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Editors
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From the President's Desk

Agroforestry for Agroecology and Farmers' Income

Agroforestry as a traditional practice, has been a way of life in India and elsewhere since ancient times. Basically, it implies agriculture with trees, notwithstanding a comprehensive definition that describes agroforestry as a *practice and science of the interface and interactions between agriculture and forestry, involving farmers, livestock, trees and forests at multiple scales* (www.worldagroforestry.org). It can reap substantial benefits both economically and environmentally, producing more output and proving to be more sustainable than forestry or agricultural monocultures, besides protection and conservation through effective protection of forest cover, control of soil erosion, salinity and water tables, increased soil organic carbon stocks at all levels and a more diverse farm economy.

Globally, agroforestry is practised on more than 43 per cent of all agricultural land involving 30 per cent of rural population that accounts for over 1 billion hectares of land and more than 900 million people. In India, the area under agroforestry is estimated to be arund 24.58 million hectares spread over 13 agro-climatic zones. According to a recent estimate, the country is able to fulfil about 70% of its timber needs through agroforestry, which is valued at about Rs. 14,000 crores annually and provides major raw materials to about 26,500 wood-based industries. It is also caters to more than 60-70 per cent of the demand of raw material for paper pulp, plywood, small timber and 9-11 per cent of the green fodder in the country.

Recently, Hon'ble Prime Minister of India has re-emphasized on the need of integrating agroforestry into the agriculture system by growing trees on bunds in farmer's fields. The famous slogan ***Har medh per ped*** meaning ***Trees on every farm-bund*** has drawn ample attention of all stakeholders to this concept and generated awareness among the farming community. Growing trees, especially indigenous trees species, provides additional

income to the small and marginal farmers in addition to promoting sustainable agriculture enhancing soil richness and contributing to ecosystem services in many ways. Incorporating trees into the agriculture system would definitely contribute towards the doubling of farmers' income.

Agroforestry addresses several of the Sustainable Development Goals (SDG) linking food production systems with environment and livelihoods. It is a viable land use option meeting the food and fodder requirements. It is evident that ecologically unsustainable use of natural resources (*soil, water, biodiversity etc.*) and their further degradation threatens food and environmental security *vis-a vis* economy and sustainability. In this regard, tree integration in farming provisions for enhanced resilience against climate related risks and befits the operational ease of a farmer for reaping long–term environmental benefits and sustaining biological diversity. Rightfully, the United Nations declared the next decade starting 2021 as the International Decade of Restoration, which succeeds the International Decade of Biodiversity (2011-2020).

On climate front, agroforestry plays an important role in achieving India's Nationally Determined Contribution (NDC) targets for 2030 and to lower the emission intensity of GHGs by 33–35% below 2005 levels and to create an additional (*cumulative*) carbon sink of 2.5–3 $GtCO_2$. Agroforestry has been recognized as the ultimate tool to enhance the resilience to climate change and reduce the carbon footprint of the developmental activities. To achieve the INDCs, 23 countries have recognized agroforestry as a priority for mitigation, and 29 countries for adaptation.

In India, research on agroforestry started with the launch of the All India Coordinated Research Project on Agroforestry in 1983, followed by commencement of forestry education programs in the State Agricultural Universities during 1985-86 and the establishment of the National Research Centre for Agroforestry (NRCAF) at Jhansi, Uttar Pradesh in 1988 which was upgraded to Central Agroforestry Research Institute (CAFRI) in 2014. During the last three decades, the country has developed robust agroforestry science, innovations and practices that are attracting global interest. Today, we have successful agroforestry models for different agro-ecological regions to achieve the objectives of crop diversification and better returns for the farmers. In order to give a new push to agroforestry in the country, the agroforestry research needs to focus on (i) developing farmer friendly agroforestry technologies for fragile ecosystems such as Himalayan region, coastal, arid and semi-arid, and water-logged ecologies to sustain these areas for higher productivity through economically viable natural resource management options, (ii) quantification of ecosystems services, (iii) introducing tree genomics for identification and characterization of quality germplasm and (iv) developing decision support mechanism and extension methodologies for large-scale adoption of agroforestry. The block chain technology may also potentially be introduced for enhanced trade of small timber from the farms for inter-state and cross border trade of agroforestry produce.

