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CONTENTS

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From the President's Desk

Precision Agriculture in India: A Perspective

By 2050, India's agri-food production will face a formidable task of feeding close to 1.7 billion people using limited cultivable land, water and energy resources. Our net sown area has almost stagnated at around 140 million hectares, and there is little scope to increase it. Natural resources, particularly soil and water, have been degrading in the process of intensification of agriculture.

Our current approach of input application is based on common recommendations of a composite sample or visual symptoms of crops, and it does not account for intra-field variability. It means sub-optimal or excessive application of inputs, as the mean values used for recommendations are rarely observed in a specific field. It reduces efficiency of input-use and also results in environmental degradation. Thus, intensification of agriculture using modern tools/techniques is essential. Precision farming is one of the solutions for sustainable development of agriculture, which advocates applying right inputs in right amounts at right time and at right place using the right technologies or techniques.

Concept, Components and Requirements of Precision Farming

The concept of Precision Farming was floated by Dr Pierre Roberts to address the problem of nutrient variability in large farms in the USA. The main objective was to optimize production, save on input cost, and minimize adverse impact on environment. Availability of geo-referenced grid soil sampling permitted assessing variability in the field and the composite sample based single recommendation for the entire farm could be done away with. The Global Navigational Satellite System (GNSS) facilitated recording crop yields as the harvester moved across the field. The variation in yield could be easily correlated with the nutrient levels recorded from the grid sampling. This enabled the entire field to be delineated into smaller homogeneous management units. To deliver

nutrients as per the site requirement led to the development of a Variable Rate Applicator. These developments happened in the 1980s. Dr Roberts' work focussed on soil nutrient management, and therefore, precision farming was initially referred to as 'Site Specific Crop Management'. The development of spectral and hyper-spectral sensors and high resolution images through satellites, accelerated information generation and collection. The term 'Satellite Farming' is sometimes used in this context. Now, the 'Precision Farming' is also referred to "Climate Smart Agriculture".

Remote sensing in precision agriculture

Satellite-based remote sensing technologies are widely used to guide the global agricultural production from a regional to global scale. There have been several efforts to use remote sensing to monitor crop conditions and utilize the indicators in process-based crop growth models to generate production estimates. The processes are slow, suitable for assessment over a large region, but not useful to a small farmer, and making it near real-time is a challenge. India has a series of operational satellites with varying spatio-temporal and spectral resolution addressing these requirements. Most of the remote sensing technologies are confined to multispectral broad bands, which have limitations for precise quantitative estimation of soil and plant properties primarily because of the low spectral resolution. Hyperspectral remote sensing is based on an examination of many contiguous narrowly defined spectral channels. It is a relatively new field and offers several advantages over the conventional broadband multispectral remote sensing.

In India, the requirement for a marketable remote sensing technology for precision agriculture is the delivery of information with the following characteristics: low turnaround time (24-48 hr), low data cost (~ 100 Rs./acre/season), high spatial resolution (at least 2 m multi-spectral), high spectral resolution (<25 nm), high temporal resolution (at least 5-6 date per season), and delivery of analytical products in simpler format. Remote sensing with high spectral and spatial-temporal resolution has considerable potential for soil and crop health monitoring, site specific nutrient management, discerning composite biotic and abiotic stresses and their levels for timely and precise application of inputs.

Precision agriculture using drones

Unmanned Airborne Vehicles or Systems (UAVs/ UASs) have been around for sometimes. The development of drones has opened up new vistas for assessing and monitoring crop growth. UAV-drones in particular have the capacity to carry all the sensors that a satellite or plane can have and can repeat the surveys as frequently as required. Variable rate adapters have been developed that can be used through drones. A feedback on damages due to natural hazards can be obtained rapidly and reliably, which can feed into the crop insurance programs. The constraint of small land holdings for Precision Farming can be easily addressed now. In developed countries, Precision Farming has been adopted for a long time, in terms of equipment, machines, sensors and software. In India, pressurized micro irrigation system, drip system specifically, and site-specific nutrient management are considered as 'Precision Farming'. Aerial sensing from the UAVs bridges the gap between ground-based observations and remotely-sensed imagery from the conventional aircraft and satellite platforms, and is identified as a viable substitute and/or complement to remote sensing platforms for agricultural applications. Integrating sensors with the UAVs may be a viable option for mapping, monitoring, and management of precision agriculture at an affordable cost (Fig. 1).

