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From the President's Desk

Self-sufficient India in Edible Oil: Achievements and Way Forward

Oils extracted from plants are in use by human beings for various purposes since ancient times. Primarily these oils are used for edible purpose, though these are also used in medicines and pharmaceuticals, soaps and cosmetics, lubricants and fuels, pet foods, and for industrial use as an important component of many other products. Besides, their by-products are used as feed, manure and other industrial and domestic purposes. In India, both annual and perennial edible oilseed crops are cultivated. Annual edible oilseed crops include groundnut, rapeseed-mustard, soybean, sunflower, sesame, niger and safflower. Whereas, the perennial edible oil seed crops include oil palm and coconut. Edible oils are also produced domestically from secondary sources such as rice bran, cotton seed, corn, and other tree-borne oilseeds (TBOs), besides some minor oil producing species of forest origin.

Cultivation of oilseeds account for 17.9% of arable land and 14.3% of the gross cropped area in India. India, the 4th largest vegetable oil economy in the world, stands first in the production of castor, sesame, safflower, and niger oils, whereas second in groundnut, third in rapeseed mustard, fourth in linseed and fifth in soybean oil. About 14 million farmers are engaged in oilseeds production and another million in their processing. Among the edible oilseed crops, soybean (36%), groundnut (32%), and rapeseed-mustard (29%) contribute 97% of the total edible oilseeds production. Sesame, sunflower, safflower and niger contribute only around 3%. In contrary, the major contribution to domestic edible oil kitty comes from rapeseed-mustard (3.2 Mt, 45%), groundnut (1.8 Mt, 25%), and soybean (1.8 Mt, 25%) amounting for 95%, whereas sesame, sunflower, safflower and niger contribute to about 5% of the total domestic production of 7.03 million tons (Mt). Around 3.50 Mt of edible oils come from secondary sources (cotton seed oil, palm oil, corn oil, rice bran oil, coconut oil, and other TBOs). Currently, India is the world's top importer and second largest consumer country of edible oils in the world. During 2021-22, India imported 14.19 Mt of edible oils worth Rs. 1,66,427 crores, which is 55% of its total requirement, in which palm

oil commanded the largest share (57%), followed by soybean (29%) and sunflower (14%) oils.

Promotion of oilseeds

Government of India has taken several policy initiatives since 1986 as listed below for making the country self-sufficient in edible oil: **Technology Mission on Oilseeds (TMO)** was launched in May, 1986 with a view to increase production and productivity of oilseeds to make the country self-reliant. Subsequently, pulses, oil palm and maize were also brought under the ambit of the Technology Mission in 1990, 1992-93 and 1995-96, respectively and the mission was designated as **Integrated Scheme on Oilseeds, Pulses (1990), Oil Palm (1992-93) and Maize (1995-96) (ISOPOM)**

- **National Mission on Oilseeds and Oil Palm (NMOOP)** (2012-2017)
  - Mini Mission–I (Oil Seeds)
  - Mini Mission–II (Oil Palm)
  - Mini Mission–III (Tree Borne Oilseeds–TBOs)
- **Seed Hubs on Oilseeds:** A budget of **Rs. 50.91 crores** was allocated for 2018-19 and 2019-20
- **National Mission on Edible Oils - Oil Palm** (2021-22 to 2025-26)

Technology Mission on Oilseeds (TMO)

The TMO, 1986 was monitored by an Empowered Committee of Secretaries for the implementation of the integrated policy headed by Dr. M.V. Rao, the Special DG, ICAR (Mission Leader) in the rank of Special Secretary of Technology Mission on Oilseeds. Under this programme National Dairy Development Board (NDDB) played a significant role in the distribution of seeds, procurement of produce for oil extraction and further marketing, which fetched consistent price to the farmers. On Research and Development front, the mission focussed on the following objectives:

- Strengthening the infrastructure to support research on oilseed crops
- Increasing production and availability of seeds
- Organizing seed villages for production of seeds of groundnut and soybean
- Distribution of seed minikits to popularize new improved varieties
- Opening of additional retail outlets in remote areas
- Demonstration of improved technology in farmers' fields

The country attained near self-sufficiency in oilseeds in early 1990s due to the implementation of TMO. The area under nine annual oilseeds was 18.6 million ha (Mha), production 11.3 Mt and average productivity 607 kg ha^{-1} at that time. After a decade of the launch of TMO, in 1996-97, the area increased to 26.3 Mha, the production reached to 24.4 Mt, and the average productivity increased to 927 kg ha^{-1} (Table 1).

To encourage domestic production of oilseeds, the Government of India hiked the import tariff on edible oils. For example, crude palm oil duty was raised from 7.5% to 15% (in August, 2017) to 30% (in Nov, 2017), to 44% (from 1st March, 2018) and for refined palm oil it was raised to 54%. The import duty on crude sunflower and rapeseed-mustard oil was 25% and for refined oil it was 35%, while for the remaining edible oils it was 30% on crude and 35% for refined forms. Import duty on soybean seed was hiked from 30% to 45% while all other oilseeds have 30% import duty. In addition, the Government has also reinforced the Mission on Oilseeds concentrating on nine annual oilseeds, tree borne oilseeds and oil palm to enhance the domestic production of oilseeds. Consequently, the national acreage under the nine annual oilseeds increased by 15%, production by 31% and average productivity by 14% in 2022-23 as compared to those in 2016-17 (Table 1). The impact of liberalization of policies is clear from the data of edible oil imports given in Table 2.

Table 1. Area, production and productivity of oilseeds over the years

Year	Area (Mha)	Production (Mt)	Productivity (kg ha^{-1})
1950-51	10.73	5.16	481
1960-61	13.77	6.98	507
1970-71	16.64	9.63	579
1980-81	17.60	9.37	532
1986-87	18.6	11.3	607
		After TMO	
1990-91	24.15	18.61	771
1995-96	25.96	22.11	852
1996-97	26.34	24.38	927
1998-99	26.71	25.21	944
2000-01	22.77	18.44	810
2005-06	27.86	27.98	1004
2010-11	27.22	32.48	1193
2011-12	26.44	30.01	1135
2015-16	26.09	25.25	968
2016-17	26.18	31.28	1195
2017-18	24.51	31.46	1284
2018-19	24.79	31.52	1271
2019-20	27.14	33.22	1224
2020-21	28.83	35.95	1247
2021-22	28.95	37.96	1312
2022-23	28.85	40.90*	

**Third advance estimates*
Source: Directorate of Economics and Statistics, Dept. of Agriculture and Farmers Welfare, Govt. of India.