The selection of suitable agroforestry model is highly influenced by land holding pattern, soil productivity and marketability of the final produce. Despite countless benefits of agroforestry, the farmers are reluctant to take up agroforestry because of lack of suitable local market and remunerative prices. To overcome these hurdles and to promote agroforestry, India led the world by enacting an exclusive National Agroforestry Policy in 2014. The main objective of the Policy is to promote Trees Outside Forest (TOF) and enhance raw material availability for wood-based industries. The policy has already been effective in bringing agroforestry into the Corporate Social Responsibility Act, establishing the National Sub-Mission on Agroforestry under the National Mission on Sustainable Agriculture to promote adoption and freeing farm-grown tree species from counter-productive felling and transit regulations in 25 states. India's agroforestry policy has been successful in increasing awareness about the benefit and potential of agroforestry, removal of legal hurdles in planting, felling and transporting agroforestry products *(mainly timber and wood)* and in channelizing huge resources to mainstream agroforestry in the national agenda. It has also exhibited ripple effect in the South Asia region and beyond. In 2019, Nepal became the second nation in the world to formulate its own national agroforestry policy, while several other countries in Asia and Africa are working on their own strategies/policies. The emergence of a more complete, equitable and self-sustaining value chain is unfolding with relaxation of the timber industry. However, it is necessary to build more entrepreneurship with adequate handholding and appropriate government support to strengthen value chains by addressing issues concerning demand and supply sides.

ICAR-CAFRI along with State Agricultural Universities is providing technical guidance and capacity building of stakeholders for successful implementation of the Sub-Mission on Agroforestry in the country under the umbrella of National Mission on Sustainable Agriculture. ICAR with its national and international partners have recently published several publications to share the required knowledge and information. However, there is enough scope to further disseminate and scale up developed farm technologies related to agroforestry and demonstrate the successful models to small farmers of fragile and stressed ecosystems. As we implement the nation-wide agroforestry programme, large-scale availability of quality planting material of important agroforestry tree species will be a major challenge. In order to enable and ensure quality in planting material production, ICAR and the World Agroforestry Centre have jointly developed a set of guidelines for production of quality planting material and also for certification of agroforestry nurseries. These guidelines have been shared with the Department of Agriculture and Farmers Welfare, Government of India for dissemination across the States. A strategic result framework with more intense engagement with states by the department is expected to bring rapid strides in expansion of agroforestry area in the country. Further, accurate mapping of current agroforestry area and its regular monitoring is crucial to ensure proper planning, and development of much needed value chains and market linkages to avoid glut of agroforestry products adversely affecting farmers. Similarly, mapping high value tree species by geoinformatics techniques is need of the time globally. Introduction of quick, accurate, reliable and economical MIR based techniques to measure soil health is another area of priority to monitor soil health in agroforestry-based systems in particular, and agriculture, in general. Through an effective ICAR- ICRAF collaboration, CAFRI and IISS have made significant progress on these research aspects and technologies have been tested and being piloted at sizable scale in India.

There is a demand and necessity to bring indigenous multi-purpose tree species into the agroforestry systems as several underutilized and neglected tree species are slowly vanishing from their natural habitats. These indigenous genetic resources require urgent attention for *in situ* on-farm conservation as an important source of nutritionally rich fruits, vegetables and products of therapeutic and medicinal importance. The genetic improvement of such species has several inherent challenges due to perennial habit, woody texture, long juvenile period, heterozygous nature and uncharacterized genetic diversity. This necessitates use of modern tools of genomics in addition to traditional methods for fast and focused improvement of these species. The germplasm of important agroforestry species should be characterized, evaluated and conserved in the field gene banks for large scale utilization. Growing suitable tree species on farmers' fields and in backyard gardens would ultimately serve dual purpose of conservation of genetic diversity and provisions for additional livelihood support to small and marginal farmers.

(T. Mohapatra)
President

NAAS

On behalf of the Academy and my own behalf, Greetings and Best Wishes to the Fellowship for a Very Happy, Safe and Healthy 2021.

(T. Mohapatra)
President

114th Executive Council Meeting

The 114th meeting of the Executive Council (EC) was held virtually on November 12, 2020 under the Chairmanship of Dr Trilochan Mohapatra, President of the Academy. After a brief welcome by the President, agenda items were discussed and approval accorded wherever necessary. Dr A.K. Singh, Secretary of the Academy presented the recommendations of the Sectional Committees that were endorsed by EC after detailed deliberations. Similarly, the recommendations on Pravasi and Foreign Fellowship for the year 2021 were accepted. The Executive Council also approved the selection of 11 young scientists working in agriculture related disciplines as Associates of the Academy with effect from January 1, 2021. After examination of suggestions received from Fellowships for various vacant positions in EC w.e.f. January 1, 2021, EC shortlisted the names for seeking votes from the entire Fellowship of the Academy to fill the vacancies as per NAAS guidelines. EC was also appraised about the appointment of Executive Director, NAAS scoring of journals 2021, CAG report- follow-up action, status of Policy papers/ Policy Briefs etc.

