NAAS NEWS

RESEARCH EDUCATION AND TECHNOLOGY POLICY FORUM

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Editors

Dr K.K. Vass

Dr V.K. Bhatia

From the President's Desk

Crop Residue Burning – Farmer Needs Alternatives

India, with an annual production of over 110 million tons of rice from 44 million ha, is the second largest producer in the world. Our national exports of rice during the year 2015-16 are valued at more than Rs 38 thousand crores. A major share of the production and exports comes from the 'food bowl' states of Punjab, Haryana and U.P. accounting for more than 25% of the national rice production.

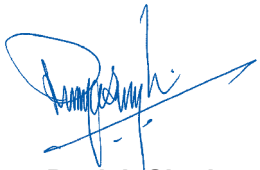
However, in the last few years the disposal of rice straw by burning and the resultant smoke emission, is said to be the chief cause for the smog that envelops Delhi in the first week of November leading to serious environmental and health concerns. An obvious reason for the farmer to burn the rice straw is because the next crop, wheat, is to be sown within 2-3 weeks of the rice harvest and there are no technological alternatives available to achieve fast clearance of fields. As a preventive action, the State Governments, National Green Tribunal and Courts, issued directives with punitive actions against farmers for crop stubble burning in the adjoining states of Delhi.

Under the circumstance, the farmer again was at the receiving end. But the air quality index commonly used is based on many variables. It must be kept in mind that fog and smog are yearly phenomena that occur in Delhi when the winter season sets in. We have to recognize that local emissions are also increasing which is reflecting in the increasing annual averages for Delhi. There are several local sources that contribute to the atmospheric SPM. With all the efforts to improve the quality of life by enhancing availability of amenities, there are a large number of poor families in urban and rural areas that burn wood for cooking, heating and for other household activities. In addition, there are still a majority of eateries, hotels and roadside ***dhabas*** in the capital that use coal or wood for cooking. Delhi has the largest number of vehicles in the country, in

fact more than the combined number of vehicles in four major metros, on road using fossil fuel, besides lakhs of small and large scale industrial units. Air-conditioning in offices and modern residences, is now a norm. The Central Pollution Control Board (CPCB) National Air Quality Programme (NAMP) which has been tracking annual PM2.5 and PM10 levels since 2009, shows a clear trend of rising PM2.5 levels over the years, picking pace in 2015, 2016 and 2017. But crop stubble burning is a temporary phenomenon and its role cannot be assessed separately. We have to take into account that there is meteorological variability from year to year. It is reported that the Central government notified the Graded Response Action Plan (GRAP) to curb pollution in January 2017 after the Delhi experienced its worst smog in 17 years in 2016. But no stakeholder has been able to implement the action plan. In this context even the Hon'ble Supreme Court on 14 Nov, 2017observed that adhocism with one or two measures would not solve the pollution crisis in the capital and a comprehensive plan by the Environment Pollution Prevention and Control Authority needed to be put in force at the earliest in a time bound manner to curb the menace of deteriorating air quality.

Taking into account the seriousness of the matter and points raised against agriculture practice the National Academy of Agricultural Sciences with a very positive approach keeping in mind the interests of farmers and issues of civil society as well, had an in depth analysis by experts on the issue. The discussion noted that Paddy stubble burning in Punjab, Haryana, Rajasthan and Uttar Pradesh is a fact but farmers have no choice. The farmers work on Paddy-Wheat cycle they are compelled to harvest paddy and work so that field is ready for next sowing. This process takes about 15 days, for them burning straw is an easy way out. The authorities instead of helping out these farmers have either coerced them into submission not to burn the straw or play a blame game with other section of civil society. If one looks at it closely, it mainly is cost issue for farmers. The stubble burning started with use of combine harvesters. These machines complete the job in 1 hour and costs Rs 1000-1500 to cover an acre of paddy field. But if traditional method of sickle harvesting, manual thrashing-cum-cleaning is employed it would require 10 men working for the entire day involving about Rs 5000 expenditure, so combines are natural choice. Out of 34 mt of straw produced by these states, 23 mt is produced using combine harvesters that need to be burnt within less than month between mid October to November 10 each year. But the combines keep 35-45 cm stubbles on the field that has no use to farmers and is burnt. Accordingly the NAAS in its deliberations examined the innovations for combines to provide alternatives. Based on this discussion a policy brief on the innovative viable solution to rice residue burning was released in October 2017 by NAAS and widely circulated. The Academy in this brief indicated through science based evidence, and validated across diversity of farmer circumstances, that concurrent use of super Straw Management Systems (SMS) fitted combine harvesters and Turbo Happy Seeder to be a practical and viable alternative to farmer's practice of burning and it has multiple benefits including farmers' profits and environmental services. This policy brief can also be of some help to authorities to put their plea before the Hon'ble Supreme Court bench that agreed to hear the PIL seeking its direction to ban stubble burning in Haryana and Punjab. While there is another contention that burning could be prevented by providing incentives to farmers to adopt alternative methods for disposing agricultural wastes. The farmers in Punjab have been reportedly asking the government for Rs 6,000 per acre of land as compensation package for losses they incur by not burning the crop residues. But in the long-run, alternatives would be much more viable over financial incentives. The other alternative proposed is that the paddy residue, if saved instead of burning can be used for power generation. States like Maharashtra, Karnataka and Tamil Nadu are prime examples of biomass based power generation. Recently, in Delhi as well, the authorities have requested the NTPC to test the feasibility of generating power from paddy residues.