Establishment and strengthening of research institutes

After independence, the institutional development for organized crop-based research was a priority during different plan periods. For accelerating the research on different crop commodities, the All India Coordinated Research Projects (AICRP) for multi-location evaluation of varieties and technologies was started in 1957 with AICRP on Maize. During the same period, the Project on Intensification of Regional Research in Cotton, Oilseeds and Maize (PIRRCOM) was also established under the Indian Agricultural Research Institute (IARI), New Delhi with a number of centres across the country.

During 1960-70, AICRPs on a number of crops viz., rice, cotton, pearl millet, small millets, etc. were commenced to generate improved breeding materials, crop production, and protection technologies and their testing in multi-location trials. The concept of the AICRPs, which are now 60 in number (22 being in the Crop Science division), has been one of the structural contributions in the field of organization and management of multi-location trials in agricultural research. Subsequently, during 1967, All India Coordinated Research Project on Oilseeds (AICRPO) including groundnut, rapeseed-mustard, linseed, sesame, and castor was established at IARI, New Delhi and in 1972, sunflower, safflower and niger were also added to the AICRP-Oilseeds. Research on soybean was initiated separately during 1967. Later on, more institutes were established for undertaking crop based coordinated research, besides other crop institutes undertaking basic and applied research on oilseed crops.

Major achievements in research on oilseeds

- **Varietal improvement:** Concerted research in the ICAR institutes and AICRPs led to the development of improved varieties/hybrids with higher yield, earliness in maturity, photo-thermo-insensitivity, amenability to mechanization, superior oil quality, tolerance/resistance to major abiotic and biotic stresses, etc. This resulted in notification of 1005 high-yielding climate-resilient varieties/hybrids of nine annual oilseeds for cultivation during 1969-2023, of which 343 varieties/hybrids of the oilseeds comprising 80 of Soybean, 55 of Groundnut, 49 of Indian Mustard, 40 of Linseed, 23 of Sesame, 21 of Safflower, 18 of Sunflower, 15 of Castor, 13 of Toria, 10 of Niger, 7 of Gobhi Sarson, 5 of Yellow Sarson, 3 each of Brown Sarson and Taramira, 1 of Karan Rai were notified during 2014-2021.
- **Breeding climate resilient varieties:** Out of 343 varieties, 319 are tolerant to one or more biotic and/or abiotic stresses such as drought, salinity, heat etc. This includes 22 drought/moisture stress /water stress tolerant varieties of soybean (5), groundnut (4), sesame (2), Indian mustard (6), niger (1), toria (3), and Taramira (1); five salinity/alkalinity/sodicity tolerant varieties of Indian mustard; and six heat stress/ high temperature tolerant varieties of sesame (1), Indian mustard (4), and yellow sarson (1). These varieties have been bred through precision phenotyping techniques and can be deployed in the areas where these abiotic stresses are recurring frequently.
- **Genetic enhancement for higher productivity:** The average national productivity of nine annual oilseeds has increased from 0.48 t ha^{-1} in 1950-51 to around

Table 2. Domestic production and import of oilseeds over the years

Year	Oilseeds Production# (lakh ton)	Domestic Availability of Edible Oils@ (lakh ton)	Imports of Edible Oils* (lakh ton)	Total Availability/ Consumption (lakh ton)	Self-sufficiency (%)	Share of Imports (%)
1986-87		38.7	14.7	53.4	72.0	28.0
			After TMO			
1990-91	186.1	63.7	5.3	69.0	92.0	8.0
1994-95	213.5	71.9	3.5	75.4	95.0	5.0
1995-96	221.1	64.7	11.6	76.3	85.0	15.0
2000-01	184.4	55.0	41.8	96.8	57.0	43.0
2005-06	279.8	83.2	42.9	126.0	66.0	34.0
2010-11	324.8	97.8	83.7	181.5	54.0	46.0
2015-16	252.5	86.3	148.5	234.8	36.8	63.2
2020-21	359.5	111.5	134.5	246.0	45.3	54.7
2021-22	379.6	116.5	141.9	258.4	45.0	55.0
2022-23	410.0**	123.3**	155.3$	278.6	44.24	55.76

*Source: #Directorate of Economics and Statistics, DA&FW; @Directorate of Sugar and Vegetable Oils of the DFPD; *Directorate General of Commercial Intelligence & Statistics, Ministry of Commerce; **As per 3rd Advance Estimate, DA&FW; $Import period from 1st April 2022 to 31st March, 2023).*

1.30 t ha^{-1} in 2022, mainly due to development and deployment of high-yielding varieties/hybrids and crop management technologies. High genetic potential of the newly developed varieties/hybrids of the annual oilseeds such as rapeseed-mustard (3.0-3.5 t ha^{-1}), groundnut (3.5-4.0 t ha^{-1}), soybean (2.2-2.8 t ha^{-1}), castor (3.0-3.5 t ha^{-1}), sunflower (2.0-2.5 t ha^{-1}), sesame (1.0-1.5 t ha^{-1}), safflower (1.0-1.2 t ha^{-1}) can be exploited to further enhance the realized productivity at the farmers' fields.

Demand and domestic production in oilseeds

Despite the increase in production and productivity, the import of oilseeds has increased over the years to meet the growing requirements (Table 2).

- The major factors contributing to the mismatch between domestic production and demand of edible oils are the increase in population from around 361 million during the 1950s to 14280 million in 2022. Likewise, during the same period, the average per capita consumption of edible oil increased more than six folds from around 2.9 kg/year to 19.5 kg/year (Table 3).
- Consequent upon the WTO agreement, there was a downward trend of import duty on the vegetable oil during 1994-2000, and the compound annual growth rate for area and production of the nine annual oilseeds was -0.84% and 0.60%, respectively. During 2000-2008, with a high import duty regime the compound annual growth rate for area and production of nine annual oilseeds increased to 2.3% and 7.1%, respectively.
- The mismatch of the domestic production and demand could also be due to the dilution of the TMO as it was redesignated as TMOP with inclusion of pulses and then ISOPOM including pulses and maize from 1995-96.
- Presently, India produces nearly 45% of its total demand for edible oils domestically and imports 55%.

Table 3. Increase in population and oil consumption over the years

Year	Population (million)	Oil consumption (kg/person/year)
1950-1960	361.1	2.9
1960-1970	439.2	3.1
1970-1980	683.3	3.34
1980-1990	846.4	5.26
1990-2000	1028.7	8.03
2000-2010	1210.9	12.42
2010-2020	1320.0	17.07
2022-2023	1428.0	19.50

Source: Yadava et al. (2022) Current Science, 123.

