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From the President's Desk

Flourish with Floriculture



Flowers and their fragrances possess significant aesthetic, therapeutic, environmental, social and commercial value. Besides, the floriculture industry is an important source of livelihood for farmers, aggregators, traders, processors and distributors engaged at different stages of the flower value chain. Floricultural activities are highly labour- and

skill-intensive, requiring utmost care at every step from upstream to downstream of the value chain. Notably, the cultivation of flowers is highly remunerative compared to several foods and other non-food crops, generating a stream of income that aids farm households in buying their food and other household necessities. These characteristics of the floriculture industry closely match the resource endowments and cash flow requirements of poor farm households. Hence, the floriculture industry offers significant income and employment opportunities to the landless and marginal and small farmers, who constitute over 86% of farmers.

Production Scenario

In India, floriculture is practised on 0.31 million hectares, producing over 3.1 million tons of flowers. And, driven by the growing demand for flowers and their value-added products, the area and production of flowers have been increasing steadily (Figure 1). Accordingly, their contribution to the economy has also increased from Rs 1740 billion in 2011-12 to Rs 2660 billion in 2019-20 (at 2011-12 constant prices). Currently, primary floriculture accounts for about 2 % of the value of the output of the crop sector. Notably, the gross income per hectare from floriculture is almost 20 times the gross income from cereals.

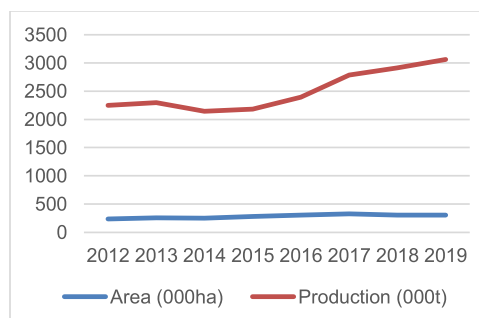


Figure 1. Trend in area and production of flowers

Demand for flowers and their value-added products is likely to grow faster. The International Vision Project (IVP) of the International Association of Horticultural Producers (AIPH), Brussels (Belgium) identifies demographic transition, increasing urbanization and rising per capita income as the main drivers of the development of the global floriculture industry. Besides, the improvements in logistics and transportation and advances in technologies for packaging and storage have also contributed to the growth of the floriculture industry. India is no exception to these developments. As

a country of youth with an average age below 30 years, India has been undergoing steady urbanization and experiencing rapid economic growth of around 7%. These trends are unlikely to subside soon.

India's floriculture is dominated by the traditional cultivation of loose flowers in open fields (2.3 million tons). Cut flowers produced in the protected environments contribute about one-fourth to the total flower production. Notably, driven by international demand and improvements in the logistics and supply chain, the production of cut flowers has been increasing fast. Besides, India has a strong tradition of growing flowering plants in fillers, pots and landscapes. Although floriculture is practised throughout the country, it is concentrated in Tamil Nadu, Andhra Pradesh, Madhya Pradesh, West Bengal and Karnataka (Figure 2). Floriculture has the status of a sunrise industry. It receives considerable financial, institutional and policy support from the central and state governments. Some states, for example, Karnataka, Tamil Nadu, Maharashtra, Odisha, Jharkhand, Sikkim, Haryana, Himachal Pradesh, West Bengal, Tripura, Mizoram and Goa, have initiated specific programs for the promotion of the floriculture industry.

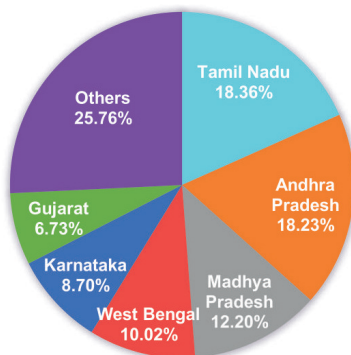


Figure 2. Share (%) of states in total flower production, 2018-19

Floriculture Research

Scientific floriculture in India can be traced back to 1935 to the efforts of a famous nurseryman Mr B.S. Bhattacharjee who started rose breeding. However, the robust foundation for rose breeding was laid by late Padma Bhushan Dr B.P. Pal who had a passion for roses. During his professional career at the Indian Institute of Agricultural Research (IARI), New Delhi, Dr B.P. Pal bred as many as 104 varieties of roses. A few significant milestones in the science of floriculture are as follows:

- Establishment of a Division of Horticulture at the Indian Agricultural Research Institute in 1956 and a National Rose Collection Centre in 1960.
- Establishment of a Division of Floriculture and Landscape Gardening at the Indian Institute of Horticultural Research (IIHR), Bangalore, in 1969.
- All India Coordinated Research Project (AICRP) on Floriculture at IARI in 1972.
- Establishment of a Division of Floriculture and Landscape Gardening at IARI in 1983.
- Establishment of a National Research Center for Orchids at Pakyong, Sikkim, in 1996.
- Upgradation of AICRP as Directorate of Floricultural Research (ICAR-DFR) in 2009 and its relocation to Pune in 2014.

In addition, several State Agricultural Universities have a dedicated Department of Floriculture and Landscaping for promoting research and teaching in floriculture science

and management of landscapes. These institutions have been engaged in research on breeding, pest management, protected cultivation, post-harvest management, landscaping, production of seed and planting material, micropropagation and dry flower technology.

Until the early 1980s, floriculture was a homestead activity. Later on, floriculture research transformed it into a commercial activity. It made available improved varieties of flowering plants, including roses (250), chrysanthemum (220), gladiolus (107), tuberose (14), China Aster (10), marigold (11), jasmine (9), bougainvillea (16), crossandra (5) and amaryllis (5). These varieties can be grown in varied climatic conditions. The varieties growing as cut flowers under protected cultivation include Arka Swadesh, Arka Ivory and Arka Pride of rose; Pusa Centenary, Pusa Kesari of Chrysanthemum; and Arka Nesara and Arka Ashwa of Gerbera.