As drones are able to cover larger areas and require less quantity of agro-chemicals (fertilizers, pesticides and herbicides), their use as applicator must be encouraged. This would entail working out the timing, speed, height, spray characteristics and volumes, and wind considerations to make the application as effective as possible. Development of nano-products is going to assume faster pace now, as the lesser quantity is economical, safer and efficient.

Use of robots

Farmers in both developed and developing countries face labour scarcity. Automated farming using robotics and advanced sensing is a viable solution. Robots can access areas where other machines cannot. For example, maize growers face a problem in fertilizer application as plants grow too quickly. "Rowbot" can solve this problem, as it easily drives between rows and targets fertilizer directly at base of each plant. Drone companies in developed countries offer farmers combined packages, which include robotic hardware and analysis software. Farmers can then move the drone to the field, initiate the software via a tablet or smartphone, and view the collected crop data in real time. Ground based robots, can undertake even a detailed monitoring as these can get closer to the crop. These can also be used for weeding and fertilizing. Weeding robots don't even need to use chemicals. "Robocrop", for example, uses computer vision to detect plants as it is pushed by a tractor. It

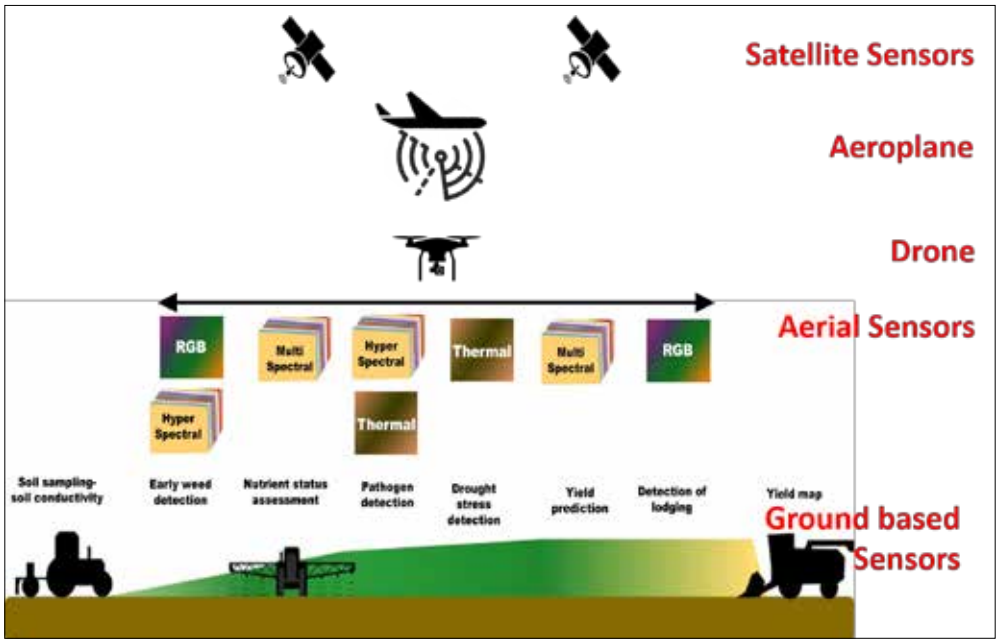

Figure 1: Schematic overview of the different ways to extract spatial information throughout a growing season of a crop, various platforms and the optimal UAV sensors. (RGB: Red–Green–Blue)

Source: Modified from Maes and Steppe, 2019

then automatically hoes the spaces between plants to uproot the weeds. Some weeding robots use lasers to kill the weeds. In Australia, even shepherding, is being attempted through robots. Several manual activities like maintaining cleanliness in cattle sheds can also be taken care of by robots.

Precision in assessment of soil properties

Finding an appropriate technique for assessing soil properties that involves less time and effort in collecting soil samples and their analysis is a challenge. Consequently, *in situ* assessment of soil properties in near real-time remains a formidable task despite decades of research in soil testing.