The *per capita* consumption of edible oils was less than 4.0 kg/year during 1961-62 which was enhanced to 6.4 kg/year during 1990-91, to 15.8 kg/year in 2012-13 and is currently more than 19.5 kg/year, widening the demand and supply gap. The demand for edible oil was 25.84 Mt in 2021-22 against the total domestic production of 11.65 Mt, which necessitated an import of around 14.19 Mt (palm oil about 60%; soybean oil 25%; sunflower 12% and others 3%) costing a huge burden to the national exchequer.

Productivity of oilseeds in India and the world

Productivity of the oilseed crops in India is significantly lower than the global average and world's best yields, except for groundnut. Shorter life span of Indian varieties in comparison to many of the high productivity countries, low seed replacement rates and prevalence of spurious seeds are some of the contributing factors. Occurrence of various biotic and abiotic stresses also hinder the realization of genetic potential and lead to fluctuation in production and productivity.

The major oilseed producing states are Madhya Pradesh, Maharashtra and Rajasthan (soybean); Gujarat, Andhra Pradesh, Rajasthan, Tamil Nadu, and Karnataka (groundnut); Rajasthan, Madhya Pradesh, Uttar Pradesh, West Bengal and Haryana (rapeseed-mustard); Madhya Pradesh, Uttar Pradesh, Rajasthan and Gujarat (sesame); Karnataka (sunflower); and Maharashtra and Karnataka (safflower). The yield gaps ranged from 37 to 71% in major oilseeds (Groundnut, Soybean and Rapeseed-mustard) with an average of 65%,and the maximum yield gap among minor oilseeds is in sunflower (160%). Therefore, production of edible oilseeds in India could be enhanced substantially by bridging the yield gap by technological interventions, even without the expansion of area under cultivation.

Achieving self-sufficiency in oilseeds: Way forward

There is a high potential to reduce the dependency on the imports and achieve the self-sufficiency in oilseed, by focussing on the priority areas of research, development and policy interventions, as presented below:

1. Research

- **Development of high yielding and improved quality varieties for specific traits**
  - **Mustard:** Oil content and oil quality (low erucic acid and low glucosinolates, high oleic acid), Orobanche resistance, Sclerotinia resistance, and identifying potential male sterility systems for hybrids.
  - **Soybean:** Oil content, oil quality (KTI free and lox2 free, high oleic acid), herbicide tolerance, water logging tolerance.

- **Groundnut:** Oil quality (high oleic acid), drought tolerance, resistance to leaf spot and rust, aflatoxin resistance.
- **Sunflower:** Oil quality, heat and drought tolerance, resistance to rust, verticillium wilt and powdery mildew.
- **Safflower:** Hybrids for higher yields.
- **Sesame:** Resistance to Phyllody and other diseases.
- **Castor:** Non-toxic castor line (Ricin and RCA free).
- **Linseed:** Removal of anti-nutritional factors, and high oleic acid, balanced linolenic: linoleic ratio for better shelf life.
- **Oil palm**: Palms with high yield, lower height and resistant to basal stem rot.

- **Breeding for water and nutrient use efficient varieties/hybrids:** The varieties with higher water and nutrient use efficiency need to be given priority in combination with the above mentioned traits for saving the valuable resources and reduce the cost of cultivation.
- **Hybrid development:** Special network on "Development of hybrids in oilseed crops" with sufficient budget provision.
- **Use of diverse exotic germplasm:** Exploring more heterotic and diverse global germplasm in all oilseed crops
- **Creation of genetic diversity using crop wild relatives (CWR):** Pre-breeding for genetic variability and introgression of resistant genes using modern biotech tools.
- **Use of modern biotech tools:** Transgenic approach, genome editing and genomic selection, rapid generation advancement system for faster and targeted results.
- **Oil palm:** Research on niche areas like tissue culture, seed gardens, cropping systems, water and nutrient use efficiency, effect of climate change on regulatory processes during ripening.

2. Development

- **Revamping of seed system in oilseeds:** Strengthening the current seed production and delivery system is needed to ensure sufficient quantity of quality seed of newly released and notified varieties. For this robust State Seed Rolling Plans are required focussing on enhanced Seed and Varietal Replacement Rates and Phasing out the old and un-notified research varieties/ hybrids from the seed system. Varietal replacement rates (<10 years old varieties in seed chain) of different oilseed crops has been enhanced to a satisfactory level in the breeder seed indents with concerted efforts during the last five years.
- **Promotion of new varieties:** Popularization of newly released HYVs with climate resilience and improved quality traits are needed through large scale demonstrations/cluster demonstrations/ mini-kits, by mapping the areas suitable for specific varieties. Public-private partnerships, which have proven to be a successful model to spread and popularise newly released public sector varieties in cereals, may be adopted in case of oilseeds. Keeping the high potential of mustard, special promotion programmes should be launched for released and notified varieties of mustard with average yield of >2.5 t ha^{-1}.
- **Area expansion for achieving the targets**
  - **Non-traditional areas:** Growing of mustard in southern states,soybean in rice-fallow of NEH and paddy areas in Odisha and Chhattisgarh.
  - **Crop diversification:** Castor and soybean in northern states under crop diversification .
  - **Cropping system:** Mustard, sunflower, sesame in NEH states under rice fallow

3. Policy interventions

- On the lines of the first TMO, independent establishment for implementation and monitoring of National Mission on Edible Oils - Oil Palm, delinking from present NFSM.
- Major responsibility for quality seed production to National Seed Corporation Ltd. with advance MoUs with states and other agencies, abolishing the tender system.
- Establishment of more number of seed hubs on edible oilseeds, especially groundnut and soybean at KVKs/SAUs with guidelines for inbuilt collaboration with the states.
- Support for farm mechanization for major operations, micro-irrigation systems to combat recurring drought and storage facilities at village level.
- Development of value chain by establishing small oil extraction plants for enhanced income and rural youth employment under "Make in India" initiative.
- Consistent procurement on MSP or implementing "*Bhavantar Yojna*" in all the states.

Acknowledgement: The input from Dr. D.K. Yadava, ADG (Seed), ICAR, New Delhi is sincerely acknowledged.

Himanshu Pathak
President

Executive Council Meetings

131st Meeting

The 131st Meeting of NAAS Executive Council was held in hybrid mode at 10.00 A.M. on 29th April 2023 under the Chairmanship of Dr. Himanshu Pathak, President NAAS.