It is very much clear that crop residue burning is an issue that needs priority attention at many levels. The NAAS apart from releasing the policy brief can play an important role by organizing interactive meetings of stakeholders, developing knowledge material for civil society, imparting training, technical backstopping, and monitoring and impact assessment. Technology interventions backed with strong policy support and people's participation will provide solution to much talked about problem of air pollution caused due to rice straw burning during onset of winters in north-west India.



Panjab Singh
President

102nd Executive Council Meeting

The 102nd meeting of the Executive Council was held on November 27, 2017 and was chaired by Prof Panjab Singh, President NAAS. It was attended by 15 EC members and after brief welcome by the President all the listed agenda were discussed in detail and approval accorded wherever necessary. Some of the important decisions were; approval was accorded to the recommendations of programme committee, the recommendations of Journal Score Committee to be submitted to EC for approval, the EC accepted the request of existing convener of Bhubaneswar Regional Chapter Prof D.P. Ray to replace him by Dr Himanshu Pathak, Director ICAR-NRRI, approval was also accorded to reduce the print version of NAAS-YEAR BOOK 2018 while full details of Fellowship will be available in the academy website. The designate Organizing Secretary of XIV Agricultural Science Congress (ASC), Dr Ashok Kumar Singh, Head, Genetics Division, IARI, New Delhi briefed the EC on the actions taken in organizing the forthcoming XIV ASC, the members were satisfied and gave useful suggestions.

Approval was accorded to Election of the following Office Bearers and members of Executive Council w.e.f 1.1.2018:

Vice-President	:	Dr Anil K. Srivastava
Secretary	:	Dr Anil K. Singh
Editor	:	Dr Kusmakar Sharma
Members	:	Dr Rakesh Kumar Jain
		Dr Ashwani Kumar
		Dr V. Prakash
		Dr Saroj Kumar Sanyal

The EC also ratified the election of following to the Academy Fellowship for 2018 under different sections:

Section I : Crop Sciences

Dr Chinnuswamy Viswanathan
Dr S.V.S. Prasad
Dr Vinod
Dr Sharat Kumar Pradhan
Dr Brij Bhuwan Singh
Dr Girdhar Kumar Pandey

Section II : Horticultural Sciences

Dr Sudhakar Pandey
Dr Sanjay Kumar Singh
Dr A.T. Sadashiva

Section III : Animal Sciences

Dr Samit Kumar Nandi
Dr Putan Singh
Dr Ram Ran Bijoy Singh
Dr Rajan Sharma

Section IV : Fisheries Sciences

Dr Joseph Selvin
Dr Kajal Chakraborty

Section V : Natural Resource Management

Dr P.C. Abhilash
Prof Indu Shekhar Thakur
Dr Raghavan Dinesh
Dr Vinod Kumar Singh
Dr Siba Prasad Datta

Section VI : Plant Protection Sciences

Dr Dharam Pal Abrol
Dr Nawal Kishore Dubey
Dr P.D. Kamla Jayanthi
Dr Subash Chander Bhardwaj

Section VII : Agricultural Engineering and Technology

Prof Virendra Kumar Tewari
Dr Navin Kumar Rastogi

Section VIII : Social Sciences

Dr (Ms) Seema Jaggi

Dr Ranjit Kumar Paul

Foreign Fellow

Dr Andreas Graner (Crop Sciences, Germany)

Pravasi Fellow

Dr Govindjee (Crop Sciences, USA)

Dr R.K. Singh (Crop Sciences, Philippines)

Dr Suresh Chandra Babu (Social Sciences, USA)

NAAS Associates Selected for 2018 under different sections:

Dr V.K. Vikas, Crop Sciences

Dr S.K. Upadhyay, Crop Sciences

Dr G.P. Mishra, Crop Sciences

Dr Vishnu Kumar, Crop Sciences

Dr J.K. Tiwari, Horticulture Sciences

Dr P.V. Behare, Animal Sciences

Programmes held

Strategy Workshop on "Conservation Policies for Hilsa and Mahseer" (Convener: Dr K.K. Vass)