Dr P.K. Joshi extended the vote of thanks to the Chair, the EC members, and all the special invitees for their guidance and support in the smooth functioning of the Academy.

115th Executive Council Meeting

The 115th EC meeting held on December 26, 2020 and was chaired by Dr Trilochan Mohapatra, President of the Academy. After brief welcome by the President all the listed agenda were discussed in detail and necessary approval accorded. Some of the important decisions included ratification of the election of office bearers/EC members/fellowship/associates from January 2021 and approval of the recommendation of the Programme Committee and various judging committees of various Academy awards. It was also decided that the recommendations of Journal Score Committee may be submitted to EC at the earliest for approval.

Elected new Office Bearers and Members of Executive Council from January 1, 2021.

Vice President	:	Dr A.K. Singh
Secretary	:	Dr K.C. Bansal
Editor	:	Dr (Ms) Malvika Dadlani
Members	:	Dr S.K. Datta
		Dr M.S. Chauhan
		Dr (Ms) Taru Sharma
		Prof A.R. Podile

The EC also ratified the election of the following scientists to the Academy Fellowship, 2021:

Section I: Crop Sciences

Dr S. Gopala Krishnan
Dr Firoz Hossain
Dr Sanjeev Gupta
Dr Devendra Ram Malaviya
Dr (Ms) Neelamraju Sarla
Dr Ram Kewal Singh

Section II: Horticultural Sciences

Dr Nagendra Rai
Dr Brajesh Singh
Dr (Ms) Subbaraya Uma

Section III: Animal Sciences

Dr B. Maheswarappa Naveena
Dr Ashish Kumar Singh
Dr Dheer Singh
Dr Abhijit Mitra

Section IV: Fisheries Sciences

Dr (Ms) Suseela Mathew
Dr Pandian Krishnan

Section V: Natural Resource Management

Dr C.M. Parihar
Dr (Ms) Prameela Krishnan
Dr Dipak Ranjan Biswas
Dr Manoranjan Mohanty
Dr Vinay Kumar Mishra

Section VI: Plant Protection

Dr Mahender Singh Saharan
Dr Pulok Kumar Mukherjee
Dr Sudisha Jogaiah
Dr Manjanath Krishnappa Naik

Section VII: Agricultural Engineering & Technology

Dr Hifjur Raheman
Dr Dilip Jain

Section VIII: Social Sciences

Dr Rakesh Chandra Agrawal
Dr Gavaravarapu Maruthi Subbarao
Dr Naveen Prakash Singh

Foreign Fellows

Dr Hugh W. Pritchard, U.K.