A new robust method is required for detailed and accurate mapping of soil properties taking into consideration spatial variations. Recent developments in remote sensing (RS) based techniques (proximal, airborne and satellite-based RS) have potential in predictive and quantitative mapping of soil properties with a higher resolution and more accuracy. Proximal sensing (visible-near-infrared, mid-infrared spectroscopy, X-ray fluorescence spectroscopy, etc.) is very effective at field scale or profile level study, whereas the airborne and satellite-based RS is suitable for characterizing soil properties over a large spatial extent. The advances in data mining techniques and fusion of data from multiple sensors have enhanced understanding of the dynamic nature of soil properties, influenced by various environmental covariates. Thus, with the advancement in the field of geo-information technology, a new and sophisticated technique, i.e., digital soil mapping (DSM) has been evolved for accurate prediction and spatial mapping at a desired scale and with a high-resolution using the machine learning (ML) techniques and data mining algorithms. The basis of DSM is the application of pedometric methods that can predict spatial and temporal variation in soil types and soil properties.

Precision livestock management

Dairy industry has taken a step towards Precision Dairy Farming. In 2000, the National Livestock Identification Scheme (NLIS) made the use of radio-frequency identification (RFID) tags containing a microchip that could be electronically read in a fraction of a second by producers. This provided accurate identification of cows because these were linked to the pedigree, management events, treatment records, electronic milk meters, computer-controlled feeding, automatic sorting and weighing, etc. The National Dairy Development Board (NDDB) also developed an Information Network for Animal Productivity & Health (INAPH) on similar lines. It was a desktop/ notebook android tablet-based field IT application, which enabled capturing real-time reliable data on breeding, nutrition and health services delivered at farmer's doorstep. It could send messages to farmers and provide appropriate advice regarding their animals, as and when required.

Some private dairy farms in India have also adopted RFID based animal identification and farm automation management system, e.g., Chitale Dairy in Pune, Sangamner Milk Union, Maharashtra, Lakshya Dairy in Haryana and Kopordern Farm at Valpoi in Sattari Taluk in North Goa.

In addition, several Apps have been developed for implementation of precision agriculture (i) **COWEL** - Computer-based decision support system contains attributes regarding housing and management conditions; (ii) **MOIRA -** Management of Insemination through Routine Analysis is a computer program, a module of DAISY- the Dairy Information System, which suggests timing of insemination of animal; (iii) **Herdman** - It uses Radio Frequency Identification Device tags and cell phones' text messaging capability to provide information regarding health of each animal, breeding record, milk yields, etc.; (iv) **Moosense -** A Wireless Sensor Network (WSN) has been developed by IIT-Delhi and NDRI, Karnal to identify and monitor animal behaviour, including the movement (3D), temperature, etc.

Precision farming techniques after appropriate modifications can be used in husbandry of pigs and poultry. Precision farming in aquaculture is challenging, but efforts are on to adapt new technologies for aquaculture.

Big-data analytics

Precision farming requires information from remote sensing satellites, sensors and drones, all geo-referenced on a GIS platform. It involves a seamless merging of data and application of optimization techniques. For real-time decision making, a Decision Support System (DSS) involving decision trees, neural networks, artificial intelligence, IoT, big data analytics, and nextgen weather forecasting is required.

Way Forward

- Low-cost sensors are required to monitor soil nutrients, soil moisture, pests and diseases. Wireless sensors will hold the key to precise nutrient and water applications. Indigenous manufacturing of such sensors needs to be promoted.
- UAVs (Drones) with appropriate sensors be used for a quick survey to identify within field variations in nutrient status, as well as pest infestation for timely action. This is cost-effective and eco-friendly. An appropriate power source for drones, however, needs to be defined.
- Precision Agriculture Service Providers or StartUps will be required in huge numbers for popularizing and scaling up Precision Farming. As Precision Farming utilizes new technologies, skill development must be a vital component, in addition to training (pilot license) on the operation of drones. Capacity building for collection of data be included in operationalizing Decision Support Systems. Some StartUps have already been providing drone services on custom hiring basis.
- Skilled human resource is required for implementing precision agricultural practices. The agricultural universities have to initiate HRD through specially designed training modules and course curricula for different levels of activities including teaching, training and research. This essentially requires exposure and training of faculty in advanced centres of excellence.
- The industry, scientists, technologists, academicians, and other stakeholders have to work in unison to develop Decision Support Systems for empowering farmers to take informed decisions in real time. Since it involves the use of artificial intelligence, IoTs, machine learning and big data analytics, a seamless merging and integration of multi-source data from remote sensing, GIS, GPS and sensors is essential. Basically, it implies moving from heuristics and experience to evidence and information for real-time decision making.
- Many agriculture-related activities can be easily done by robots. In India, their presence is barely noticeable but these have a great future. IITs, NITs and other similar organizations have to perhaps interact more with agriculture scientists and extension workers to identify farmers' needs to design robots to meet specific needs.
- A Network Project on precision Agriculture has been recently initiated by ICAR. This needs further strengthening with additional activities covering more institutions, and crops/animals namely pig, poultry, goats and aquaculture. In a few years of its operation, the network can be considered upgradation to an All-India Coordinated Research Project so that Precision Agriculture Research is institutionalized to deliver innovative technologies and methods.