The President emphasized the need to enhance the activities of the Academy with closer interphase with the teachers, students, farmers, industry representatives and media to broaden its horizon and increase visibility. He informed the EC that the presentation about the activities and achievements of NAAS made by Dr W.S. Lakra, Secretary, NAAS during the ICAR Directors' and VC's Conference was much appreciated.

Taking a new direction, it was decided that henceforth Panel Discussions on important issues will be held during the Foundation Day Celebrations in place of the presentations of the newly inducted Fellows. This year the panel discussions will be held on 4 June on:

1. Roadmap for Agricultural Research, Education and Extension for Amrit Kaal -2047
2. Empowering SAUs to Meet the Emerging Challenges in Agriculture.

It was proposed to invite a progressive farmer, SAU representative (President IAUA) and industry leader as special invitees in the EC Meetings with no voting rights. The President will be authorised to nominate suitable persons based on the suggestions received from the Fellowship.

It was also decided that NAAS should bring out publications on (i) State of Indian Agriculture and (ii) Indian Agriculture in the Amrit Kaal: The Road Map'. A Committee was constituted under the Chairmanship of Dr. Anil K. Singh, Vice President NAAS, to deliberate on the feasibility and modalities of probable changes in rules and bye-laws in order to implement new changes.

In addition to the listed agenda items, Dr. Gopalakrishnan, Director, ICAR-CMFRI, Kochi apprised the committee about progress related to the preparations of the XVI ASC.

132nd Meeting

The 132th Meeting of NAAS Executive Council was held in hybrid mode at 3.30 PM on June 3, 2023 under the Chairmanship of Dr. Himanshu Pathak, President NAAS. At the outset the President welcomed all members present and emphasised the need to broaden the scope and reorient Academy's activities.

After reviewing the preparations for the XVI ASC, approved Agenda Items were taken up for discussion. Recommendations of the Committee chaired by Dr. AK Singh to review and suggest changes in the Objectives and the Bye laws of the Academy to introduce new categories and criteria for inducting Fellows were presented and deliberated upon. It was decided that the proposals for change will be put up to the General Body for its approval.

As discussed in the earlier EC meeting, it was decided that two publications (i) the State of Indian Agriculture and (ii) Indian Agriculture in the Amrit Kaal: the Road Map' will be brought out by NAAS. Of these the State of Indian Agriculture will be published annually to be released on 1st of January every year. Dr. Anjani Kumar and Dr P.K. Joshi were entrusted with the responsibility to develop these documents, respectively. Thereafter, the Secretary and the Treasurer outlined the reports and resolutions to be presented before the General Body for approval. The EC was informed about the appointments of the new Executive Director and an Editorial Manager.

Meeting of the Conveners of the Regional Chapters

A meeting of the Conveners of Regional Chapters, was held under the chairmanship of the President Dr. Himanshu Pathak on June 3, 2023 in hybrid mode to review the progress of their activities. Four conveners Dr. U.K. Behera, RC, Barapani; Dr. A.K. Patra, RC, Bhopal; Dr. Biswapati Mandal, RC, Kolkata, and Dr. A.S. Dhatt, RC, Ludhiana were present physically, while others participated online.

All Chapter Conveners presented an overview of their chapters' activities and future plans.

Concluding the discussions, President Dr. Himanshu Pathak, suggested a target-oriented approach for regional chapters each year. He proposed identifying 4-5 essential activities that every chapter should undertake. Additionally, he proposed adopting a theme for each year, such as declaring 2023 as the "Year of Millets." He also emphasized the need for brainstorming sessions concentrated entirely on regional issues.

30th Annual General Body Meeting

The 30th Annual General Body Meeting of the Academy was organized in hybrid mode under the chairmanship of the President Dr. Himanshu Pathak, on June 5, 2023 at 9.30 a.m.

At the outset, a moment of silence was observed in remembrance of nine esteemed Fellows of NAAS, Dr. Yogendra Alagh, Dr. Chitranjan Bhatia, Dr. Devkinandan Kamra, Dr. Ajay kumar Paridha, Dr.Nipendrakumar Roy, Dr. Rajendra Nath Sahaney, Dr. B.N. Singh, Dr. Keerti Singh, and Dr. D.P. Ray who left this world since the last GB.

Dr. W.S. Lakra, Secretary then welcomed the President, Dr. Himanshu Pathak, the Immediate-Past President, Dr. T. Mohapatra, all Office Bearers and EC members, as well as all the esteemed Fellows who were attending the AGM.

Dr. Himanshu Pathak, President of the Academy, also extended a warm welcome to all the esteemed Fellows present at the Annual General Body meeting as well as the newly elected Fellows and Associates.

Thereafter the agenda as listed, were taken up by the Secretary, Prof. K. C. Bansal, who mentioned that the Academy organized all the scheduled meetings and committed activities during the year, which included 11 Brainstorming Sessions, and several strategy workshops, consultation meetings and round table discussions. He also informed that in 2022, 34 new Fellows, including 2 Foreign Fellows and 3 Pravasi Fellows, were inducted and 10 Associates were selected, bringing the total number of Fellows to 760 and total number of Associates to 114 as on 1st January 2023.

The GB was informed that the Academy published 4 strategy papers (No. 15 to 18), 14 Policy Papers (No. 107 to 120) and 2 Policy Briefs (No. 12 & 13) and 4 issues of the NAAS News during the year. All 4 numbers of NAAS Official Journal 'Agricultural Research' were printed in time with the help of Springer India Pvt. Ltd. As decided in the EC meeting, two panel discussions were held, in place of presentations by the newly-elected Fellows, on June 4, 2023 on the topics of "Roadmap for Agricultural Research, Education and Extension for Amrit Kaal -2047" and "Empowering Agricultural Universities to meet the emerging challenges in Agriculture". This year's Foundation Day Lecture was delivered by Shri B.V.R. Subrahmanyam, IAS, Chief Executive Officer, NITI Aayog and addressed by the Chief guest Prof. Ramesh Chand, Hon'ble Member, NITI Aayog.

Two meetings with Foreign and Pravasi Fellows were held on July 1, and July 5, 2022. On May 22, 2022, a session titled "Global Genebanks and Biodiversity Management for Sustainable Agriculture" was held to commemorate International Biodiversity Day, and a special lecture by Mr Kent Nnadozie, Secretary of the International Treaty, FAO, Rome on "The International Governance of Plant Genetic Resources for Food and Agriculture: The Role and Place of the International Plant Treaty" was organized on Sept 15, 2022.