The ICAR-Directorate of Floricultural Research is engaged in breeding novel varieties (Electron beam radiation for novelty induction), alternate media sources for the nursery industry, vertical gardening for indoor air quality, nutraceutical pigments, essential oils, ecosystem services through pollinizers, variety specific markers, farmer-friendly diagnostic tools for diseases, foldable crates for the reduction in transportation cost and retaining quality of flowers, biodegradable pots (to reduce the plastic footprint in the nurseries), development of tools and gadgets for floriculture, and value-added products like floral teas, rose water, gulkand, etc. DUS test protocols have been developed, and test guidelines have been notified for 13 flower crops. The CSIR- National Botanical Research Institute, Lucknow, also undertakes research on several aspects of floriculture, including breeding and value-addition.

Globally, the research on floriculture has been advancing rapidly using genome-editing and CRISPR, or CRISPR/Cas9 tools to change the colour of the flowers of ornamental plants. With the application of IoT, the flower yield can be increased up to 70%. Smart greenhouses represent one of the typical applications of IoT. A smart farm can automatically control production conditions based on a customized database.

A harvesting robot for roses has been developed and tested in the Netherlands. Rose cutting machines using camera vision and industrial manipulators have been designed to produce rose cuttings from rootstocks. Grafting is a delicate process requiring novel skills, and the automatic grafting machines are in the pipeline. ICAR- DFR has developed a prototype of a grafting machine, which is being recalibrated for rootstocks of roses. Scheduling is an important strategy to prevent gluts in the market and protect farmers from volatile prices. It can optimize area and planting material requirements, balancing the supply and demand for different flowers. Many Interactive Decision Support Tools (e.g., Flowers on Time, and Virtual Grower 3.0) have been developed to facilitate the process of scheduling.

International Trade in Floricultural Products

India is a net exporter of floricultural products. Between 2016-17 and 2020-21, India annually exported floricultural products worth Rs 548 crores, compared to their imports of Rs 167 crores, leaving a trade surplus of Rs 381 crores.

Table 1. Trade in floricultural products (in Rs crores)

	Export	Import	Net trade
2016-17	545	134	411
2017-18	507	136	371
2018-19	571	174	397
2019-20	542	230	312
2020-21	576	160	416
Average	548	167	381

India's export basket comprises mainly dry flowers (60%), fresh-cut flowers, value-added products, seeds, and planting material. India exports floricultural products to 134 countries, albeit in smaller quantities. However, the main export destinations are the USA, the Netherlands, United Arab Emirates, UK, Germany and Japan (Figure 3). It exports tropical cut foliage mainly to the Middle East countries.

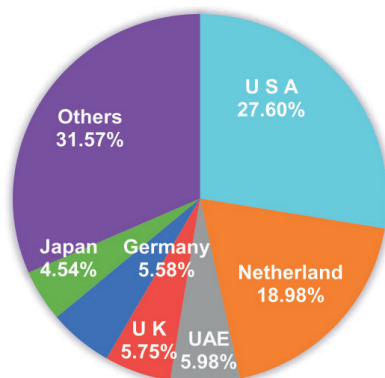


Figure 3. India export destinations (% of the total value of floriculture exports)

India imports its requirements of floricultural products mainly from Italy, the Netherlands and China (Figure 4). It imports trees and shrubs from Italy, the USA and the Netherlands; other live plants from China, the Netherlands and Italy; tissue culture plants from the Netherlands, Italy and Iran; bulbs from the Netherlands and New Zealand; flowering plants from Thailand, Taiwan and China and, foliage and branches from China, Madagascar and Turkey. Imports of orchids are mainly from Thailand and Malaysia, but their imports have declined drastically.

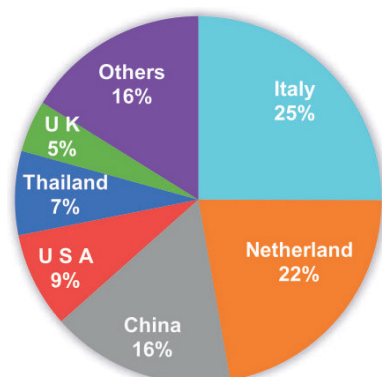


Figure 4. India's sources of imports of floricultural products (%)

Opportunities and Way Forward

India's diverse climatic conditions offer considerable scope for producing different types of flowers for domestic and international markets. A wide variety of cut greens can be grown under shades in multi-tier cropping systems. Nursery hubs in different parts of the country have a rich collection of foliage plants which can be utilized to produce cut greens for domestic and export markets.


There is a great scope to reduce reliance on imports of exotic trees, live plants and shrubs by strengthening their propagation base in the nursery hubs and popularizing indigenous ornamental plants. It requires developing nursery standards to make these competitive in the international market. Forced bulbs of tulip, daffodils, iris, cala lily, lily, and gladiolus are imported from the Netherlands and

New Zealand. The Himalayan region has a conducive environment for their cultivation. India is rich in orchid diversity, especially in the North-eastern region and Western and Eastern Ghats. The native species can contribute immensely to breeding new hybrids. Vanda coerulea from the Northeast has contributed the blue pigment to the global orchids. The ICAR-IIHR, Bengaluru developed a hybrid variety of tuberose, Arka Prajwal, which could replace the local cultivars (Mexican Single) in West Bengal. This variety is now cultivated in about 3600 hectares in Nadia and North 24 Parganas. Tuberose flowers are exported to Bangladesh, Nepal and Bhutan through land routes. The highly fragrant white flowers, like tuberose and jasmine, are in great demand in the Middle East.

To harness the emerging opportunities in domestic and global markets, there is a need to evolve a strategy to promote floriculture.