Strategy Workshop on 'Conservation Policies for Hilsa and Mahseer' was organized on November 7, 2017 at NAAS, New Delhi. Prof Panjab Singh, President NAAS Chaired the workshop, and participants representing NAAS, SAUs, traditional universities, ICAR Institutes, ICAR Headquarters, WWF (India), NGOs, anglers association and other officials attended the workshop. At the outset Dr J.K. Jena, Secretary NAAS and DDG (Fy) ICAR extended a warm welcome to the President and all participants to this important workshop and briefed the house about the importance of the topic including economic and ecological importance of two target species to the fishery sector. The workshop aimed to look at the effectiveness of existing fish conservation policies in respect of these two important species, impediments/constraints in their implementations in the perspective of National Water, Environmental, Fishery policies, and Wildlife Protection act with a focus on Hilsa and Mahseer.

Dr K.K. Vass, Convener made a comprehensive presentation on the objectives, status of inland fisheries, importance and conservation issues related to Hilsa and Mahseer, with critical analysis of existing policy instruments, proposed recommendations and strategy. Further, two detailed presentation on Mahseer with regard to culture technology was presented by Dr Debajit Sarma of ICAR-DCFR and another related to its migration and population dynamics by Prof Prakash Nautiyal, of Garhwal Central University. A presentation on Hilsa with a focus on population structure and culture possibilities was made by Dr V.R. Suresh of ICAR-CIFRI. The experts participated in discussion and presented their views on the conservation related issues on respective species. Elaborate interventions were made by Dr K.K.Vass, Convener, Dr J.K. Jena, DDG(Fy), ICAR and Dr Pawan Agarwal, ADG (NASF), ICAR. At the end, the Chairman was briefed about the main outputs of the workshop and he desired that based on the discussions and suggestions the revised document be submitted to NAAS as soon as possible by the convener. A formal vote of thanks was proposed by Dr Jena, Secretary NAAS.

Main emerging highlights/recommendations of the discussions were:

The wild inland fish stocks viz., Hilsa and Mahseer that have not been brought under viable aquaculture so far, but have great ecological and intrinsic value, merit required investment, for science led protection and conservation.

Inland fisheries lack science-based fish conservation policy support. It cannot be addressed under the

overall general umbrella of biodiversity. So we need specific conservation policy support for target species especially for migratory stocks similar to Tiger, Dolphin etc.

The meaningful conservation policy can be developed by DAHF&D in consultation with MoEF, Ministry of Water Resources and Ministry of Power. A joint group may be constituted to undertake the exercise.

It is suggested that a steering group comprising MoEF / WWF / DoF / MoA / MoWR / Line Departments and community representatives be set-up to guide, coordinate and monitor efforts for Mahseer conservation.

In the Indian Forest Protected Areas 1972 regulation, the inland fish species need to be included so that Protected Area benefit can accrue to inland species as well. Further, the "hunting" and "angling" in the protected area regulation may be delinked.

A centrally sponsored comprehensive scheme may be launched exclusively for in-situ and ex-situ conservation of migratory stocks with a provision of alternative livelihood for the fishers to stop fishing of threatened stocks.

The issues concerning inland fish conservation especially of Mahseer and Hilsa, do not receive any attention for opinion formulation among the political class and civil society. The success of any conservation initiative will largely depend on their perception. We need to take appropriate steps for creating this awareness among this section of society.

The Hilsa generates a huge business starting from catching to entire marketing chain till the product reaches the consumer and at each level a percent of profit is generated and shared among different stakeholders, at the cost of each fish traded, but nothing is ploughed back for the protection of Hilsa stock. It would be appropriate if a small percentage as cess (Payment for Ecosystem Services, PES) is levied for supporting approved conservation activity/s.

Similarly Mahseer is directly linked with angling and not with any commercial fishing thus hugely supporting eco-tourism industry therefore, investment on its conservation including habitat improvement, should also be the responsibility of concerned tourism department and the private sector who are the beneficiary of tourism activity.

It is recognized that research on developing aquaculture protocol for Hilsa and Mahseer is going on in the country and we have made reasonable progress but the level of technology is still at infancy in comparison to other warm-water cultivable fish species. The ICAR and DAHF&D should encourage such institutional efforts and provide adequate funding support for improving and extending appropriate culture technologies.

It is observed with concern that research on inland fish conservation especially of migratory stocks is totally neglected in the country. Therefore, research on migration, fish behavior, fish physiology in respect of migration, hydrology, upstream/downstream flow needs of different species, appropriate gear/sampling techniques, fish pass design, habitat requirements, and ranching need to be pursued on priority.