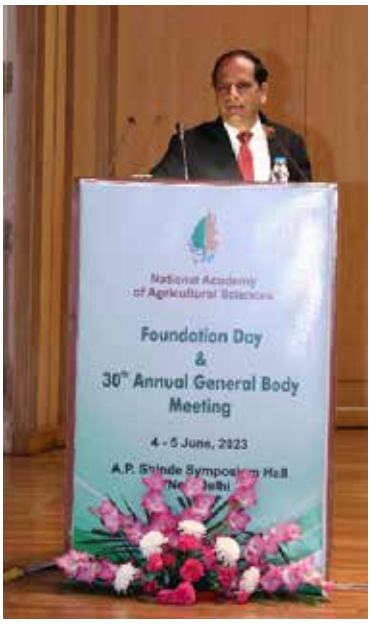
The newly elected Fellows and Associates were admitted to the Academy, and Young Scientist Awards were presented. Thereafter, 2023 Padma Awardee Fellows, Dr. Arvind Kumar, Dr. Bakshi Ram, and Dr. M.V. Gupta; two outstanding farmers, Sh. Sultan Singh

and Sh. Bharat Bhushan Tyagi; two distinguished industry representatives, Sh. Raju Barwale and Dr. M. Ramasami; two notable media persons, Sh. Harish Damodaran and Dr. O.P. Yadav; and three NAAS Fellows, Prof. Rajeev K. Varshney, Dr. Abdelbagi M. Ismail and Dr. Uma Shankar Singh; who received very high international recognitions, were felicitated.

The XVI Agricultural Science Congress is scheduled to be held from Oct 10-13, 2023 at ICAR-Central Marine Fisheries Research Institute, Kochi. The theme of the Congress is 'Transformation of Agri-Food Systems for Achieving Sustainable Development Goals'. The Fellowship was invited to join the Congress.

Presidential Address

Dr. Himanshu Pathak, President, NAAS and Secretary, DARE & DG, ICAR in his address to the Fellowship, emphasized the challenges before the Academy and the need to relook its programmes in 2023 to address the current issues. He suggested that the Academy may focus on identifying a specific theme with a special relevance each year, such as the opportunities and challenges in mainstreaming millets



as the theme in the Year 2023, and organize one big event to deliberate on the theme holistically. He also expressed the need to organise the Agricultural Science Congress annually, instead of bi-annually. The Academy should reorient its activities to make publications on current issues more frequent, and bring out a concise publication on the "State of Indian Agriculture" to be released on January 1st every year. He further emphasised on fostering close linkages and active collaboration with other scientific journals and scientific academies for quality publications.

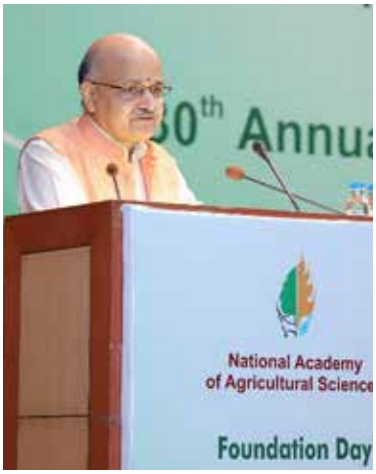
Similarly, the association between the NAAS and PAAS need to be enhanced, and the academy should attract and encourage more students through fellowships, internships, and visits to advanced laboratories. It is desired that the academy increases its engagements with print, social, and electronic media of repute, to convey important science-backed ideas, concepts and policy inputs to the wider community. Brainstorming sessions should be held to encourage participation from a wider audience, including teachers, industry partners and other stakeholders.

The Academy needs to promote most activities, correspondence and publications through online processing to save time and resources and to make the system more efficient, including journal ratings. He also recommended the use of social media to improve communication and promote transparency within the esteemed scientific community. The President invited suggestions from the esteemed Fellowship for generating resources to strengthen the Academy and improve its function further.

Foundation Day Lecture

Foundation Day Lecture 2023

The Foundation Day lecture was delivered by Shri B.V.R. Subrahmanyam, IAS, Chief Executive Officer of NITI Aayog on June 5th, 2023. During his lecture, he shed light on India's remarkable achievements in the field of agriculture and emphasized how these advancements can pave the way for India's transformation into a Global Leader in agriculture. Shri Subrahmanyam presented compelling data indicating that India has the potential to feed half of the world's population, and highlighted the significance of the agricultural sector for the nation's prosperity. Shri Subrahmanyam also addressed the challenges that lie ahead, stressing upon the importance of tackling issues such as fisheries and animal farming. He pointed out that these areas require special attention and innovative solutions for better returns. Further, he emphasized the need for a dynamic system of research in the agricultural sector, elucidating the significance of continuous innovation and adaptation to overcome the challenges faced by the industry. His lecture provided a holistic view with valuable insights into India's agricultural achievements, its potential as a global leader in food production, and the steps needed to ensure sustainable growth in the sector.



Prof. Ramesh Chand, a distinguished member of NITI Aayog, and the Chief Guest, shared valuable insights on the role of agriculture in achieving the goal of *Viksit Bharat* (Developed India). He highlighted the need for sustainable methods, more productivity, and better market access to fulfil the rising demand for organic products. Prof. Chand acknowledged the need for a balance between technological progress and job creation. He emphasized the importance of nurturing manufacturing sectors that can provide quality employment opportunities while leveraging technology to enhance productivity and competitiveness.

NAAS Programmes

Expert Consultation on Clean Plant Programme (Convener: Dr. V. K. Baranwal)

NAAS organized an expert consultation in hybrid mode on 03.04.2023 under the chairmanship of Dr. Himanshu Pathak, President, NAAS, to discuss the implementation of **"Atamanirbhar Bharat Clean Plant Programme"** announced in the Union budget of the Govt. of India during 2023. The consultation was convened by Dr. V.K. Baranwal in which 81 NAAS Fellows and experts from ICAR Institutes, Agricultural/Horticultural Universities, and private sector participated and provided their valuable inputs.

The programme aimed at production of clean planting material for perennial and clonally propagated fruit crops including grape, apple, and citrus, where the demand for planting material is very high. For instance, in grape alone 50 lakhs planting material are required every year, but certified clean planting material are not available to the growers.

The deliberations led to following recommendations:

- In the view of huge demands for planting materials of clonally propagated fruit crops and the high risk posed by the viruses, a Clean Plant Programme is urgent needed.
- An apex body for clean plant programme (CPP) through a National Centre for Clean Plant Programme (NCPP), and a Management Cell need to be established for smooth operation of clean plant programme.
- Crop-wise Clean Plant Centers (CPC) may be established at ICAR Institutes or Agricultural/ Horticultural Universities which should have trained scientists in virology, and tissue culture, necessary laboratory set-up and required land for constructing green houses / net houses, if not existing.
- Clean plant centers should provide clean planting stocks to certified nurseries for further

maintenance, multiplication and distribution of plants to the growers.