- Promote flower cultivation under the 'One District One Product' (ODOP) program.
- Explore novel indigenous species and varieties for cut flowers and other uses and promote their cultivation in multi-tier greenhouses to harvest vertical space.
- Protected cultivation of flowers is capital-, energy- and knowledge-intensive, requires soilless culture, enriched alternate media, liquid fertilizers, cladding material, and hail proof nets to withstand extreme weather conditions. A necessary strategy is needed to support this adequately.
- There is a need for accreditation of the nurseries to supply quality planting material and facilities for indexing the mother plants and screening for seed-borne diseases at periodic intervals. Unified standards for planting material and uniform pricing are needed.
- Discourage excessive and indiscriminate use of pesticides, which harm pollinators, and promote research on eco-friendly bio-pesticides.
- Floriculture should go hand in hand with beekeeping.
- Promote manufacturing of tools and gadgets to reduce drudgery and enhance operational efficiency.
- For better shelf-life of packaged flowers, introduce eco-friendly crates and support vending solar-powered air-cooled pushcarts.
- Develop integrated Flori-Malls at major markets with dedicated cold chains and plants to extract essential oils, pigments, dyes and other flower products. Vermicomposting units for recycling spoiled flowers may also be integrated with these malls.
- Indigenous processing and value-addition technologies and the production of novel high-value compounds with food/nutraceutical/pharmaceutical properties need to be developed in collaboration with the CSIR labs.
- Invasion of cheap plastic flowers from neighbouring countries harms the floriculture industry, causes pollution, and damages human and animal health. There is a need for strict import restrictions on imports of plastic flowers.

Let's flourish with flowers


Trilochan Mohapatra
(President)

New Year Get-together

A new year get-together of the NAAS fellows was organized online. At the outset, Dr P.K. Joshi, Secretary, NAAS, welcomed Dr Trilochan Mohapatra, President, NAAS, office bearers, members of the Executive Council, and the distinguished Fellowship and wished them a happy, healthy and prosperous 2022. He expressed deep appreciation, on behalf of the Academy, to the outgoing members of the EC, namely, Dr J.C. Katyal, Dr U.S. Singh, Dr R.K. Jain, Dr R.K. Varshney, Dr Brahm Singh, Dr Arvind Kumar, Dr Madhoolika Agarwal and Ch Srinivasa Rao for their contributions; and welcomed new office bearers, namely, Dr K.M. Bujarbaruah as Vice President, Dr Rajiv Varshney as Foreign Secretary, Dr Rajender Parsad as Treasurer, and Dr Ch Srinivasa Rao, Dr C.N. Ravishankar, Dr Ashok K. Singh, Dr P.S. Singh, Dr B. Mohan Kumar and Mr Sanjay Garg as EC members. Despite the Covid-19 pandemic, the Academy did exceedingly well during 2021. It organized 15 brainstorming sessions, one panel discussion and International Women's Day and published ten publications, including policy papers, strategy papers, policy briefs, and a memoir of Dr V.L. Chopra.

Addressing the Fellowship, the past Presidents, Dr Panjab Singh, Dr R.B. Singh and Dr Mangala Rai, stressed the role of Academy in promoting science-led agriculture development and hoped that the recommendations emerging from the NAAS on the issues of national importance would help guide agricultural policy and planning.

In his presidential address, Dr Mohapatra expressed his satisfaction with the performance of agriculture in 2021 amidst the challenges posed by the Covid-19 pandemic. He aspired the Academy to provide leadership in science



and science policy. Nonetheless, he put forward the following issues:

- Regional Chapters need to be more proactive in identifying regional issues that require the Academy's deliberations.
- Academy must work towards building linkages with the Science Academies in India and abroad to share the expertise and learnings from each other.
- NAAS publications should be innovative and provide well-articulated recommendations along with action plans.
- Academy should organise inter-Academy discussions on the issues of common concern.
- The issue of ZNBF needs to be addressed scientifically and holistically, generating evidence through experiments and farmers' fields.

On this occasion, ten publications were released by the President.

123rd Executive Council Meeting

The 123rd Meeting of the Executive Council was held in hybrid mode at 11.30 A.M. on 18 January 2022 under the Chairmanship of Dr T. Mohapatra, President NAAS. Dr P.K. Joshi, the Secretary, welcomed President, EC members and new office bearers and thanked outgoing office bearers for their services to the Academy.

The President, in his opening remarks, greeted all the members and mentioned that the EC meeting was scheduled in February, but this particular meeting was called to outline the aspirations of the Academy and do some loud thinking on issues of contemporary importance. He urged new members to give their viewpoints.

He appreciated the efforts in updating the NAAS website and suggested continuous improvements. He desired that the Plenary Lectures during the XV Agricultural Science Congress be available on the website. He desired that a small group may be constituted to deliberate on the

recommendations, cull out actionable points and develop a roadmap to address these. He also appreciated the proactive role played by the Academy in organizing a Stakeholders Consultation on Genetically Modified (GM) Food and Feed Import and Detection of Unauthorized GM Food Events'.

The President emphasized that many activities have been planned for this year. We should focus on joint activities with other Science Academies, both national and international, and experts from outside the NAAS. The existing MoUs with foreign academies need to be looked at critically and made operational. He concluded by invoking the EC members, especially the newly elected members, for committed engagement in the activities of the Academy and to provide new insights and ideas for improving the visibility of the Academy. After that, the agenda items were deliberated upon, and the EC was apprised of the major activities.

A group of experts from the Academy had deliberated on exploring possible priority areas for the upcoming budget 2022-23. The recommendations were sent to the Hon'ble Finance Minister, Government of India, NITI Aayog and other Ministries.

Academy organized a Round Table Discussion in response to FSSAI notification on the Food Safety and Standards (Genetically Modified or Engineered Foods) Regulations. By responding quickly, the Academy could provide stakeholders' viewpoints to the Government.

Call for nominations for the election of Fellows and selection of Associates and Young Scientist Awards have been uploaded on Academy's website. EC members should give wide publicity and nominate outstanding professionals for fellowships and awards.