Trilochan Mohapatra
President

Executive Council Meetings

127th Meeting

The 127th Meeting of NAAS Executive Council was held in a hybrid mode on August 23, 2022 under the chairmanship of NAAS President Dr T. Mohapatra. The Chairman welcomed EC members and briefly mentioned about the activities undertaken, including the Annual General Body meeting. A special mention was made of the intellectually stimulating Foundation Day lecture delivered by Prof P. Balaram, former Director, Indian Institute of Science, Bangalore. He appreciated the new initiative of the Academy to organise interactions with the Foreign and Pravasi Fellows to enhance their involvement in the Academy activities and harness their experience and expertise. The EC was informed about the progress in Ranking of Professional Societies based on modified criteria to make them more objective and quantifiable.

Dr Himanshu Pathak, Convener of Pune Chapter has joined the position of Secretary, DARE and Director General, ICAR and now shifted to Delhi. It was decided that Dr.C.N. Ravishankar, Director, CIFE may be nominated as the new Convener of Pune Chapter

The Academy had earlier elected five Fellows and one Associate in the Section of Frontier Sciences, which was later discontinued in the 72nd EC Meeting following recommendations of S.S. Acharya Committee. The previously elected Fellows under this Section have, therefore, been placed in appropriate Sections (Crop Sciences/Plant Protection).

128th Meeting

The 128th Meeting of NAAS Executive Council was held in a hybrid mode on 16 September 2022 under the chairmanship of Dr T. Mohapatra, President NAAS. Two Policy Papers and two Strategy Papers were released on this occasion.

The EC approved the revised logo, new dates (10-13 October 2023) and venue (Le Meridian Hotel, Kochi). The criteria for the election of Fellows was deliberated at length and it was suggested to have relook at the procedure and revision of the guidelines.

The following activities were recommended for implementation.

Roundtable meetings of NAAS EC members and Fellows with the foreign Academies with whom NAAS has already signed MoUs; an interaction meeting of NAAS and other key national Academies to deliberate on issues related to funding of R&D, food and nutritional security, climate change, etc.; an interaction meeting with the industry and farmer leaders; all Regional chapters as well as the Office Bearers at the headquarters may undertake interactive programmes with the school children focussed on nutrition literacy.

BRAINSTORMING SESSIONS

Scaling up Innovative Agricultural Extension Models (Convener: Dr Ashok K. Singh, DDG (ICAR); Co-Conveners: Dr Randhir Singh, ADG (AE) and Dr V.P. Chahal, ADG (AE)

A brainstorming session on 'Scaling up Innovative Agricultural Extension Models' was organised by the Academy on September 12, 2022 under the chairmanship of Dr T. Mohapatra. Dr. Himanshu Pathak, Secretary DARE and Director General ICAR was the chief guest. Dr A. K. Singh, DDG (AE), ICAR, New Delhi, and Convenor presented the base paper highlighting innovative public and private extension models, and raised issues relating to scaling out of these. Dr Pathak praised the frontline extension system of the Indian Council of Agricultural Research in planning and executing extension interventions

efficiently and effectively. He also highlighted the role of Krishi Vigyan Kendras (KVKs) as a grassroots-level extension institution, linking farmers and other stakeholders to the National Agricultural Research System (NARS). He urged the delegates to gear up extension system to face the agrarian challenges, harnessing new technology options and meet the changing needs. Dr Mohapatra remarked on the need of remodelling KVKs as a single window delivery system for dissemination of technologies and agro-advisory, and capacity development. Situation-specific and demand driven extension models are the need of the hour. Convergence and partnership based extension models are required. Private extension has to play a complementary and supplementary role to the public extension system.