Research on stock restoration needs to be initiated, while some successful attempts have been made by Anglers Associations in Cauvery River but these models need to be examined and given scientific basis. Any restoration model should be trial tested on pilot scale, further, ecosystem and fish stock response to restoration models be documented for policy intervention.

In the concerned fishery departments of inland states it is observed that conservation is nobody's business, all efforts are made to improve the production, so conservation is neglected. It is suggested that in these department/s a senior level officer should be responsible for conservation activity that should not be targeted for increased fish production but should meet conservation specific targets.

It is suggested that States require conservation policy specific to a particular fish species, as the State of West Bengal has made specific for Hilsa, by establishing Hilsa Conservation and Research Centre in 2013. This example may be followed by other states as well for their specific species.

There is a strong need to formulate science-led EIA policy for migratory fish species likely to get impacted by big water diversion projects in entire Himalayan region. Each state has its own approach, but all are ad-hoc. Most of the EIA reports in the DPR are fragmentary and not much importance is given to fishery component. This approach has to be dispensed with.

In fish conservation strategy the conflict management would play a key role, in the sector we have, four main conflicts viz., fishery jurisdiction, management

mechanism, internal allocation within the sector, external allocation – fishery players and outsiders. This requires serious attention.

Strategy Workshop on "Accelerating Seed Delivery Systems" (Convener: Dr K.V. Prabhu)

Strategy Workshop on 'Accelerating Seed Delivery Systems' was organized on December 27, 2017 at NAAS, New Delhi. Prof Panjab Singh, President NAAS Chaired the workshop. Prof R.B. Singh, Co-chair and Past President, NAAS made opening remarks. The participants represented SAUs, ICAR Institutes, ICAR Hq., private seed sector, and other experts. At the outset Dr Prabhu, Convener and Secretary NAAS extended a warm welcome to the President and all participants to this important workshop and briefed the house about the importance of the topic including its economic implications on Indian Agriculture. Apart from Dr Prabhu, 11 technical presentations were made by the other experts. Dr Prabhu mentioned that presently the public sector comprises of one national level corporation viz. National Seed Corporation (NSC), 15 State Seed Corporations (SSCs), 22 Seed Certification Agencies (SCAs), two Central Seed Testing and 122 State Seed Testing Laboratories (3 ISTA accredited and 20 have ISTA membership) which is providing requisite strength in serving the seed industry and farmers. The research and development in the public sector is dependent on public research under the aegis of the ICAR institutes and SAUs. SAUs and ICAR Institutes are also engaged in breeder seed production and also in production of foundation and certified/truthfully labelled seed of their varieties. Besides, seed is also produced by the farmers under Farmers' Participatory Programme of several Institutes and under Seed Village Programme of the Government of India. Following, 34 agricultural universities and 22 ICAR institutes across the country are engaged in seed production activities. State Agricultural Universities are taking up breeder seed production involving its KVKs to bring seed revolution in the country. Private sector has more than 600 players (including domestic and multinational companies) and the top 10 seed producers account for more than two-third of domestic market. Over the past two decades, private sector seed companies have collected germplasm and also built their R & D capabilities. Some of these have realised the importance of R & D and now spend about 5-10% of their sales on it. These players have developed many hybrids based on the local needs of the farmers and have been able to gain significant market shares. In this background the workshop discussed very important issues related to; seed / variety replacement rate, genetically modified crops, use of molecular tools for varietal identity and genetic purity, seed bill, poor conversion ratio, public sector seed corporations, global seed trade, climate smart seed production and storage facilities. The experts provided many useful suggestions and based on those appropriate recommendations were made at the end of workshop.

Precision Agriculture*

Anil Kumar Singh
Former VC, Rajmata Vijayaraje Scindia Krishi Vishwavidyalaya, Gwalior
aksingh.icar@gmail.com

Indian Agricultural Production System has been breaking all records of food & horticultural crops and milk production. In 2016-17, even pulses production scaled new heights enabling the country to consider exporting them – a commodity which was being imported until very recently. But the challenge to feed a projected population of 1.6 billion in 2050 and provide them with nutrition security, is a formidable one because of the continuously degrading natural resource base and shrinking of good agriculture

*Extracted from 8th Dr G.S. Sekhon Memorial Lecture delivered on 31.10.2017 at Bhubaneswar.

land for cultivation as well as transformed dietary requirements and life styles. It has been estimated that to meet the demands of that vast population, land, water and labour productivity have to be increased manifold times.