Dr Ravendra Naidu, Australia

Pravasi Fellows

Dr Vijai K. Gupta, Morocco

Dr Indrajeet Chaubey, USA

NAAS Associates Selected for 2021 under Different Sections

Dr S.K. Jha, Crop Science

Dr K. Chakraborty, Crop Science

Dr T.K. Koley, Horticultural Science

Dr S. Hati, Animal Sciences

Dr R. Giri, Animal Sciences

Dr S.L. Jat, Natural Resource Management

Dr B.B. Basak, Natural Resource Management

Dr D.M. Firake, Plant Protection Sciences

Dr Surender Singh, Plant Protection Sciences

Dr S. Mandal, Agril. Engg. & Technology

Dr V. Acharya, Social Sciences

Academy Awards for the Biennium 2019-20

Name of Award	Name of Awardees
Memorial Awards	
Dr B.P. Pal Award	Prof. Rattan Lal, Distinguished University Professor of Soil Science, The Ohio State University, Columbus, USA
Dr K. Ramiah Award	Dr Gyanendra Pratap Singh, Director, ICAR-Indian Institute of Wheat & Barley Research, Karnal, Haryana
Dr K.C. Mehta Award	Prof. S.R. Niranjana, Ex-VC & Professor and Chairman, University of Mysore, Mysore, Karnataka
Dr M.S. Randhawa Award	Dr Rakesh Chandra Agrawal, DDG (Agricultural Education) & National Director, NAHEP, ICAR, New Delhi
Dr N.S. Randhawa Award	Dr Himanshu Pathak, Director, NIASM, Barapani, Pune, Maharashtra
Dr P. Bhattacharya Award	Dr Manmohan Singh Chauhan, Director, ICAR-National Dairy Research Institute, Karnal, Haryana
Endowment Awards	
Dr L.C. Sikka Endowment Award	Dr C.N. Ravishankar, Director, ICAR-Central Institute of Fisheries Technology, Kochi, Kerala
Dr (Ms.) Prem Dureja Endowment Award	Dr Subbaraya Uma, Director, ICAR-NRC on Banana, Trichy, Kerala
Dr N.G.P. Rao Endowment Award	Dr Ram Kewal Singh, ADG (Commercial Crops), Indian Council of Agricultural Research, New Delhi
Recognition Awards	
Plant Improvement	Dr Sudesh Kumar Yadav, Scientist-F, CIAB, Mohali
Plant Protection	Dr Supriya Chakraborty, Professor (Virology), JNU, New Delhi
Soil, Water & Environmental Sciences	Dr Arvind Kumar Shukla, Project Coordinator (Micronutrients), IISS, Bhopal
Animal Sciences	Dr Kajal Chakraborty, Senior Scientist, CMFRI, Kochi
Agricultural Engineering & Technology	Dr C.R. Mehta, Director, CIAE, Bhopal
Social Sciences	Dr A.R. Rao, ADG (PIM), ICAR, New Delhi
Young Scientists' Awards	
Plant Improvement	Dr Ranjith Kumar Ellur, Scientist, Division of Genetics, IARI, New Delhi
Plant Protection	Dr Susheel Kumar Sharma, Scientist (Plant Pathology), RCNEHR, Imphal
Soil, Water & Environmental Sciences	Dr Vijay Singh Meena, Scientist (SS), VPKAS, Almora
Animal Sciences	Dr Monika Saini, Scientist-I, AIIMS, New Delhi
Agricultural Engineering & Technology	Dr R. Pandiselvam, Scientist, CPCRI, Kasaragod
Social Sciences	Dr Shivendra Kumar Srivastava, Scientist (Senior Scale), NIAP, New Delhi

Brainstorming session on *Agriculture and Food Policy for Five Trillion Dollar Economy* (Convener: Dr Suresh Pal)

Unleashing the potential of agriculture assumes significant importance towards realizing the target of US$5 trillion economy by 2024-25. The NAAS organized a brainstorming session *Agriculture and Food Policy for Five Trillion Dollar Economy* on October 14, 2020 to discuss in detail the potential of agriculture and the needed policy reforms to achieve the target. The key issues and recommendations emerged from this session are as follows:

- There is a high correlation between agricultural growth and overall economic growth, and the need for balanced sectoral growth cannot be undermined towards achieving the target of US$5 trillion economy. The agricultural sector needs to grow at least thrice the rate it grew during the past five years.
- Diversification towards high-value agricultural commodities has immense potential to raise agricultural growth. Diversification should focus on regions having high growth potential. Development of rural infrastructure and risk management shall go a long way to promote diversification.
- Modernization of land records and development of leasing of common lands should be accorded high priority.
- Investment in production and market infrastructure assumes paramount importance in accelerating agricultural growth. Investment intensity needs to be doubled from the existing level. Subsidies to the agricultural sector should be re-oriented to focus on both the productivity and environmental outcomes.
- The growth of agro-industries in rural areas is important and there should be special zones for their development. Development of MSMEs, stakeholder training, finance, better regulatory environment and convergence of government programmes should receive greater attention. E-commerce has to be promoted extensively for increasing domestic demand for agricultural and processed food commodities.
- The possibility of exporting value added agricultural commodities as an alternative to basic material needs to be explored. Good Agricultural Practices need to be popularized. The application of digital technology for traceability of residues in the products is necessary to ensure product quality.
- Agricultural research needs to concentrate on demand-led innovations' and research-extension linkages need to be strengthened.
- Aggregation of production, modernization of supply chain, and financial and insurance services to farmers should be through the participation of private sectors.
- The Centre and State governments must work in tandem. Immediate attention is needed on building capacity of FPOs and establishment of agri-business centres at district/regional level.
- The flow of technology should be encouraged through suitable policy and regulatory frameworks. Farm mechanization should be given due emphasis.
- The rural financial institutions need to be strengthened to expand farm-sector credit for creating capital assets.
- Incentive structure needs to be developed in agriculture for rendering ecosystem services, along-with rationalization of existing subsidy structure.
- At US$ 5 trillion level the consumption expenditure at normal prices is expected to increase by 58% — 43% in food expenditure and 71% in non-food expenditure. Further, the food consumption pattern would change towards high value commodities. This will require realigning production basket in commensuration with changed consumption pattern.
- There exists a huge scope to improve resource use efficiency in agriculture. This is reflected by the fact that presently only 11% of the gross irrigated area is covered under micro-irrigation.