Major recommendations are as follows:

- Krishi Vigyan Kendras (KVKs) need to be strengthened to have Agri Clinic & Technology Incubation Centres following Single Window Delivery approach. Establishment of diagnostics lab, and processing & value addition facilities is necessary at KVKs.
- Policy framework needs to be developed to ensure convergence of stakeholders (Producers, Processors, FPOs, Market promotion agencies like APEDA etc.)
- Innovative extension model of state Government of Andhra Pradesh named Rythu Bharosa Kendra (RBK), which ensures convergence of all stakeholders for efficient extension delivery may be examined and considered for replication in other states.
- Innovative extension models of ITC, BKC WeatherSys for customised agro-advisory delivery for crop management, weather alerts and market intelligence can be integrated with public sector ICT based extension delivery platforms like Kisan SARATHI.

Beyond Price Support and Subsidies (Convener: Dr Pratap Singh Birthal, Director, ICAR-NIAP and Co-Conveners: Dr Shivendra Kumar Srivastava, ICAR-NIAP and Dr Prabhat Kishore, ICAR-NIAP)

In order to achieve self-sufficiency in food grains and ensure food security for all, an integrated approach is needed encompassing investments in agricultural research and extension systems, and provision of subsidies on critical inputs to incentivize farmers to adopt new technologies, guaranteed support prices for food grains and their procurement to ensure farmers a remunerative access to markets, minimize price fluctuations and reduce unscrupulous trade practices, and the public stockholding of food grains and their distribution to the weaker sections at affordable prices. This strategy worked well and made the country self-sufficient in food grains.

However, the strategy has come under criticisms from several fronts regarding their adverse effects on land and water resources, reduction in agro-biodiversity,

increase in inter-household and inter-regional disparities, and disincentive to private investment in markets, storage and warehouses.

The political economy of public support to agriculture is complex, and it is difficult to withdraw the incentives once introduced on a large scale. Moreover, some components of the current agricultural policies provide incentives for unsustainable patterns of production, and hence, require a re-look for their developmental role, scrutiny, and repurposing these in a manner that leads to efficient and sustainable growth of agriculture and higher incomes for farmers. Towards this, a brainstorming session was organized at NAAS in a hybrid mode on September 30, 2022 under co-chairmanship of Dr Trilochan Mohapatra, President, NAAS and Shri Siraj Hussain, former Secretary, Ministry of Agriculture and Farmers Welfare, Government of India. The main objectives of the brainstorming session were (i) rationalization and repurposing of agricultural subsidies and (ii) looking for feasible alternatives to minimum support price. The participants included academicians, policymakers and farmers. A few important recommendations emerging from the deliberations are as follows:

- MSP is necessary for better price realization and higher yields, but given its negative externalities there is a need for critical examination of alternative means of market support including price deficiency scheme and futures' trading.
- Invest in research on alternative crops of rice and wheat so as to improve their profitability.
- Re-purpose agricultural subsidies based on valuation of ecosystem services.
- Devise a package of compensation for farmers diversifying away from rice and wheat
- Differentiated volumetric pricing of water will aid in crop diversification

SPECIAL LECTURES & EVENTS

- A special lecture by Dr Amit Roy, Former President, and CEO, IFDC and Former Executive Director, Global Phosphorus Institute (GPI), Ben Guerir, Morocco was organized on the topic 'Managing Fertilizers for Food Security and Environmental Sustainability' on September 08, 2022. It was co-chaired by Dr T. Mohapatra, President, NAAS and Dr. Himanshu Pathak, Secretary, DARE & DG, ICAR. Dr. Roy highlighted that fertilizers are essential for increasing food production but needs to be managed to reduce losses to the environment. Further, increased nutrient use-efficiency is urgently needed through innovative products, application practices and proper policies. He emphasized that public-private partnership is need of the hour to develop new fertilizers and application techniques.

- The Academy organised a special talk on 'The International Governance of Plant Genetic Resources for Food and Agriculture: The Role and Place of the International Plant Treaty' by Mr. Kent Nnadozie, Secretary, International Treaty on Plant Genetic Resources for Food and Agriculture, United Nations, FAO, Rome on September 15, 2022. It was Chaired by Dr T. Mohapatra, President, NAAS, and convened by Prof K.C. Bansal, Secretary, NAAS. The talk generated a great discussion and the participants learnt a lot on recent developments in global utilization and exchange of plant germplasm for food and agriculture. The highlight of the presentation was a reminder of the need for collective action for sustainable development.