Water and agrochemicals (fertilizers, pesticides, herbicides etc.) are vital inputs in the agricultural production system. Water, the most critical of them, is becoming scarcer each passing day. The country became "water stressed" in 2007 and if the 'business as usual scenario' continues the entire country may become "water scarce" by 2050 or earlier. It is estimated that only a handful of basins will have per capita water availability above the threshold level by 2025. The irrigation projects developed at a very huge cost to the exchequer, function at an efficiency level of 38-40 per cent. Mismanagement of water ultimately leads to degradation of natural resources. In spite of a plethora of technologies available like drip and sprinkler irrigation having water application efficiency between 60-90%, water use efficiency continues to be low. The latest estimates put the area under drip and sprinkler irrigation systems around 8.63 million ha as on 25.12.2016 out of a potential of 69.5 million ha. It is an established fact that increase in water use efficiency automatically results in increase in nutrient use efficiency. A typical example is drip fertigation which leads to a quantum saving of at least 40% in the fertilizers applied.

Use efficiency of fertilizer nitrogen, which constitutes more than 60% of total plant nutrients consumed in India is abysmally low; 30-40% in rice and 40-60% in other crops. Excessive use of nitrogenous fertilizers is leading to ground water pollution as well as increased N_2O emission. Nitrogen use efficiency can be increased by treating urea with nitrification inhibitors or coating with some hydrophobic substances to retard the release of urea in soil solution or its microbial oxidation to nitrates, which leach down or are lost to the atmosphere as N_2 or NOx gases. The global warming potential (GWP) of NO_2 is about 310 times that of CO_2. Phosphorus use efficiency is even lower at 15-20% while that of micro nutrients is dismally low varying between 2-5 %. Such low use efficiencies lead to considerable financial losses to the exchequer and cause serious environmental hazards. Urea Super Granules (USG), Leaf Colour Chart (LCC), Green Seeker using sensor are some of the developments which can enhance nutrient use efficiency. Development of crop-region specific customized fertilizers is needed to maximize fertilizer use efficiency. It is important to note that inclusion of nutrients like boron, copper, manganese and molybdenum has to be done cautiously because of a narrow margin between the deficiency and toxicity thresholds of these nutrients. Nano-fertilizers, nano-pesticides and related products, are being formulated and evaluated by many researchers and will definitely reduce the quantum of chemicals used and enhance their use efficiency. However, bio safety and environmental issues have to be addressed before recommending them on large scale. We have to do away with the conventional form of agriculture that focuses on Recommended Dosage of Fertilizes with emphasis on NPK only. Soil Health Card Scheme provides ample opportunity to switch over to site specific nutrient management immediately. Precision farming is tailored to provide the needed amount of a specific input at a given location. It is based on the principle of delivering – the Right Amount of the Right Input at the Right Time in the Right Place. Site specific input management in terms of water and agro chemicals is the precursor to precision farming.

The potential of precision agriculture for economical and environmental benefits could be visualized through reduced use of water, fertilizers, herbicides and pesticides as well as optimizing farm equipments usage. Instead of managing an entire field based upon some hypothetical average condition, which may not exist anywhere in the field, a precision agriculture approach recognizes site-specific differences within fields and adjusts management actions accordingly. Farmers usually are aware that their fields have variable yields across the landscape. These variations can be traced to management practices, soil properties and/or environmental characteristics. Soil characteristics that affect yields include texture, structure, moisture, organic matter, nutrient status and landscape position. Environmental characteristics include weather, weeds, insects and diseases. Sometimes the within-field variability can be very large.

The high production levels have to be not only sustained but also achieved with emphasis on energy savings and low emission technologies considering climate change impacts. These aspects have not been factored in the projected production estimates of various commodities. 2016 became the warmest year on record. Annual CO_2 concentrations remained above the 400 ppm level all through the year in 2016 and rainfall is becoming more erratic with higher variability and uncertainty. Obviously higher amount of inputs would be needed to obtain the same levels of productivity. Technology-driven farming is the only option for increasing farmers' income and reducing

cultivation costs with the ultimate aim of shifting to precision farming.

Small sized farms coupled with scattered holdings will be a major hindrance in switching over to precision farming as it involves a seamless merging of remote sensing, GIS, GPS, sophisticated machinery and sensors for application of various inputs in measured quantities varying over space and time. The Government's decision to use drone technology for estimating crop yields and damage is an indication of its intention to use modern technologies in agriculture. Precision farming is already fairly common in developed nations like USA, Australia and several European Countries where the focus is on cost cutting, minimal environmental damage and high quality produce.