Themes and venues for the next Agricultural Science Congress 2023 were discussed. In response to NAAS communication, 15 ICAR Institutes and 10 State Agricultural Universities expressed their willingness to hold the Congress. The organizations/states where Congress had not been held earlier should be preferred. The host institutions must have the required infrastructure and logistics to hold parallel sessions. The possibility of online satellite sessions in other institutes was also discussed. IVRI, Izatnagar, Uttar Pradesh; ICAR-CMFRI, Kochi, Kerala; and Junagadh Agricultural University, Junagarh, Gujarat were shortlisted for further discussion in the next EC meeting.

After detailed discussions, Sustainable Food Systems was identified as a broad theme encompassing health, nutrition, and SDGs.

Suggestions were invited from EC members to identify speakers for the Foundation Day lecture on 5 June 2022. The following names cropped up: Dr Johan Swinnen, Director General, IFPRI; Dr V.K. Paul, Member of NITI Aayog; Dr P. Balaram, former Director, IISc; Dr Ismahane Elouafi, Chief Scientist, FAO; Dr Soumya Swaminathan, Chief Scientist, WHO; and Sh Sadhguru Jaggi Vasudev, Isha Foundation.

Dr A.K. Singh, Vice President, apprised the EC about the scoring of journals and informed them that NAAS scoring is done on a three-year cycle basis. But, new journals are also evaluated each year. Eight new journals, and 33 non-impact factor journals, which have resubmitted documents, will be evaluated.

Dr Anil K. Singh informed that the Academy has decided to confer the Young Scientist Award every year instead of biannually. Presently, six awards are given, one each in the disciplines of Plant Sciences (Crop Sciences and Horticulture Sciences); Animal Sciences and Fisheries; Plant Protection; Soil Water and Environmental Sciences; Agriculture Engineering and Technology; and Social Sciences. It was proposed that separate awards may be given in the categories of Crop Science, Horticulture Sciences, Animal Sciences and Fisheries Sciences, raising the number of Young Scientist awards from six to eight. Since these awards will now be given every year, it was agreed to confer these in the AGM rather than in the Agriculture Science Congress.

Engaging a language editor was discussed at length, and it was decided that expression of interest from eligible professionals may be sought, and qualified ones may be short-listed and empanelled.

124th Executive Council Meeting

The 124th Meeting of the Executive Council was held in hybrid mode at 10.00 A.M. on 18 February 2022 under the Chairmanship of Dr T. Mohapatra, President NAAS. Dr Mohapatra expressed his appreciation for the successful organization of the Strategic Consultation on Preparedness for Prevention of Transboundary Infectious Diseases of Livestock and Poultry in South Asian Countries" on 15 February 2022. It was organized by NAAS jointly with the International Livestock Research Institute (ILRI), the South Asian Association for Regional Cooperation (SAARC) and the Bangladesh Academy of Agriculture (BAAG). Dr Mohapatra urged that the Consultation proceedings may be drafted at the earliest under the guidance of Dr K.M. Bujarbaruah, highlighting the recommendations and an action plan so that these can be shared with the SAARC members.

President appreciated the efforts of the Committee on 'Academic Standing of the Scientific Societies' under the chairmanship of Dr K.C. Bansal. However, the list needs to be more comprehensive, and evaluation criteria require modification. This should be a dynamic process repeated every three years.

Presenting the progress on the collaboration with the Scientific Academies in other countries, Dr Rajiv Varshney informed that the Crop Science Society of America (CSSA) had shown interest in collaborating. Suggestions were made to invite the Foreign Fellows and Pravasi Fellows to participate in NAAS activities.

Proposals received from different ICAR institutes and SAUs for organizing XVI Agricultural Science Congress were discussed, and it was decided that the Congress would be organized at ICAR-CMFRI. The theme of the Congress shall be 'Transformation of Agri-Food Systems and Sustainable Development Goals'

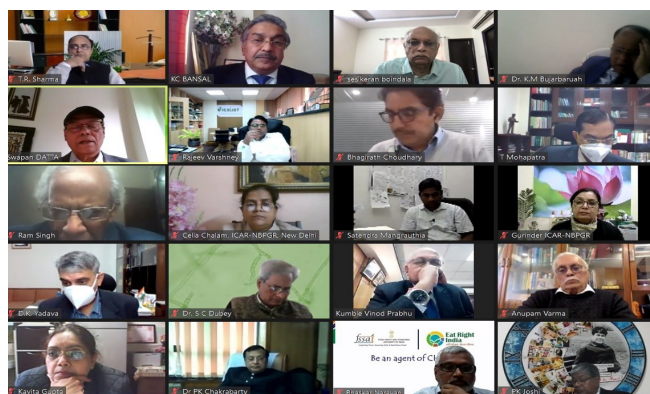
It was agreed to invite Prof P. Balaram, former Director, Indian Institute of Science, Bengaluru, to deliver the Foundation Day lecture.

The EC approved the change of Convener of Ludhiana Chapter and placed on record the gratitude of the Academy to Dr B. S. Dhillon for his services as Convener of this Chapter. Dr Sanjay Kumar will replace Dr B.S. Dhillon.

NAAS Programmes

Stakeholders Consultation on 'Draft Regulation for Genetically Modified (GM) Food and Feed Imports and Detection of Unauthorized GM Food Events' (Convener: Prof K. C. Bansal, Co-convener: Dr Gurinderjit Randhawa)

A Stakeholders Consultation on 'Draft Regulation for Genetically Modified (GM) Food and Feed Imports and Detection of Unauthorized GM Food Events' was organized by the Academy on 10 January 2022 in the hybrid mode under the Chairmanship of Dr Trilochan Mohapatra with Dr Swapan K. Datta, former DDG (CS), ICAR. More



than 50 delegates/stakeholders actively involved in GM/GE research from the ICAR/DBT institutes and other national institutes of repute from both public and private sectors enriched the consultation. Key recommendations that emerged were submitted to the FSSAI and are summarized below:

- Food safety aspects of all GMOs or GEOs, whether produced locally or imported, are to be dealt with by FSSAI.
- The term 'Genetic Engineering' may be substituted by 'Modern Biotechnology' and defined as per the guidelines of the Codex Alimentarius Commission.
- The term 'Genome Editing' needs to be clarified in the definition of Genetic Engineering itself, and the genome-edited products may be exempted. Genome edited crop products of SDN1 and SDN2 categories cannot be detected, remain indistinguishable from a conventionally bred product, and contain no foreign DNA.
- Concerning the laboratory for Genetically Modified Foods testing, it was suggested that the existing accredited GMO laboratory infrastructure for detection, identification and quantification at ICAR/ICMR/CSIR/SAUs be upgraded by MOEF&CC under the Global Environment Facility (GEF) project.