National Symposium on Food, Nutrition and Environmental Security: Towards Achieving SDGs (29-30 August, 2022)

India's current population of 1.40 billion (around 17.7% of world population) is likely to reach 1.51 billion by 2030 thus becoming the most populous country in the world. A fundamental question arises as to whether India will continue remaining self-sufficient in food production and achieve sustainable development goals (SDGs) by 2030. The challenge to produce more from decreasing per capita arable land and irrigation water besides the increasing abiotic and biotic stresses, is quite alarming. The impact of climate change on agriculture is expected to further reduce production of major food crops by almost 10-20 per cent. With a widespread prevalence of malnutrition achieving nutrition security remains a formidable task. In such a scenario the commitment of Government of India to meet SDGs and the Paris Agreement for Climate Change present unique opportunity for the entire agricultural sector to get realigned for a better future.

Hence, India is committed to bring a demand-driven and technology-led revolution to meet the challenges of rising demand for food, improved livelihood opportunities for farmers, and to attain sustainable farming for wider agricultural growth.

With this in view, a two day symposium was jointly organised by the Trust for Advancement in Agricultural Sciences (TAAS), Indian Council of Agricultural Research (ICAR), National Academy of Agricultural Sciences (NAAS), and the Indian Society of Plant Genetic Resources (ISPGR) in collaboration with Alliance of the Bioversity International & CIAT, ICRISAT, IRRI and CIMMYT. The symposium was well attended and addressed by eminent scientists including Dr. RS Paroda, Chairman, TAAS; Dr Ramesh Chand, Member (Agriculture), NITI Aayog, GoI; Dr Himanshu Pathak, Secretary DARE & DG ICAR; and Dr T. Mohapatra, President, National Academy of Agricultural Sciences (NAAS).

The symposium deliberated on various aspects of agricultural development and following were the major recommendations:

- Technology development plays a significant role in achieving SDG targets by improving the efficiency and effectiveness of new and more sustainable methods of development.
- The creation of new technologies that foster research and stimulate innovation are needed through stronger knowledge-sharing and collaboration amongst stakeholders both at the national and international level.
- To make supply-chains more efficient and to support sustainable and durable markets, the rural infrastructure needs substantial improvement.
- Efficient and sustainable use of natural resources, adoption of hybrids and use of biofortified seeds will be essential for food and nutrition security.
- Focussed attention is needed on raising farm profitability, reducing cost of production, expansion of irrigation networks, development of the livestock sector, agri-business management and stronger producer-market linkages.
- To achieve sustainable agriculture higher investment in research for development, strong public-private partnerships, search for pro-poor innovations and their effective implementation are essential.
- This will need out-of the box thinking and creating science-based regulatory regimes; adoption of precision agriculture; digital solutions and artificial intelligence (AI).

Other Activities

- The Academy took part as an Observer in the 9th Governing Body Meeting of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), FAO, United Nations. Dr. K.C. Bansal, Secretary, NAAS represented the Academy and participated in the deliberations.
- **The Academy organised two Interaction meetings with Foreign and Pravasi Fellows** on July 1 and July 5, 2022. The meetings were coordinated by Prof. Rajeev K. Varshney, Foreign Secretary. Dr. P.K. Joshi, Secretary, NAAS presented an overview of the activities of the Academy. Dr. T. Mohapatra recollected earlier interactions with some Fellows and emphasised on active participation and more contribution of Foreign and Pravasi Fellows to various activities of the Academy. After detailed discussion, specific action points were decided in order to harness the full advantage of the rich experience and expertise of Foreign and Pravasi Fellows. They agreed to contribute articles and review papers to NAAS Journal, and also act as reviewers of the articles. They can also provide gainful insights into new research areas and the policy framework for new developments in agriculture, including regulatory aspects of the GM crops, Gene editing, and Food Safety Standards. It was decided to hold such interactions once in every 6 months.

Activities of the Regional Chapters

Bengaluru Chapter

Bengaluru Chapter organized an online lecture by Dr Stephen A Krawetz, the Charlotte B Failing Professor of Foetal Therapy and Diagnosis and Associate Director, CS Mott Centre for Human Growth and Development, Wayne State University School of Medicine, Michigan, USA" on 22 July 2022. The lecture was focused on the sperm biomolecules and microbes in relation to male fertility and reproductive health. He elaborated the role of sperm RNA and retained elements on the successful birth of the viable offspring. He mentioned that his research group has established the transcripts expression pattern among the sperm, testis and brain that has been observed to be similar, but the biological significance has to be elucidated. He also explained the likely role of sperm microbiome on semen quality and fertilization.

