Dr. Tripathi, left an indelible impression among his colleagues and the agricultural fraternity globally. while serving at Central Inland Fisheries Research Institute, Barrackpore; Freshwater Aquaculture Research and Training Centre (FARTC), Central Institute of Freshwater Aquaculture, Kausalyagang, Bhubaneswar; Central Institute of Fisheries Education, Mumbai; International Centre for Living Aquatic Resources Management, Bangladesh Office, Dhaka; and Special Advisor, Support to Regional Aquatic Resources Management, Bangkok.

The contributions of Dr. Tripathi, were recognized with several awards and distinctions including the Association of Hydrobiologists Gold Medal 1986; MPEDA Aquaculture Award, 1993; D.Sc (h.c.) Central Institute of Fisheries Education (Deemed University), Mumbai, 2013. Besides NAAS, he was a Fellow of several acclaimed scientific Academies, including the Zoological Society of India, Kolkata; Society of Biosciences; Bioved Research Society; Inland Fisheries Society of India, Association of Aquaculturists, Indian Fisheries Association, and Aquatic Biodiversity Conservation Society, Lucknow.

The scientific community has lost an excellent scientist, an able administrator, and a wonderful human being. The Fellowship of the Academy prays to the Almighty to give peace to the departed soul, and solace to the bereaved family to bear this great loss.

Dr. Balram Sharma
(1940-2023)

The Fellowship of the National Academy of Agricultural Sciences deeply mourns the sad demise of one of its most distinguished fellows, Dr. Balram Sharma, a visionary leader and a scientist par excellence in Plant genetics & breeding.

Dr. Sharma served in various important positions, including the Head, Division of Genetics, Indian Agricultural Research Institute, New Delhi and left an indelible impression among his colleagues as well as the agricultural fraternity.

The contributions of Dr. Balram Sharma, a renowned pulse breeder, were widely recognized with several awards, fellowships and distinctions including Prize of Bharatiya Vigyan Patrika Samiti, New Delhi, 1972; IARI Best Teacher Award, 1997; Hari Om Ashram Award, 1997-98; N.I. Vavilov Medal, USSR Academy of Sciences, Moscow; IARI Certificate of Appreciation for Developing Variety 2001-02 and 2006. He was a Fellow of several acclaimed Academies, including National Academy of Sciences, India and National Academy of Agricultural Sciences, India.

The scientific community has lost a brilliant scientist, administrator, teacher and a wonderful human being. The Fellowship of the Academy prays to the Almighty to give peace to the departed soul, and solace to the bereaved family to bear this great loss.

Announcement

The XVI Agricultural Science Congress will be organised in Kochi with ICAR-CMFRI as the host institute. The theme of the Congress shall be 'Transformation of Agri-Food Systems for Achieving Sustainable Development Goals'. The Congress will be held during 10-13 October, 2023