Use of Drones in Agriculture

Nano technology applications

Nanotechnology applications have the huge potential to change agricultural production by allowing better scientific management. It can enhance agricultural productivity by using Nano porous zeolites for controlled release and efficient amount of water, fertilizer etc.; Nanocapsules for delivery of herbicides, vectors and management of pests; Nanosensors for detection of aquatic toxins and pests; and a host of other applications.

Robotics in Agriculture

Agriculture currently faces challenges of reducing cost of inputs, labour shortages and increasing profitability coupled with minimal environmental damage both in the developed and developing countries. Traditional farming methods are unable to deliver efficiencies required by the market. The rise of automated farming is an attempt to solve these problems by using robotics and advanced sensing.

Dairy farming is one farming activity which has witnessed a rapid increase in mechanization from milking to processing and packaging. Many tasks that are considered unhygienic like manure cleaning are being executed by robots.

Robots also have an advantage as they are able to access areas where other machines cannot. For example, Maize growers face a problem that the plants grow too quickly to reliably fertilize them. "Rowbot" has solved this problem as it can easily be driven between the rows of maize and apply nitrogen fertilizer directly at the base of each plant. Ground based robots, provide even more detailed monitoring as they are able to get closer to the crops. Some can also be used for other tasks like weeding and fertilizing. Some 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 then automatically hoes the spaces between plants to uproot the weeds with a vacuum based removal system. Other weeding robots use lasers to kill the weeds. This is a boon to those farmers who are into organic farming. Robots can work very efficiently in fresh delicate fruit harvesting of commodities like strawberries. Drones are being routinely used for spraying, monitoring, land mapping and pest detection. Some Drone companies offer farmers combined packages which include robotic hardware and analysis software. The farmer 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. It is now possible to differentiate between stresses caused by different nutrients through hyper spectral signatures. Smart phone controlled drip system is no longer a distant goal. Flying drones have already entered the domain. Can self-driving tractors, robotic harvesters, integration of data technology into day to day operations in the digital era, field level data collection by sensors attached to tractors or installed in the field, be far behind. The sensor technology is developing very rapidly be it location, optical, electro-chemical or mechanical sensors and increasingly affordable including wire-less ones.

The sooner we shift to personalized farming- the faster will be reduction in environmental foot prints, productivity enhancement in a sustainable manner and moderation of climates change impacts. According to some industry estimates (IDTechEx), currently robots and drones have a US$3 billion market in agriculture which is likely to be doubled by 2022.

Precision agriculture service providers: Since the Indian Agricultural production system is dominated by small and marginal farmers who are most unlikely to be familiar or conversant with the use of modern tools and techniques, it is necessary to have in place service providers to assist them in making decisions about adopting site-specific crop management. Agricultural service providers or properly trained extension workers can offer a variety of precision agriculture services to farmers. By distributing capital costs for specialized equipment over more land and by using the skills of precision agriculture specialists, these service providers can reduce cost and enhance the efficiency of associated activities. Purchasing highly sophisticated and expensive equipment as well as learning the necessary skills is a significant up-front cost. Agricultural service providers can help identify a group of committed farmers (Self Help Groups or Co-operatives to form a cluster) to justify purchasing the equipment and allocating human resources to offer these services to them. Governmental interventions and policy support will be crucial in promoting and popularizing it.

Ultra Precision Agriculture

In Precision Farming, a very large volume of data is continuously generated on various parameters having an inherent variability in units, format, space and time from a number of different devices which may include computer-based vision detection and data visualization sensors and techniques. Cloud-based information systems are being developed to provide real-time decision support by a seamless merger of multi-source data. They are being built on a cloud computing platform to provide scalability needed for processing data as well as new data integration techniques are being developed to process such data.

It is expected that the next generation Decision Support and Automation System (DSAS) will feature a fully automated decision process, starting from data acquisition to data analysis and decision synthesis, to control field devices based on scientific recommendations.

Today, in the Indian context in particular, an enabling environment exists as the GoI is keen to exploit the benefits of modern technology in agriculture e.g. remote sensing tools, drones, mechanization (custom hiring) etc. There is a huge potential for developing mobile-based application through Digital India programme, an intense focus on entrepreneurship and skilling of youth, massive soil data generation through Soil health cards, enhancing water productivity, reduction in chemical fertilizer use, encouraging contract farming, commitment to reduce GHGs emission etc. – all of which will lead to the Doubling the Farmers Income by 2022.