Coimbatore Chapter

Demonstration of a biocontrol delivery technology to banana farmers

Farmers engaged in banana cultivation need efficient delivery of *Trichoderma* to manage Panama wilt. In this regards, NAAS-Coimbatore chapter organized a demonstration to banana farmers on 01.07.2022 to deliver *Trichoderma* in banana rhizomes in mechanized sett treatment device at Kondayampalayam village, Thondamuthur Block, Coimbatore. About 50 farmers participated in the programme. Dr. R. Viswanathan, Convenor, Coimbatore chapter explained the benefits of mechanical delivery of agro-inputs in vegetatively propagated crops.

Lecture on biotechnological interventions for sustainable food production

A lecture on "Biotechnological interventions for sustainable food production" by Dr C. Appunu, Senior Scientist (Plant Breeding), ICAR-SBI, Coimbatore, was organized on 08.08.2022. The lecture highlighted the need for biotechnological interventions to improve specific traits, bio-safety guidelines and genome editing approaches. Dr. Hemaprabha, Director, ICAR-SBI delivered the Chief Guest's address. About 100 college students from different colleges and deemed universities actively participated in the event.

Interaction with school students

ICAR-SBI and NAAS Chapter, Coimbatore organized an interaction meeting with students of Panchayat union middle school, Veerakeralam, Coimbatore on 10.08.2022. Dr. R. Viswanathan FNAAS, convener, NAAS chapter-Coimbatore delivered the theme address on 'Freedom movement' and distributed national flags to the students. Dr. Putra Pratap, Principal Scientist conducted the quiz for the students on freedom fighters. Shri. S.B. Babvuraj, FAO, P.V. Devassy, AO, B.V. Santhosh AAO and others from ICAR-SBI also participated in the meeting.

Quiz competition for college students

As part of 75th Independence Day celebrations, NAAS-Coimbatore Chapter and ICAR-Sugarcane Breeding Institute, Coimbatore organized a 'Science Quiz' competition for college students on 12.08.2022 at ICAR-SBI, Coimbatore. About 50 students, from educational institutions participated.

Quiz programme in progress

Brainstorming session on researchable issues in Plant Pathology

Prof P. Vidhyasekaran FNAAS, Former Director (CPPS), TNAU and Dr. R. Viswanathan participated in the "Brainstorming session on researchable issues in Plant Pathology" organized by the Department of Plant Pathology, TNAU on 06.09.2022 at Coimbatore. Prof P. Vidhyasekaran emphasized genomic approaches to understand host-pathogen interactions, identifying resistant and susceptible genes and genome editing strategies to develop disease resistant crops. Dr. R. Viswanathan suggested pathogenome approach to understand the pathogen biology and to strategically manage the diseases. He also highlighted emergence of minor diseases to major diseases and elaborated on pokkah boeng in sugarcane.

Hyderabad Chapter

Soil health management awareness programme

NAAS Hyderabad Chapter in association with ICAR-NAARM conducted a one-day training programme on ***Soil testing*** in collaboration with KVK Yagantipalle, Andhra Pradesh on 27.07.2022 in hybrid mode under SCSP of NAARM in seven villages of Kurnool.

Farmers training on Organic Production and use of Bio Inoculants in Agriculture

The chapter in association with ICAR-NAARM, Hyderabad also organised a training for farmers on 'Bio-inoculants - its uses and application in agriculture' at SAIRDKVK, Gaddipally, in Suryapet district of Telangana during 25-26 August, 2022. A total of 60 farmers from 7 villages participated in the programme.

'Sankalp 7.0' – an Annual B-Fest of Agri Business Management Students (PGD-ABM)

NAAS Hyderabad Chapter in association with PGDM-ABM Students of ICAR-NAARM, Hyderabad organized the 7th edition of Sankalp, an annual Business Festival during Sep 16-17, 2022 under the aegis of NAARM PG Alumni Association. The event received an overwhelming response as reflected by more than 9,100 registrations from more than 1,000 institutions which included all IIMs and IITs, several other leading B-schools and agricultural colleges.