- By making available sufficient quantities of disease free, quality planting material of fruit plants, this programme will help achieve higher incomes to farmers in terms of higher productivity and better quality to consumers and potential to earn foreign exchange through export

Panel Discussions

Two Panel Discussions were organized on the "Road Map for Indian Agricultural Research, Education and Extension for Amrit Kaal 2047" and "Empowering SAUs to Meet the Emerging Challenges in Agriculture" on 4th June 2023 under the chairmanship of Dr Himanshu Pathak, President, NAAS and Secretary, DARE and DG, ICAR. Dr. Anil K. Singh, Vice President, NAAS co-chaired the sessions. In his opening remarks, the Chairman apprised the Fellowship that this is one of the new initiatives taken by the Academy as a part of the Foundation Day celebrations, to discuss the key issues affecting agricultural research, education and extension.

Road Map for Indian Agricultural Research, Education and Extension for Amrit Kaal 2047 (Convener: Dr. P.K. Joshi, Former Director - South Asia, IFPRI)

Discussion area	Panellists
Agricultural Research	• Dr. N.K. Singh, National Professor B.P. Pal Chair, NRCPB • Dr. G. Taru Sharma, Director, NIAB • Dr. H.P. Singh, Former DDG (Hort.), ICAR • Dr. J.K. Jena, DDG (Fish.), ICAR • Dr. N.K. Tyagi, Former Member ASRB • Dr. V. Prakash, Former Director, CFTRI
Agricultural Education	Dr. R.C. Agrawal, DDG (Agril. Education), ICAR
Agricultural Extension	Dr Shaik N Meera, ATARI
Agricultural Policies	Dr. Pratap S. Birthal, Director, NIAP Dr. Rajendra Prasad, Director, IASRI

Dr PK Joshi flagged the key challenges and opportunities before Indian agriculture and emphasized the important role of agricultural research, extension and education in meeting the aspirations for the Amrit Kaal, as envisioned by the Hon'ble Prime Minister for India to emerge as a developed nation by 2047, when it celebrates its hundred years of

independence. Therefore, agricultural research, education and extension need to address future challenges supported by appropriate policies, to harness the opportunities in next twenty-five years. The views presented by the key panelists were deliberated further.

It was proposed that the national agricultural research and education system should have some flagship programs, such as, (1) characterization of available plant, animal, fish and microbes' genetic stocks; (2) harmonization of water-food-energy (WEF) nexus ensuring integrity of ecosystem; (3) promotion of bio-circular economy in agriculture; (4) productivity enhancement through mechanization of agriculture and food system; (5) 3-D ocean farming; (6) improvement of genetic potential and animal health; (7) application of disruptive agricultural technologies; (8) sustainable approaches for Himalayan agriculture; (9) one-health-one-world approach; (10) sustainable and climate resilient agricultural systems; and (11) smart peri-urban agriculture.

To achieve the goals of Amrit Kaal in agriculture we must do the following:

- Develop and prioritize clear goals and targets
- Allocate sufficient financial resources to high priority areas
- Develop state-of-the-art scientific research infrastructure
- Upgrade knowledge and skills of scientists to keep pace with rapidly changing developments
- Build multi-disciplinary and multi-institutional partnerships
- Collaborate with advanced research and educational institutions at national and global levels
- Reform agricultural education and agricultural extension system
- Adopt differentiated and disaggregated approach to develop improved technologies, and
- Bring policy reforms to effectively implement the necessary changes in the structure of agricultural research, education and extension system.

Empowering SAUs to Meet the Emerging Challenges in Agriculture (Convener: Dr. K.M. Bujarbaruah, Former VC, AAU Jorhat & Vice President NAAS)

Panellists

- Dr. R.C. Aggarwal, DDG (Edu.) ICAR
- Dr. Ashok K. Singh, Director-cum-VC, IARI, New Delhi
- Dr. Triveni Dutt, Director-cum-VC, IVRI, Izatnagar
- Dr. Dheer Singh, Director-cum-VC, NDRI, Karnal
- Dr Anupam Mishra, VC, CAU, Imphal, Manipur
- Dr. Inderjeet Singh, VC, GADUVASU, Ludhiana

The Convenor and the panellists emphasized the urgency to empower the state agricultural, veterinary, and fishery universities along with central and deemed universities, to address the challenges in agriculture for ensuring food and income security.

To achieve the status of a developed nation, we need to focus on agriculture, industry, and other sectors with young, techno-savvy and innovative minds.

However, this dream can only be realized if the 21st-century knowledge, technology, skills, human values, and visioning/analytical powers are ingrained in our education system for preparing the world class human assets. Many talented youths are leaving the country in search of better education, thereby, benefiting other countries while trying to outperform their countrymen. Foreign universities are targeting India to establish world-class learning institutions due to the gap in quality education infrastructure in their country.

To address the emerging challenges in agriculture, proper focus is needed on agricultural education to nurture and prepare science, industry, and society-ready students. State/DUs and Central Agricultural Universities are at the forefront of agricultural knowledge dissemination, and it is crucial to empower them to meet the current and impending challenges. As the teachers will play a vital role in imparting education not only on subject knowledge, but also on the cognitive skills (critical thinking and problem-solving) and soft skills (social and emotional skills, cultural awareness, empathy, perseverance, teamwork, leadership), necessary pedagogic skills will also be required for them.

The following key recommendations emerged from the discussions:

- Aligning agricultural education with the National Education Policy
- Fostering inter-university collaboration
- Globalisation of educational institutions
- Promoting public-private partnerships
- Additional support from ICAR, and
- Addressing autonomy and regulatory challenges with IAUA for the growth of agricultural universities.

Activities of the Regional Chapters

Bengaluru Chapter

- The NAAS Bengaluru Chapter organized an exposure visit for 30 MSc students from the Department of Biotechnology and Microbiology, East West First Grade College of Science, Bengaluru at ICAR-National Institute of Animal Nutrition and Physiology, Bengaluru on 12 May 2023. The scope of Agricultural Biotechnology and Microbiology for higher studies and career opportunities were explained to the students.