- Genetically Modified Organisms or Genetically Engineered Organisms or Living Modified Organisms shall not be used as an ingredient in any infant food, needs to be either deleted or revised.
- All food products having individual Genetically Modified or Engineered (GE) ingredients 2% or more should be labelled as 'Contains GMO'.
- Concerning the detection of unauthorized GM food events, it was suggested that Apex Central Reference laboratory, Satellite Referral Laboratories, and a knowledge bank to provide relevant information to the stakeholders might be established.

Strategic Consultation on 'Preparedness for Prevention of Transboundary Infectious Diseases of Livestock and Poultry in South Asian Countries'

A Strategic Consultation on 'Preparedness for Prevention of Transboundary Infectious Diseases of Livestock and Poultry in South Asian Countries' was held on 15 February 2022. It was organized by the NAAS jointly with the



International Livestock Research Institute (ILRI), the South Asian Association for Regional Cooperation (SAARC) and the Bangladesh Academy of Agriculture (BAAG). The meeting was attended by more than 125 participants, including the key leaders in the animal husbandry sector of South Asian countries, the office bearers of NAAS, ILRI, SAARC and BAAG, along with the guests from BMGF, FAO, WHO and private organizations. The President appreciated the efforts put in by the organizers, particularly to Dr H. Rahman, Regional Representative for ILRI, South Asia, and representatives of the SAARC countries, for excellently organizing the program.

Experts' Meet on 'Self-sufficiency in Edible Oil Production' (Convenor: Dr Sanjeev Gupta)

India faces a substantial supply deficit in edible oils. Over 55% of the country's edible oil demand is met through imports. A rationalised and comprehensive approach



is needed to reduce import dependence and increase domestic production. The NAAS, therefore, organized an Experts' Meet on 28 March 2022 under the Chairmanship of Dr Trilochan Mohapatra, President, NAAS. Dr Mangala Rai, former President, NAAS, was co-chair. The following recommendations emerged from the consultation:

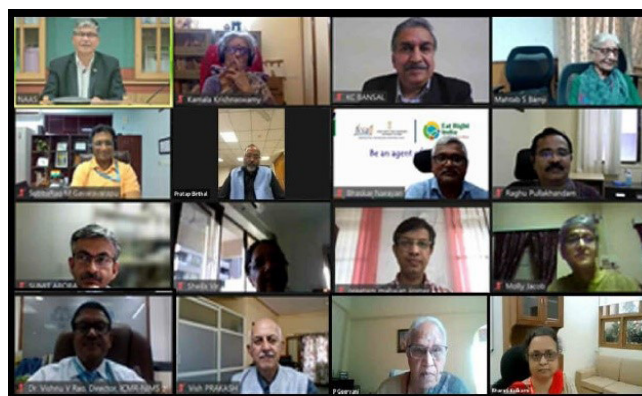
- Considering India's high per capita consumption of edible oils, an aggressive campaign needs to be launched on media platforms to reduce their consumption. Efforts are also required to restrict their use for industrial purposes.
- Use advanced breeding tools (fast track breeding, genomic selections, gene silencing, genome editing, etc.) to increase productivity and quality parameters in oilseeds.
- The decision to release indigenously developed GM oilseed crops may be hastened.
- Secondary sources of edible oil (i.e., cottonseed, rice bran and TBOs) need mainstreaming in the edible oil sector. Innovations in refining, bleaching and deodorisation will contribute to achieving self-sufficiency in edible oils.
- Create an 'Oilseed Development Fund', imposing a 0.5% cess on imports, and the funds can be utilized for R&D projects and incentivizing farmers.
- Raise import duty on edible oils to encourage domestic production.
- There is a huge yield gap in oilseed crops, about 60%, which needs to be bridged through micro-nutrient applications, life-saving irrigations, and customized fertilizers.
- Ensure the availability of quality seeds to farmers by establishing more seed hubs, seed villages, and seed banks.
- Identify potential areas for each oil crop to utilise the resources efficiently.
- Extend subsidies and incentives to all machines and equipment to adopt micro-irrigation.
- Explore export avenues for sesame, groundnut and castor oils.
- Promote value chains under 'Make in India', inviting

cooperatives and corporates to create production and processing hubs.

- Government agencies procure only 5% of the oilseed production. A separate procurement agency needs to be established for the effective implementation of MSP and to encourage farmers to take up more oilseed crops.

Brainstorming Session on 'Food Fortification Issues and Way Forward' (Convener: Dr K. Madhavan Nair)

A brainstorming session on 'Food Fortification Issues and Way Forward' was organized on 11 March 2022 under the Chairmanship of Dr Ramesh Chand, Member, NITI Aayog, to deliberate on the issues emerging from new recommendations on nutrient requirements and dietary allowances by the ICMR-NIN, 2020; a nationwide study on the status of micronutrients (anaemia, iron, vitamin A and D, folic acid and vitamin B12, and iodine) among children aged between 1-19 and adolescents (CNNS 2019); and urban diet and nutrient survey (NNMB 2017).



In his opening remarks, Dr Ramesh Chand stated that the national policy on food and nutrition considers the ground realities. He voiced concerns about the high prevalence of malnutrition despite significant increases in the food supply.