Awards and Honours

- The degree of Doctor of Science (D.Sc.) Honoris Causa of Bhidhan Chandra Krishi Vishwidayla (BCKV), West Bengal was conferred to Prof Panjab Singh, President NAAS, at 20th Convocation of the University held on October 20, 2017.
- Prof Panjab Singh, President, NAAS was honoured with Lifetime Achievement Award on the eve of Third International Conference on Bioresource and Stress Management held during 8-11 November, 2017 at Jaipur, Rajasthan, India for his incredible contribution in the field of Agricultural Sciences.
- Dr K.V. Devaraj, Fellow, NAAS and Former Vice-Chancellor, University of Agricultural Sciences, Bengaluru was given Lifetime Achievement Award in recognition of his distinguished contributions towards pioneering research, teaching and development of Inland Aquaculture in India by Asian Fisheries Society India Branch on 21st November, 2017 during the 11 Indian Fisheries and Aquaculture Forum held at Kochi, Kerala, India. The award was presented to him by the Hon'ble Vice-President of India, Shri Venkaiah Naidu Ji at the inaugural ceremony of 11th IFAF.
- Prof M.P. Pandey, Fellow NAAS and Former Vice Chancellor (BAU & IGKVV) was conferred D.Sc. Degree (h.c.) by the Hon'ble Governor and Chancellor of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur in its 19th Convocation held on December 4th, 2017 at Kanpur. The Hon'ble Shri Venkaiah Naidu, Vice President of India was the Chief Guest and Shri Surya Prakash Shahi, the Agriculture Minister of UP has been the Special Guest.

Forth Coming Programmes for 2018

- Status Paper on Saving the Harvest (Convener: Prof Anupam Varma)
- Role of A1 and A2 Milk in Human Health (Convener: Dr A.K. Srivastava)
- Management of Biotic Stresses in Livestock (Convener: Dr (Mrs) Manju Sharma)
- Development and Adoption of Novel Fertilizer Materials (Convener: Dr (Ms) C. Varadachari)
- Need for Uniform Policy for Fish Disease, Diagnosis and Quarantine (Convener: Dr P.K. Sahoo)
- Microbiome of the Rumen and Mitigation of Methane Production (Convener: Dr D.N. Kamra)
- Renewal energy: A New Paradigm for Growth in Agriculture (Convener: Dr O.P. Yadav)

Announcements

National Academy of Agricultural Sciences – Invites Nominations for different Awards for the Biennium 2016-2017

1. Memorial Awards (6 nos)

The nominee should be a distinguished scientist above 55 years in age. The period of assessing the contributions would be life time upto the year of nomination. Each award consists of a citation and a silver plaque.

2. Endowment Awards (3 nos)

The award would be given to outstanding scientists for their contributions towards ensuring (i) food and nutritional security and (ii) overall contribution to agriculture. The nominee can be from any branch of science relevant to agriculture. The award comprises a citation and a silver plaque.

3. Recognition Awards (6 nos)

The awards would be given to distinguished scientists, in the age group of 35-55 years, who are Fellows of the National Academy of Agricultural Sciences. The award comprise a citation and a silver plaque.

4. Young Scientist Awards (6 nos)

Scientists below the age of 35 years are eligible for this award. Each award comprise a citation and gold plated silver medal.

For details, please visit Academy Website at www.naasindia.org or write to the Executive Director, National Academy of Agricultural Sciences, NASC, DPS Marg, New Delhi -110012. Tel ; 011-25846051, Email. naas@vsnl.com

Last date for receipt of nominations in the Academy is. **March 31, 2018**

Note: Self Nominations are not acceptable.

XIV Agricultural Science Congress

The NAAS in collaboration with the ICAR and IARI will be organizing XIV Agricultural Science Congress (ASC) at New Delhi from February 20-23, 2019 on the theme "Innovations in Agricultural Transformation". The four-day event will include technical sessions, plenary sessions, public lectures, farmers sessions, poster presentations, inter-university student elocution contest, panel discussions and number of satellite meetings. Moreover, ASC- AgriTech-2019 will be a major associated event. A large number of participants cutting across the disciplines of researchers, faculty, policy makers, farmers, entrepreneurs, development departments, corporate and private sector leaders, NGOs, and students shall be attending this biennial congress of the Academy.

The theme of the Congress, "Innovations for Agricultural Transformation", is central to the national complementary pledges of building a New India and Doubling Farmers' Income by 2022. The New India must be free from hunger, undernutrition, poverty, and glaring inequities. And, Agriculture is the foremost sector to free the nation of these persisting maladies. The Congress will provide an intellectually rich multi-stakeholder platform for discussing and critically analyzing veritable disruptive innovations for transforming agriculture and food systems to reshape India. The Congress will showcase agriculture not only as the main source of employment and livelihood security for nearly 50 percent of India's population, bulging to be the largest in the world by 2025, but also as a business opportunity, service provider, industry, and ecosystem protector.