Brainstorming session on *Innovations in Potato Seed Production and its Adoption* (Convener: Dr S.K. Chakrabarti)

A brainstorming session on *Innovations in Potato Seed Production and its Adoption* was organized by NAAS on 27th October 2020 in virtual mode. The meeting was chaired by Dr Trilochan Mohapatra, President, NAAS and co-chaired by Dr H.P. Singh, former DDG (Horticulture), ICAR. Dr Mohapatra in his address reiterated several challenges associated with potato seed production, and called upon stakeholders to address the challenges, especially reducing seed cost. He

also opined that the current models of seed production in potato failed to achieve the targets of producing good quality seed at affordable price. Therefore, it is necessary to work out effective alternative seed production models including innovative techniques like Apical Rooted Cuttings (ARC) to ensure certified grade potato seed to farmers at their doorstep. He also emphasized the need to create necessary infrastructure to produce certified potato seed of global standard to facilitate exports of potato and its products.

Dr H.P. Singh enumerated the challenges in production of certified quality seed, and hoped that the upcoming deliberations would bring out an alternate efficient seed production models. Dr D.K. Yadav, ADG (Seeds), ICAR elaborated on the present system of seed production including breeder, foundation and certified seed. He informed that quality of breeder seed is closely monitored and controlled by ICAR-Central Potato Research Institute. Dr Bir Pal Singh, former Director, ICAR-CPRI made a comprehensive presentation on potato seed systems, including the potato tissue-cultured mini-tubers (PTCMT) based hi-tech system. Dr Sanjeev Sharma, Head, Plant Protection, ICAR-CPRI made a presentation on national certification system for tissue-culture raised plants and its forward linkages. Dr Samarendu Mohanty, Regional Director (Asia), International Potato Centre, and Dr R. K. Singh, Head, Seed Technology, ICAR-CPRI, Shimla made a presentation on *Apical rooted cuttings (ARC) for production of certified seed and* opined that the seed system based on ARC could be a cheaper alternative. Dr R. K. Singh suggested a mechanism for integrating ARC in certified seed production. Dr S. K. Pandey, former Director, ICAR-CPRI made a presentation on true potato seed for production of certified seed (TPS). He gave a comprehensive account of TPS system in India and also highlighted on future technology of diploid hybrid seed production. He mentioned that quality standard for multiplying the parental lines before making crosses for production of TPS has been elaborated in the Indian Minimum Seed Certification Standard. Dr S.P. Singh, Technico Agrisciences Pvt. Ltd. indicated that private sector is making all efforts for assuring seed quality, hence involvement of a dedicated body at the national level would definitely help in checking unfair means sometimes being followed by few unscrupulous elements. Dr P.K Joshi suggested that a well-designed survey should be taken up to ascertain the participation of public and private sectors in current potato seed production system in India.

Dr H.P. Singh in his concluding remarks suggested that a committee consisting of members from ICAR, DAC&FW, State Departments, and private sector should be constituted to carve out a national body for seed quality testing and certification exclusively for potato.

Strategy workshop on *Utilization of Wastewaters in Urban and Peri-urban Agriculture* (Convener: Dr J.C. Dagar)

A strategy workshop on *Utilization of Wastewaters in Urban and Peri-urban Agriculture* was organized on November 17, 2020 under the chairmanship of Dr T. Mohapatra, President NAAS. Dr A.K. Singh, Secretary, NAAS welcomed the

participants and briefed the objectives of this session. Dr S.K. Chaudhari, DDG (NRM), ICAR acted as co-chairman. Dr Mohapatra emphasized that ever-increasing demand for water, food and other essential commodities is a challenge, which may accentuate further in the wake of continued migration to urban areas for their livelihood and better life-expectations.