- During the reported period, the NAAS Policy Papers No 96 (Livestock Improvement through Artificial Insemination) and 103 (Antimicrobial Resistance) were translated and printed in Kannada language, and released by the honourable President of NAAS Dr Himashu Pathak and other dignitaries on 3rd June at New

Delhi during the meeting of the Convenors of the Regional Chapters.

- A lecture was also delivered by the Convener of the Chapter Dr Raghavendra Bhatta on Agricultural Science for Higher Education and as career option to about 250 students at Standard School, Bangalore (Rural) on 26th May 2023.

Coimbatore Chapter

- A function was organized by the NAAS Chapter, Coimbatore to felicitate NAAS Fellow Dr. Bakshi Ram, Former Director, ICAR-Sugarcane Breeding Institute, Coimbatore, on being conferred with Padma Shri award in the field of Science and Engineering for his outstanding contributions in sugarcane breeding.
- A brainstorming session on "Sugarcane scenario : research and industry perspective", was held at ICAR-Sugarcane Breeding Institute, Coimbatore on 10.05.2023. Delivering the Inaugural address, Dr. T.R. Sharma, DDG (CS), ICAR lauded the work of scientists of ICAR-Sugarcane Breeding Institute and desired that they focus on developing climate resilient varieties having high water-use and nutrient-use efficiency, deploy gene editing, improvise the technologies available for inter-cropping sugarcane with oil seeds & pulses and also developing appropriate machinery for mechanical harvesting, The eminent participants included Dr G. Hemaprabha, Convenor of the Coimbatore Chapter and Director, ICAR-SBI, Coimbatore, Dr. Bakshi Ram, Dr. R.K. Singh, ADG (CC), ICAR, Dr. D.K. Yadava, ADG (Seeds), ICAR, Dr. M. Manickam, CMD, Sakthi Sugars Ltd., Dr R. Viswanathan, Director, ICAR-IISR, Lucknow, Shri M. Silvester, VP, South Indian Sugar Mills Association – TN.
- An awareness programme on Natural resource conservation under Azadi ka Amrit Mahotsav was organised on 26 May, 2023. A talk was delivered on 'Reviving water bodies' by Sh. R. Manikandan, Co-ordinator, *Kovai Kulangal Pathukappu Amaippu* & *Jal Shakti* Award winner, 2019.
- An awareness programme was organised on 30 June, 2023 in collaboration with ICAR-SBI, Coimbatore to manage a new phenomenon of combined incidence of crown mealy bug and Pokkah disease, affecting the sugarcane crop in some parts of Tamil Nadu, which was attended by farmers from Sethiathope, TN.

Hyderabad Chapter

- NAAS Regional Chapter, Hyderabad in association with ICAR-NAARM, Hyderabad celebrated the International Day for Biological Diversity on the theme "From Agreement to Action: Building Back Biodiversity" on 22nd May, 2023. On this occasion, an Online lecture on 'Silk Diversity Conservation for Socioeconomic Sustainability of Poor Farmers' by Dr. N.K. Krishna Kumar, Former DDG (Hort.), ICAR was organized in a special session chaired by Dr. A.K. Singh, Vice President, NAAS and Former DDG (NRM) and co-chaired by Dr. B. Venkateshwarlu, Former VC, VNMKVP, Parbhani, Maharashtra. Seventy

participants from various ICAR institutions, SAUs, NAAS Regional Chapter-Hyderabad Fellows and Associates participated virtually.

- Hyderabad Chapter in association with ICAR-NAARM celebrated the World Milk Day with the theme "Showcasing how dairy is reducing its environmental footprint, while also providing nutritious foods and livelihoods" on 1st June, 2023. On this occasion, an Online lecture on 'Global Food Security: Role of Milk and Milk Products' by Dr. Dheer Singh, Director & Vice Chancellor, ICAR-National Dairy Research Institute, Karnal was organized in a special session chaired by Dr. Ch. Srinivasa Rao, Convener, NAAS-Hyderabad Chapter and Director, ICAR-NAARM. A total of 75 participants from various ICAR institutions, SAUs, NAAS, Fellows and Associates of NAAS Regional Chapter, Hyderabad and NAARM faculty members attended the lecture session virtually.

The following recommendations emerged from the discussions:

- Focus should be given to selection of efficient & eco-friendly dairy animals.
- Novel manure management strategies need to be promoted at grassroots level.
- Adoption of point of care technologies for animal health and dairy product
- Alternative methods for animal disposal to be innovated.
- Promotion of both bovine & non-bovine milk to attain nutritional security.
- Awareness programs to be conducted on health related aspects of dairy food consumption.

Karnal Chapter

- National Academy of Agricultural Sciences (NAAS) Karnal Regional Chapter, in association with ICAR-National Bureau of Animal Genetic Resources, Karnal organised a Special Brain storming session on May 30, 2023 under its program of "Application of gene technology for improvement of indigenous breeds under local field conditions". Dr S.P. Dixit, Head, Animal Genetics Division, ICAR-NBAGR delivered the lead lecture. Presiding over the function Dr M.L. Madan, Convener of the Karnal Regional Chapter, highlighted the advances in technology and improvements in the application of these advances in animals both for health and production. He specially focused on the need in the use of genomic selection in the Indian context for increasing productivity of native cattle and buffalo. Dr B.P. Mishra, Director, ICAR-NBAGR highlighted the immense use of the technology for genetic improvement. Eminent scientists including Dr Arjava Sharma, Former Director, ICAR-NBAGR & CIRC and Dr Y.S. Rajput, Former Head, DC Division, ICAR-NDRI and other NAAS Fellows participated in the discussions.

The following salient recommendations emerged from discussions:

- ♦ Genomic selection, a faster and precise technology, which has been applied in several countries resulting in significant improvement in milk productivity, must be used as a technology of preference.
- ♦ Advanced gene based technologies as well as ART may be used in conjunction with the genomic selection for faster improvement of economic traits as well as multiplication of elite germplasm.

Varanasi Chapter

National Academy of Agricultural Sciences-Varanasi chapter in collaboration with ICAR-Indian Institute of Vegetable Research, conducted a one day 'Awareness Programme on Advances in Agricultural Sciences' at Shri Krishna Intermediate College, Bahoranpur, Babhniav, Varanasi to inform about the scope of Agriculture education, develop scientific insights in agriculture, and spread awareness about the importance of vegetables in our daily diet. Nearly a thousand students attended the programme, accompanied by their teachers. Various activities were conducted including essay competition, planting of mango, guava and drumstick plants followed by a discussion on climate change, its impact and environment protection. Presiding over the programme, Dr. Tusar Kanti Behera, Convener, Varanasi Chapter and Director, ICAR-Indian Institute of Vegetable Research, highlighted the main activities of NAAS and talked about for the nutritional and medicinal importance of vegetables and fruits. He also apprised the students about agriculture education, the new inventions and opportunities available in it. He advised the teachers to include agriculture in their routine teaching programmes. The programme was also attended by the scientists of IIVR and other NAAS fellows.