Dr K. Madhavan Nair highlighted the existing fortification strategies, the current status of micronutrient deficiency and the ICMR-NIN (2020) nutrient requirements which enables the provision of three reference values for nutrients viz. EAR (Estimated Average Requirements), RDA (Recommended Dietary Allowances) and TUL (Tolerable Upper Limits). He made a detailed presentation on the prevalence of nutrient inadequacy, modelling to compute standards for iron, folic acid, vitamin B12, vitamin A and vitamin D fortification of foods, and deliberated on the likely impact of layering interventions with single vs multiple vehicles. He suggested that the adoption of ICMR-NIN 2020 reference values and methodological framework to shift the population nutrient adequacy to their requirements distribution should form the basis for setting the fortification standards to address the micronutrient deficiencies safely.

Dr N. Bhaskar, Advisor (Science and Standards), FSSAI, briefly presented the basis of the existing fortification standards and stressed the need for robust monitoring mechanisms for science-based policy changes. He has raised concerns about amending RDA to the EAR in the FSS Act 2006.

Dr A. Laxmaiah, Scientist G highlighted that NIN does not recommend universal fortification; is not in favour of fortification of multiple staple foods with the same nutrient and suggests assessing inadequacies from NNMB data across all age groups to evolve fortification standards through modelling to shift the intake distribution close to the required distribution, while minimizing the risk of exposure beyond tolerable upper levels as specified by the ICMR-2020.

This was followed by a panel discussion chaired by Dr M S Bamji, INSA Honorary Scientist. The following recommendations emerged:

- Dietary diversification is a sustainable strategy to address the problem of malnutrition, including micronutrient deficiencies, holistically. Through behavioural change communication, better systems for educating people, particularly women and children, are needed to get the best results despite economic constraints.
- India needs to implement micronutrient fortification, based on evidence from the dietary inadequacies, as a complementary strategy and dietary diversification.
- Deal with the fortification of each micronutrient separately and contextually (vitamin A for poor children, vitamin D for upper SLI).
- Fortification needs to be discouraged if there is an ongoing universal supplementation program of specific nutrients (i.e., iron and anaemia mukt Bharat).
- Restrict the fortification of one vehicle rather than a layering of multiple vehicles as this may pose a safety issue, particularly concerning iron and vitamin A.
- Use oil as a vehicle for vitamins A and D and salt for iron.
- Close monitoring for addressing risk and benefit in the context of evidence for a rise in biomarkers of iron and NCD is needed.
- Short and long term monitoring mechanisms of food fortification on health and toxicity need to be established.
- There is a need for contemporary and representative data on dietary intakes and functional/biochemical deficiency prevalence across all age groups.

National Science Day

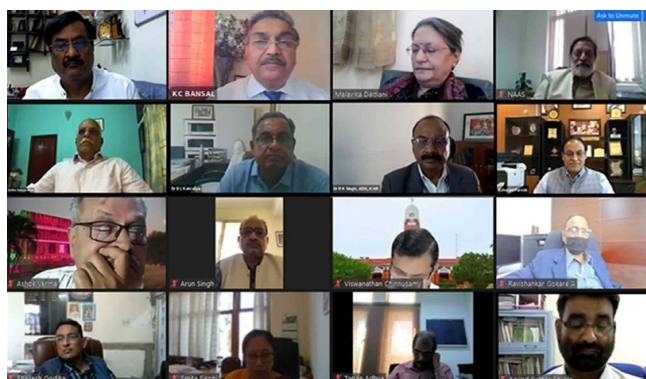
The Academy celebrated National Science Day on 28 February 2022 with a lecture delivered by an eminent economist Prof R. Ramakumar from the Tata Institute of Social Sciences, Mumbai, under the chairmanship of Dr T. Mohapatra, President, NAAS.



The application of modern science in agricultural production has been the hallmark in transforming India from a ship-to-mouth to food self-sufficiency. Prof Ramakumar emphasised the importance of modern science and technology in shaping the development of agriculture and stressed the need for increased investment in quality public research. He discussed the strong linkage between public investment in agricultural research and reduction in rural poverty. Today, India spends less on agricultural research. Prof Ramakumar warned of the implications of relying on private sector agricultural research, which develops technologies suited to commercial and capital-intensive cultivation.

International Women's Day

The Academy celebrated International Women's Day on 8 March 2022, organizing a panel discussion on 'R&D Innovations for Sustainable Agriculture in India' through an online platform. The program was co-chaired by Dr T. Mohapatra and Dr K.M. Bujarbaruah and moderated by Prof K. C. Bansal. Dr T. Mohapatra, in his opening remarks, highlighted the challenges women faced and emphasized the need for gender equality in society.



Six women scientists served as panellists. Dr Parveen Chhuneja, Director, School of Biotechnology, PAU, Ludhiana, highlighted the importance of molecular marker technology along with the role of disease resistance genes. Dr P.D. Kamala Jayanthi (ICAR National Fellow), Indian Institute of Horticultural Research, Bengaluru, opined that the changing climatic conditions and extensive monocropping had influenced the ecology and biology of insect pests leading to a considerable shift in their pest status across several crops posing challenges to farmers and researchers alike. Considering the recent global emphasis on sustainable pest management

solutions with minimal 'carbon footprint', she highlighted the intensive efforts being made globally to identify green chemicals that can support integrated pest management strategies with minimal disturbance to agri-ecosystems. Dr Parameswari Balasubramaniam, ICAR-NBPGR, Hyderabad, emphasized biotechnological innovations to update current disease management strategies. Dr Ch. Jyotiprava Dash, ICAR-IISWC, Koraput, briefed about the issues in hydrology, scientific validation and refinement of

indigenous technologies, solar-operated micro-irrigation and ecosystem-based land use planning. Dr Monika Saini, Scientist -I, AIIMS, New Delhi, spoke about women's crucial and unique contribution to India's livestock sector. Dr Reshma Gills, Scientist, ICAR-CMFRI, Kochi, focused on the constraints and the role of social scientists in the mass adoption of various technologies. She emphasized the need for teaming up with social scientists to develop farmer-friendly technologies.