Reflecting on the journey from the Green Revolution to the Gene Revolution, the Congress will underpin the need for innovations to drive congruent acceleration of productivity, profitability, sustainability, and inclusivity. Besides leaps in genetic enhancement, innovations in precision agriculture, natural resource management, climate smart agriculture, mechanization, micro-irrigation (per drop more crop), ICT, digital technology, farmer-market linkage, value chain and post-harvest management, renewable energy, price realization, and, of course, farmers' net income will be duly discussed.

Alongwith innovative technologies, the Congress will examine and identify the uncommon synergistic transformative policies, strategies, institutions, partnerships, processes, products, investments, business models, trade, group dynamics (FPOs, cooperatives), and human resources development. Further, in this fast changing globalized world, and keeping in mind the increasing appreciation of local-global interdependence, increasing volatilities of climate change, achieving the SDGs by 2030, the Zero Hunger Challenge and the Paris Declaration, the Congress will analyze the scope of international partnership toward creating Evergreen Revolution for Evergreen Economy.

The Organizing Committee through this announcement is requesting all stakeholders to join this mega event. Your participation will be very important in identifying business unusual approaches and strategies including policy options in Transforming Indian Agriculture through Innovations. Further details will be shortly available on the Congress website.

Academy Fellowships

Nominations are invited for Election of Fellows and selection of Associates of the Academy for 2019. The last date of receipt of Nominations is **March 31, 2018**. Nomination forms and relevant details are available at website : http://www.naasindia.org.

Obituary

Dr Lalji Singh was born in a small village Kalwari in Jaunpur District of Uttar Pradesh, India on 5th July 1947. He obtained his B.Sc. degree in 1964 and Master's degree in 1966 from Banaras Hindu University (BHU) and won the University Gold Medal. He worked for Ph.D work and received his doctorate from the BHU in 1971 in the area of Cytogenetics. Dr Singh received the Commonwealth Fellowship to carry out research at the Institute of Animal Genetics, University of Edinburgh, UK, where he worked for 13 years from 1974 to 1987. In June 1987, Dr Singh returned to India and joined the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad, as a senior scientist. Dr Singh developed and established the DNA fingerprinting technology for forensic investigation of crime and civil disputes. In July 1998, he became the fourth Director of the CCMB, where he served until July 2009. On 22 August 2009, he was appointed as the 25th Vice Chancellor of Banaras Hindu University, Varanasi, India.

Dr Singh's lifetime contributions for the development and establishment of indigenous DNA Fingerprinting Technology in India were recognized by the nation, and he was now popularly known as the "Father of DNA fingerprinting" in India.

While at CCMB Dr Singh realized an urgent need for assessment and conservation of the wildlife resources of India. He conceptualized the Laboratory for conservation of endangered species (LaCONES) in 1998. On 2 February 2007, the laboratory was inaugurated and dedicated to the Nation by then President of India Dr (Late) A.P.J. Abdul Kalam.

The laboratory recorded a major success in the Assisted Reproductive Technology (ART) of wild animals, when the world's first successful artificial insemination of an in estrus induced spotted deer, led to the birth of a live fawn on 14 March 2006.

Dr Singh with his co-workers provided a new concept of Chromosomal translocation of sex-determining region from Y chromosome to X chromosomes causing sex reversal in mice. These findings later became the foundation for the discovery of a similar phenomenon of sex reversal in humans.

The fundamental DNA-based research carried out by Dr Singh and his colleagues on primitive tribes including the tribal population of the Andaman and Nicobar Islands, provided critical insights into the evolution and migration of humans, have furthered the scientific community's understanding of the origin of man in terms of evolution and migration from place to place.

Based on his immense contribution he received more than 50 awards including ISCA 'New Millennium Plaque of Honour' Award 2002; Padma Shri 2004; Rajiv Gandhi Rashtriya Ekta Saman, 2007; CSIR Technology Award in Life Sciences, 2008; Shanti Swarup Bhatnagar Fellowship of CSIR in 2010. He was Fellow of Indian Academy of Sciences, 1989; National Academy of Sciences, India, 1991; Indian National Science Academy, 1993; National Academy of Agricultural Sciences, 2001; National Academy of Medical Sciences, 2002; Third World Academy of Sciences, 2002. He was Vice-President of NAAS from 2012-2014 and also Member of Executive Council from 2008-2010.

Dr Singh passed away on December 10, 2017 while in active work, he is survived by his wife Mrs Amravati Singh and two sons, our heartfelt condolences to the members of family. The Academy and the country have lost a very valuable and high caliber scientist called as 'Father of DNA Fingerprinting in India." The entire Fellowship mourns the sudden sad demise of a great scientist and Fellow of the Academy and pays homage to the departed soul.

Editors: Dr K.K. Vass and Dr V.K. Bhatia

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