Plantation in the college campus

Distribution of prizes & certificate

Interaction with students & teachers

Fellows' Views

Monitoring and Bioremediation of Environment Pollutants in Agriculture and Other Emerging Concerns

The pollutants of environmental concern, including heavy metals, metalloids, pesticides, persistent organic pollutants (POPs), refractory and purgeable organics, endocrine disruptive chemicals and persistent bioaccumulative toxicants (PBTs), together with other new emerging pollutants (NEPs) and contaminants including pharmaceuticals and personal care products, hormones, pesticides, other pharmaceutically active compounds, and organic micropollutants, which are not commonly monitored, are emerging as a major cause of concern. These affect the aquatic environment, field and horticultural crops, dairy, goatery, poultry and fisheries, and human health due to their toxicity, persistence, and bioaccumulative nature. In view of potential combined impact of these, the lack of knowledge regarding their fate, behaviour and ecotoxicological effects, and the deficiency in analytical and sampling techniques, action is urgently required at multiple levels. Conventional physical and biological treatments are not economically feasible due to their physicochemical properties, complexity and toxicity of secondary metabolites, which need to be

researched by multi-disciplinary teams, and included in National and International routine monitoring and bioremediation programmes.

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Obituaries

Dr. Vishnu Swarup
(30.07.1925 - 22.06.2023)

Dr Vishnu Swarup, a distinguished Fellow, an outstanding horticulturist and plant breeder, who held several senior positions in India and abroad, passed away on 22 June, 2022. During his long tenure at the Indian Agricultural Research Institute, New Delhi as Assistant Geneticist, and Assistant Professor, Division of Botany, Vegetable Specialist, Geneticist (Floriculture), and Senior Geneticist (Floriculture), Division of Horticulture, Chief Vegetable Specialist, and Project Co-coordinator, Division of Vegetable Crops and Floriculture, he left an indelible impression among the agricultural fraternity. He was instrumental in making the Division of Horticulture, IARI a strong centre of vegetable and flower breeding. He mentored many young students and researchers at IARI. His book on 'Garden Flowers' is referred as one of the most reliable reference books even after more than six decades of its publication. Dr Swarup's contributions to the international fraternity as Vegetable Expert in Nigeria, FAO Consultant in the Philippines and Zimbabwe, Consultant of the Commonwealth Secretariat in the South Africa Development Community (SADC) countries; and Visiting Scientist in Bulgaria and Hungary, are well remembered. He contributed immensely in vegetable breeding both in the public research system as well as in the private seed sector as the Director (R&D), Indo-American Hybrid Seeds (Ind).

Dr Vishnu Swarup's contributions were recognized with several awards and distinctions. Besides NAAS, he was a fellow of the Indian Society of Vegetable Sciences; and Member Gamma Sigma Delta (USA), and Sigma Xi (USA).

The Academy has lost a brilliant agricultural scientist, teacher and a wonderful human being. The Fellowship prays to the Almighty to give peace to the departed soul.

Dr. Debi Prasad Ray
(15.08.1949 - 29.04.2023)

The Fellows of the National Academy of Agricultural Sciences deeply condole the sad demise of Prof. Debi Prasad Ray, an eminent Horticulturist and Fellow of the Academy, who passed away on April 29, 2023. Dr. Ray held several senior positions during his long professional career, including those of Dean, Extension Education; Registrar, and Vice-Chancellor, OUAT, Bhubaneswar and Principal Advisor to Founder President of Siksha 'O' Anusandhan University, Bhubaneswar. He was also the President, Indian Society of Vegetable Science, Odisha Horticulture Society, and Agriculture Society of India, Kolkata; Vice-President of Horticulture Society of India, and Confederation for Horticulture Association of India, and Chairman of many high level national committees of ICAR, DBT, DST & Planning Commission. He was a Fellow of Horticulture Society of India, National Academy of Biological Sciences, Indian Society of Vegetable Science; Confederation of Horticulture Association of India, and Odisha Environment Society.

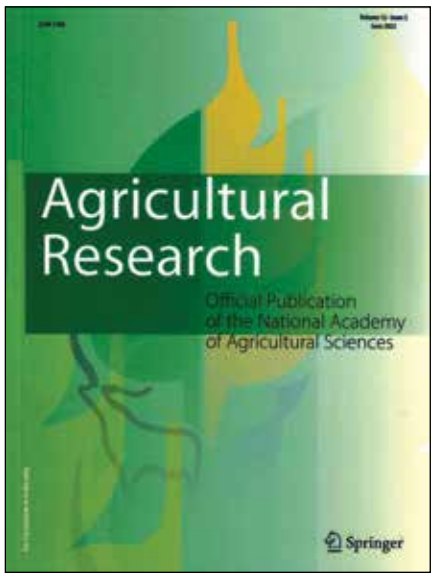
For his contributions, Prof. Ray was recognized with several awards and honours including , Kadali Puraskar, ICAR-NRC for Banana, Trichy; Dr. M.H. Marigowda National Award, UAS, Bangalore; Think Odisha Leadership Award; Life Time Achievement Award, Indian Society of Vegetable Science; Life Time Contribution for Promotion of Agriculture Science, Indian Science Congress, and many more. He was bestowed the Col Commandant Rank by the Ministry of Defence, Government of India.

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

Agricultural Research Journal

The Academy takes pleasure in informing that *Agricultural Research*, the official publication of NAAS, now in its 12th year, has established itself as a multi-disciplinary agricultural research journal with growing credentials. Under the able guidance of the Editor-in-Chief Dr. Anupam Varma and the valuable support from the editorial team, the journal has secured an Impact factor of 1.4 and NAAS score of 7.4.

Though a fairly large number of manuscripts are received every year, with an average acceptance rate of <5%, the Editorial Team is facing difficulty in finding enough quality papers for publication. The esteemed Fellowship is requested to give this information wide circulation among their peers and students and contribute their valuable research findings in the form of full papers (max 5000 words) or brief reports (max 2500 words); critical reviews (max 7500 words), case studies and hypothesis (max 2500 words); debate articles (max 2000 words); and commentaries, opinions, policy issues (max 1500 words) to *Agricultural Research* for further improvement of the quality and standing of this journal.



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