Activities of the Regional Chapters

Coimbatore Chapter

Lecture on 'Recent Developments in Nanotechnological Applications in Agriculture'

Dr K.S. Subramanian, Director of Research and NABARD Chair, Tamil Nadu Agricultural University, Coimbatore, delivered a lecture on "Recent developments in Nanotechnological applications in agriculture" on 31 January 2022 in hybrid mode. The program was chaired by Dr Hemaprabha FNAAS, Director, ICAR-SBI. Dr Viswanathan welcomed the participants and introduced the speaker. Dr Subramanian introduced the basic principles of nanoscience and covered broad areas of nanoparticles (NPs) for plant health, Nano diagnostics, smart delivery system, preservation of perishables and bio-safety. He cited examples of the application of nanotechnology in pest and disease diagnosis, on-site detection of nitrogen and moisture in the field, pesticide residue analysis in fruits, etc.; carbon nanotubes and ZnO NPs to improve seed invigoration/ germination; smart delivery of inputs such as nano-silica derived from bagasse, nano-silica loaded with biomolecules like azadirachtin and nano lures to attract rice stem borer. He also highlighted the use of nanoemulsions for extending the shelf-life of fruits' delayed ripening. On biosafety issues, he emphasized nano products that are not inhibitory to pathogens, predators and parasitoids of insect pests, earthworms, aquatic fauna and human cell lines.

World Pulses Day

Coimbatore Chapter celebrated 'World Pulses Day' jointly with ICAR-SBI on 10 February 2022, organizing a lecture on 'Pulses to empower youth in achieving sustainable agricultural food system' by Dr Subbalakshmi Lokanadhan, Professor (Agronomy), Tamil Nadu Agricultural University, Coimbatore. The program was chaired by Dr Hemaprabha, Director of ICAR-SBI, and Dr Viswanathan gave a welcome address and introduced the speaker.



Dr Hemaprabha delivering the presidential address



Dr Subbalakshmi Lokanadhan delivering the lecture

National Science Day

National Science Day was celebrated with a lecture on 'How to deliver technologies' by Dr K.A. Mohan, Biotechnologist and Chief Advisor, Rasi Seeds, Attur, Salem, on 28 February 2022. He highlighted the role of technology from the public and private sectors in the development of Indian agriculture. He narrated the success story of Bt cotton and its positive impact on cotton production and reduction in pesticide consumption. He also highlighted poor adoption of IPM strategy in bollworm resistance, resistance management in bollworm, ratooning of cotton and new sources of Bt genes. Dr Hemaprabha and Dr Viswanathan chaired the program.



Dr K.A. Mohan delivering the Science Day lecture

Cuttack Chapter

One field visit-cum- awareness program on 'Climate Smart Rice Farming' was organized on 17 February 2022 at Badakusunpur, Tangi-Choudwar block, Cuttack, in collaboration with ICAR-National Rice Research Institute. Dr Padmini Swain, Director, ICAR-National Rice Research Institute, was the chief guest. Different climate-smart agricultural practices such as wet-direct seeded rice using drum seeder, the system of rice intensification (SRI), mechanical transplanting, community nursery, drip irrigated rice, mulching for vegetable cultivation, alternating wetting and drying (AWD), sensor-based irrigation, real-time nitrogen management practices using CLCC and riceNxpert, traditional farmers' practices, and different crop diversification practices were demonstrated.

An awareness program was organized, and fertilizers, pesticides and herbicides were distributed to farmers.



Field day and awareness program by Cuttack Chapter

Hyderabad Chapter

Farmers' Training for Doubling Farmers' Income with IFS

Hyderabad Chapter, in association with ICAR-NAARM, organized a six-day training program in hybrid mode (in two phases) on 'Doubling Farmers Income with Integrated Farming Systems (IFS)' at Krishi Vigyan Kendra, Palem, Nagarkurnool, involving 90 farmers of three villages viz., Vanguroni, Kulmuloni and Agraharam Potlapally from two districts of Mahabubnagar and Nagarkurnool of Telangana during 4-6th and 10-12th January 2022. Dr Ch. Srinivasa Rao explained how to double the income following IFS technologies. Other topics covered relate to organic farming opportunities and the formation of commodity groups, self-help groups and farmer producing organizations.



Training for Doubling Farmers' Income with IFS

Livelihood Enhancing Skill Development Training for Rural Women

Hyderabad Chapter, in association with ICAR-NAARM and Krishi Vigyan Kendra (KVK), Yagantipalle organized a ten-day Skill Development Training Programme on 'Eco-Friendly Bag making' under SCSP for SC women from 7 to 18 February 2022 at KVK, Yagantipalle. A total of 20 women from Yanakandla and Yagantipalle villages of Bethamcherla Mandal of Kurnool district, Andhra Pradesh, were trained in bag stitching and a business plan for starting a bag-making enterprise. In his address, Dr Ch. Srinivasa Rao pointed out the harmful impact of plastic bags, emphasized the necessity of using eco-friendly bags, and urged the participants to form small groups and start their businesses with Eco-friendly bags making for sustainable development of their livelihood.



Livelihood Enhancing Skill Development Training for Rural Women

National Science Day

Hyderabad Chapter, in association with ICAR-NARM and Samskuthi Foundation, Hyderabad organized 'National Science Day' on 28 February 2022 on this year's theme 'Integrated Approach in Science and Technology for a Sustainable Future'. Around 200 UG and PG students from seven engineering colleges participated. While speaking on the occasion, Dr Ch. Srinivasa Rao explained how agricultural engineering, farm mechanization, and food processing are gaining importance. Highlighting the importance of science and technology, he quoted the example of Bharath Biotech's journey and its vaccine in managing the Covid-19.