It has been estimated that about 63% of rural/peri-urban households don't have drains while 31% of households have open drains – often leading to mixing of grey water with faecal matter and indiscriminate disposal of liquid waste in open areas or mixing into water bodies without treatment. As a result, 75% of all surface water in India is contaminated and serving as a breeding ground for several vector-borne diseases like malaria, polio, dengue, cholera. It has been estimated that about 80% water pollution is due to sewage and rest is due to industrial effluents and other factors such as burning of the crop residues. On the one hand, India faces scarcity of water, the country generates about 61754 million litters of sewage water per day (~63% untreated), which is not utilized economically and causing serious land, water, air and food pollution. This water can judiciously be used in innovative horticulture, agroforestry, development of lawns/ gardens/green-belts/landscapes, vertical farming, dairy and poultry units in peri-urban areas, roof-top cultivation, growing avenue trees and ornamental plants in open spaces, cultivation of aromatic and ornamental plants and aqua-culture by developing low-cost technologies.

The following suggestions came out of the deliberations:

- Develop quality standards for different uses of wastewaters of different types based on their source of generation and extent of treatment.
- Develop low-cost and user-and environment-friendly techniques for wastewater treatments and developing model systems.
- Need guidelines and critical limits of heavy metals for safe utilization of such waters.
- Classification of wastewaters for different uses, such as forestry, aquaculture, livestock, horticulture and re-use in non-food crops.
- A network program on pollutant bio-accumulation modelling under representative soil-water-crop-weather combinations can significantly reduce the cost, labour and time requirements involved in future large-scale multi-location and multi-commodity field experiments, and also help developing waste water reuse guidelines for effective agriculture planning.
- Identification of suitable economically viable plant species for different systems and use of different qualities of water, such as (a) untreated wastewater (b) partial treated sewage water (c) treated and harvested rainwater and (d) conjunctive use of water.
- Link Government Schemes such as Smart City Development Program and Swachh Bharat with programs for effective utilization of wastewaters.
- Adapting suitable remediation measures, such as use of biological (including microbial) systems for absorbing heavy metals and removing pathogens. Technologies such as JALOPCHAR (developed by IARI) are relevant for replication. Ground-level interventions such as mini-forest seed-ball and purifying water by Floating Islands of Phragmites and Vetiver grass are important.
- Proper irrigation methods such as drip irrigation for different systems must be developed. Cheap techniques such as passage of the sewage water not containing heavy metals through gravel media or specially designed vegetation-beds or bio-absorbents before then use for irrigation or simple sedimentation or bio-sedimentation and solar techniques may be used.
- Different models need to be developed for private sector utilisation, washing stations, upscaling of viable technologies and remediation measures.
- Wastewaters of rural areas must be drained properly, stored and judiciously utilized.
- Policy matters include resolution of land tenure conflicts; integration of urban policies and plans with peri-urban areas; dissemination of technical knowledge among urban planners; reshaping the plans of municipal bodies; developing norms and protocols to establish agroforests, horticultural systems, greenbelts and landscapes, development of stadia, dairy, food parks, aquaculture (including ornamental) ponds, and other activities; and making available finance and land on affordable rates in peri-urban areas..

Strategy workshop on *Need for Breeding Tomatoes Suitable for Processing in India* (Convener: Dr A.T. Sadashiva)

A strategy workshop on *Need for Breeding Tomatoes Suitable for Processing in India* was organized on November 24, 2020 to seek views of various stakeholders, including the

plant breeders, processors and policymakers on the present status of processing tomatoes in India and to explore scope for processing tomatoes in India. It was organized under the chairmanship of Dr Trilochan Mohapatra, President, NAAS and convened by Dr A.T. Sadashiva. A total of 57 participants, including 3 foreign delegates attended this workshop. Most of the tomato produced in India is consumed fresh (culinary purpose), and hardly 1% is processed. Indian consumers use tomatoes in fresh as well processed forms such as chutneys and pickles. In the absence of a typical processing variety in India, the processors buy fresh market tomatoes available during glut when the prices crash.

The workshop covered all the important issues right from global scenario to Indian scenario in processing tomatoes vis-a-vis the present status of processing tomatoes from stakeholders' point of view. Some important recommendations emerged from the discussion are:

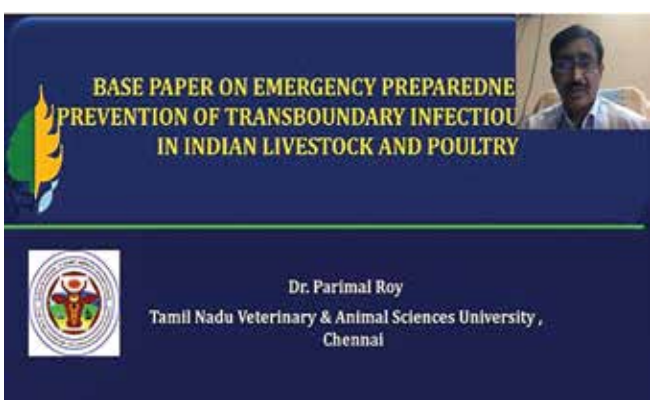
- There is a need for development of high yielding multiple disease resistant processing tomato variety and F1 hybrid with Concentrated Fruit Maturity (CFM) & jointless pedicel for machine harvesting (MH). Emphasis should be on enhancement of productivity, lycopene and brix in processing tomatoes. Adopting CRISPR/Cas-9 based mutagenic approaches to tweak some crucial genes that determine plant architecture and processing qualities may help develop desired cultivars in less time.
- There is an urgent need for the Indian tomato processing sector to look at value added products for pharmaceutical and nutraceutical industries. This would help in reducing losses to the tomato industry. The sector should also look at other products like sun-dried tomatoes. Use of peel and seed, by-products from processing, needs attention.

Analyse market for type of products best suited to replace fresh consumption.

- The processing industry in India is immature and needs help by the government to grow and compete internationally. India has potential to export tomato-based products rather than to import such products. Targeted scaling out of GAP with suitable processing type varieties is to be promoted in selected areas close to the processing facilities.
- Identification of areas/districts ideal for establishing tomato processing industries and development of region-specific tomato cultivars with processing qualities.
- Secure tomato supply for processing at a fixed price through contracts with growers. An inter-professional organization may act as an intermediary and have technicians to train and assist growers.

Brainstorming session on *Emergency Preparedness for Prevention of Transboundary Infectious Disease in Indian Livestock and Poultry* (Convener: Dr Parimal Roy)

Transboundary and Emerging Diseases are considered to hold the greatest economic threat to animals worldwide. The Academy organized a brainstorming session on *Emergency Preparedness for Prevention of Transboundary Infectious*



Diseases (TADs) in Indian Livestock and Poultry, which was convened by Dr Parimal Roy, Tamil Nadu Veterinary and Animal Sciences University on December 19, 2020 through virtual mode. More than thirty eminent scientists and stakeholders from relevant fields attended the meeting. During base paper presentation, Dr Parimal Roy pointed out several gaps in preparedness to combat TADs that warrant immediate attention to bring together the strategies favoring their diagnosis, prevention and management. Dr Trilochan Mohapatra, President of NAAS, in his opening remarks also emphasized the need for rapid communication of new outbreaks, strengthening of international borders for prompt screening and redressal of related issues concerning veterinary public health, pathogenesis, epidemiology, statistical modeling, diagnostics, biosecurity, genomics and

vaccine development. The experts made presentations on current system of TADs reporting from India, government policies to deal with TADs, current infrastructure of TADs diagnosis, early warning of livestock diseases, and an outline of collaborative approach on TADs. Seven panelists namely Dr M.P. Yadav, former Director, IVRI, Dr Habibar Rehman, ILRI regional representative, South Asia, Dr Praveen Malik, Animal Husbandry Commissioner, Prof J.P.S Gill, GADVASU, Dr R. K. Singh, former Director, IVRI, Prof A. Raja, TANUVAS and Dr Jayaraman Krishnarajan, Poultry Consultant shared their opinion on prevention of TADs. Dr B.N. Tripathi, DDG (AS), ICAR, who Co-chaired the session summed up following key recommendations that emerged from the presentations and panel discussion:

- Strengthening of international border areas with required quarantine facilities and infrastructure for diagnosis of TADs,
- Development of active national disease surveillance mechanism,
- Training of field veterinarians on animal disease investigation and surveillance,
- Development of animal vaccine for COVID-19,
- International collaboration for control and eradication of TADs,
- Development of a robust National Animal Disease Diagnostic Laboratory Network,
- Harmonization of SOPs and guidelines for emergency preparedness for the prevention of TADs,
- Emergency Funding support – for need-based urgent research,
- Re-introduction of National Bio-security Bill for establishing National Bio-security Authority.