Karnal Chapter

To highlight the primacy of agriculture in school education and advocate it as a professional career for students, the Karnal chapter of National Academy of Agriculture of Sciences (NAAS) conducted an essay competition in agriculture for the school and college students. The title of the essay competition in Hindi was "कृषि का हमारे जीवन में महत्त्व" meant for students up to tenth class and the title in English was "Food and Nutritional Security through Agriculture - Perspectives and Challenges" for senior school (11th and 12th class)

as well as graduate students. A total of 250 essays in Hindi and English were received. The students shortlisted in the final round, made oral presentation on the said topics. Top three performers in Hindi and English category were selected for the awards.

Pune Chapter

ICAR-National Institute of Abiotic Stress Management (NIASM), Baramati conducted a programme under Pune Chapter of the National Academy of Agricultural Sciences (NAAS), on "Nutrition and feeding habit of school going children" at Chaitanya's International School, Baramati on August 03, 2022. The faculty and more than 50 students attended the programme.

Varanasi Chapter

Adoption of five schools to create awareness about Nutritious and Healthy Eating among Students

Varanasi Chapter of NAAS adopted five Primary and Middle Standard Schools from rural areas of Varanasi and Mirjapur districts of Uttar Pradesh to create the awareness about the nutritious and healthy eating among the students. Besides, awareness programme, the Chapter is promoting the establishment of Nutri Kitchen Garden (Poshan Vatika) in the available space of the schools by providing seeds of important vegetables and fruit plants.

A baseline survey on health status was conducted.

Forthcoming Programs

1. Plant-based vs Dairy Milk- Myths and Facts
2. Public-Private Partnership in Agriculture: Current Opportunities and Challenges
3. Sea Weed Cultivation and Utilization
4. Service Delivery Mechanism in Livestock Sector

Change of Addresses

- Dr M.S. Chauhan, Vice Chancellor, G.B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar 263145, Uttarakhand; Tel.: Cell: 9991652455; Email: chauhanabtc@gmail.com
- Dr B.S. Dwivedi, Member (NRM), Agricultural Scientists Recruitment Board, Krishi Anusandhan Bhavan-I, Pusa, New Delhi 110012; Tel.: Cell: 9654809309, 9811365124; Email: bsdwivedi@yahoo.com
- Dr M.L. Jat, Global Research Program Director, Resilient Farm and Food Systems, ICRISAT, Patancheru, Hyderabad 502324, Telangana; Tel.: Off. 8455683356; Cell: 9154991956, 9999108787; Email: m.jat@cgiar.org; jat_ml@yahoo.com
- Dr Arvind Kumar; Ex Vice Chancellor RLBCAU Jhansi, Flat no 515 Carnation Tower, Gaur Saundaryam, Plot No. GH-05C, Sector-Teczone IV, Iteda, Greater Noida (West) 201318, U.P., Tel.: Cell: 9711008862; Email: akrlbcau@gmail.com
- Dr Himanshu Pathak, Secretary, DARE & Director General, Indian Council of Agricultural

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Obituary

Dr Ajay Parida

(1963-2022)

The Fellows of the National Academy of Agricultural Sciences deeply condole the sad demise of Dr Ajay Kumar Parida, an outstanding scientist, on 19 July, 2022 who made significant contributions in the field of plant biotechnology, transgenics and molecular breeding.

Dr Parida left an indelible impression among agricultural scientists in various exemplary roles as Senior Scientist, Principal Scientist, Director (Biotechnology), and Executive Director, M.S. Swaminathan Research Foundation, Chennai; Visiting Research Scholar, College of Wales, Aberystwyth, UK; Visiting Scientist, University of Naples, Italy; Visiting Fellow, IRRI, Philippines.

Dr Parida was awarded several fellowships and awards, including ISCA Umakant Sinha Memorial Award, 2000; B.M. Birla Science Award, 2003; National Biosciences Award, 2006; NASI-Reliance Award, 2009; TATA Innovation Fellowship, 2010; T.S. Sadasivan Memorial Lecture Award, 2012; Padma Shri by Government of India, 2014; Samanta Chandrasekar Award, 2014; Prof. M. G. K. Menon Lecture, 2017. He was a Fellow of National Academy of Agricultural Sciences and National Academy of Sciences, India.

In his demise, the scientific community has lost a brilliant scientist, academician 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 irreparable 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.

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

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