Mentoring Government High School Students on Nutrition Aspects

As part of activities involving students, the Hyderabad Chapter, in association with Madhumitha Foundation,



National Science Day

Suryapet, Telangana, organized an interactive program for students of 9th and 10th classes from the Zilla Parishad High School and Kodakandla Model School from Jangaon district of Telangana on 10 March 2022 at ICAR-NAARM, Hyderabad. Dr Ch. Srinivasa Rao motivated them to pursue science, especially agricultural science, as a career. During the interaction, the nutrition aspects of food systems covering kitchen gardens, leafy vegetables, traditional foods, millets, food losses were highlighted. He also enlightened students about the Swachcha Bharat Mission and the need for cleanliness in villages, and how they can help in these endeavours.

Interaction with School Students on Nutrition Aspects

Livelihood Enhancement Skill Development Training for Women Farmers on Jute Bags Making

Hyderabad chapter, in association with ICAR-NAARM and



Krishi Vigyan Kendra (KVK), Ghantasala, Krishna District, Andhra Pradesh, organized a five-day training program on 'Enhancing Livelihood of Women Farmers through Jute Bag Making' under the SCSP program for farmers of four villages, viz., Kuchhikayalapudi, Ramanapudi, Ghantasala and Thadepalli. Dr Rao stressed the opportunities for bio-degradable natural fibres and their benefits to the soil and environment. Dr K. Jhansi, Program Coordinator, KVK, Ghantasala highlighted the role of women farmers and sensitized them towards using jute fibre bags instead of plastic bags.



Training for Women Farmers on Jute Bags

NAAS Policy Paper 30 : Organic Farming was translated in Telugu. A bulletin containing profiles of Fellows and Associates of NAAS Hyderabad Regional Chapter has been compiled and published.



Pune Chapter

Panel Discussion on 'Climate Resilient Fisheries and Aquaculture'

Climate change has become a new reality of the 21st century. It is one of the most important global environmental challenges with implications for food production, including fisheries and aquaculture sectors. The abiotic stressors such as high temperature, soil salinity, acidity, nutrient deficiency, pollutants, drought, floods, etc., are aggravating due to climate change. Considering the importance of fisheries and aquaculture to food security and protecting the livelihoods of the fishing communities, it is important to develop a resilience strategy to the effects of climate change and adaptation to a changing climate.

The NAAS Pune Chapter organized a panel discussion on 'Climate Resilient Fisheries and Aquaculture' on 7 March 2022 in collaboration with ICAR-Central Institute of Fisheries Education, Mumbai. The program was convened by Dr H. Pathak, Director, ICAR-NIASM, Baramati and was coordinated by Dr K.K. Krishnani, Principal Scientist, ICAR-CIFE, Mumbai.

The panellists deliberated on the impacts of climate change on fisheries and aquaculture and the management strategies for adaptation and mitigation. The discussion also included the policy recommendation for the resilient climate fisheries in Maharashtra.



Climate Resilient Fisheries and Aquaculture

Fellows Views

Nutritional Security by Promoting Nutri Kitchen Gardens (Poshan Vatika)

Nutri kitchen garden is defined as the growing of nutrient-rich crops (fruits & vegetables) in the school compound, residential houses, or in their vicinity to meet the family's nutritive diet requirements all year round. Nutri kitchen garden is a cost-effective model to cultivate nutrient-rich crops for personal or community consumption to promote good health and well-being by providing micronutrients through a constant supply of fruits and vegetables. This concept can be promoted in urban areas through rooftop gardening, terrace gardening, vertical gardening and container gardening. Demonstration of Nutri kitchen garden in the rural areas, particularly in primary schools, will improve nutritional literacy among students. The produce of the Nutri kitchen garden will ensure the

availability of diversified vegetables and fruits for mid-day meals, addressing the micro and micronutrient deficiencies and hidden hunger in children and also help in improving immunity. Learning to eat healthy at a young age could decrease the risk of lifestyle diseases such as heart attack and diabetes later. Nutri kitchen garden provides better use of unoccupied areas lying vacant at schools, homes, Anganwadi, institutional compounds, etc. Moreover, the involvement of the students or family members for one to two hours daily in gardening helps build better inter-personal relations, besides giving the satisfaction of growing one's food, which brings a sense of control and calm.

Sudhakar Pandey, FNAAS

ICAR-Indian Institute of Vegetable Research, Varanasi

Forthcoming Programmes of NAAS

- Sustaining Pulse Revolution
- Impact of COVID-19 on Livestock (Animal Health and Dairy/Poultry/Meat/Feed Industry)
- Promoting Millets Production, Value Addition and Consumption
- Plant-based vs Dairy Milk: Myths and Facts
- Scaling up Innovative Agricultural Extension Models
- Public-Private Partnership in Agriculture: Current Opportunities and Challenges
- Seaweed Cultivation and Utilization
- Beyond Price Support and Subsidy
- Service Delivery Mechanisms in Livestock Sector

Obituary

Dr Virender Kumar Batish



The National Academy of Agricultural Sciences deeply condole the sad demise of Dr Virender Kumar Batish, a Fellow of the Academy and an outstanding scientist. In his illustrious career, he made immense contributions in the field of probiotics as biotherapeutics, molecular diagnostics (PCR, qPCR), recombinant proteins, genetics and molecular biology

of lactic starters.

Dr Batish left an indelible impression among agricultural scientists in various roles as a Scientist, Senior Scientist, Principal Scientist and Head of Dairy Microbiology Division and Emeritus Scientist (ICAR), ICAR-National

Dairy Research Institute, Karnal. Dr Batish was awarded DBT Long-term Overseas Associateship, 1986; UNDP, 1988; World Bank, 1995; DBT Short-term Overseas Associateship, 1998; and IIFS Vijay Shree Award, 2004; He was a Member of Biotechnology for Food and Agriculture Sectional Committee, BIS, FAD-23; Member, DBT Taskforce on "Food and Nutritional Security; and Member, Task Force on "Guidelines for Evaluation of Probiotics in Foods".

In his loss, the scientific community has lost a brilliant scientist, teacher, academician and 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 significant loss.

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

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