Activities of Regional Chapters

Cuttack Chapter

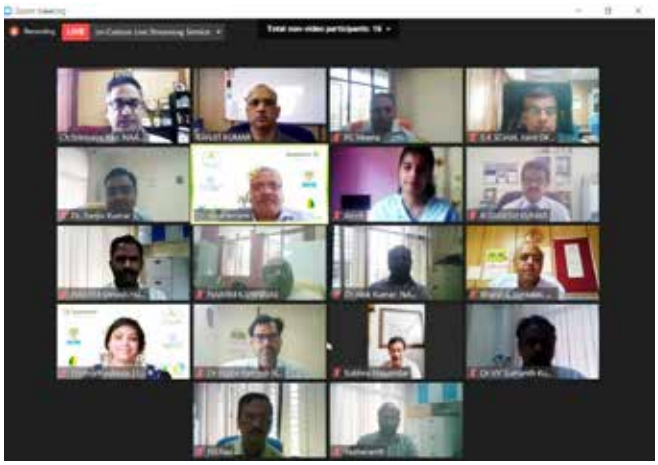
COVID-19 Pandemic General Awareness Quiz

An online COVID-19 Pandemic General Awareness Quiz was organized by the Cuttack Chapter of the National Academy of Agricultural Sciences for the students of the CRRI High School, Cuttack on September 18-19, 2020. The awareness quiz was convened by Dr A. K. Nayak, NAAS Fellow and coordinated by Dr Mohammad Shahid, NAAS Associate. The idea behind the quiz programme was to enhance awareness on the causes, effects and some remedial measures to control the gravity of corona pandemic. A total of 15 students participated in the quiz.

Hyderabad Chapter

Sankalp 2020: National Business Festival

A two-day national level Business-Fest (Sankalp-2020) was organized on October 4-5, 2020 by the Post Graduate Diploma-Agribusiness Management (PGD-ABM) students of ICAR-National Academy of Agricultural Research Management, Hyderabad in collaboration with NAAS-Hyderabad Chapter, Sammunati Financial Services, Tata Rallis India Limited, SAVe Foundation and a-IDEA (Agri-Business Incubator) of NAARM. Due to the pandemic situation, the annual B-Fest was organized online. The event attracted 5004 registrations from 40 institutes including several IIMs and leading management colleges.



Sankalp-2020 Annual Business Festival

The Business-Fest comprised of four competitions namely, Adhishtatha (Best business manager competition), Samadhaan (Case study competition), Advitiya (Business plan competition), Flashgun (Photography competition), Darpan (Business quiz competition), and Ideas-360 (Content creation competition). Mr Subhra Majumdar, General Manager from Tata Rallis India Ltd was the chief Guest and Mrs. Poorna Pushkala, Head HR, Samunnati Financial Services and Intermediation Pvt. Ltd. was Guest of Honour during the inaugural programme. Mr Satyanarayana Vaddi, Senior Advisor, SAVe Foundation was the Chief Guest during valedictory function.

Dr Ch. Srinivasa Rao, Director, ICAR-NAARM and Convener, NAAS-Hyderabad Chapter presided over the inaugural and valedictory functions. He appreciated the innovative organization of annual business festival by the students of agribusiness management of ICAR-NAARM. He opined that Sankalp as an event helps to improvise skills, think innovatively, and inspire and ignite young minds. He also spoke about how Agri-business management can help to improve agriculture sector in India and the livelihoods of Indian farmers. He also highlighted the role of Farmer Producer Organizations (FPOs) in the context of marginal and small Indian farm holdings. Dr Rao also stressed on the critical role of Public Private Partnership (PPP) in research, technology and innovations and overall agricultural development in India and congratulated all the winners of Sankalp'20.

Scientific essay writing competition

Academy's Hyderabad Chapter in collaboration with ICAR-National Research Centre on Meat, Hyderabad and ICAR-National Academy of Agricultural Research & Management, Hyderabad conducted a scientific essay writing competition on *Balanced animal protein consumption for improved nutrition and implications to human health in India* among undergraduate and post graduate students of State Agricultural/Veterinary Universities in Telangana and Andhra Pradesh during the month of November, 2020. In response, a total of 30 essay write-ups were received from students of Sri Venkateswara Veterinary University, Tirupati; P.V. Narsimha Rao Telangana Veterinary University, Hyderabad; Acharya NG Ranga Agricultural University, Guntur; and Osmania University, Hyderabad. Essays will be evaluated by expert committee members and winners will be announced during the proposed NAAS, Hyderabad chapter sponsored *National Workshop* to be held at NAARM, Hyderabad later.

Ludhiana Chapter

- Under its on-going series of lectures, Ludhiana Chapter of the Academy organised an online lecture by Dr Atul, Former Director of Extension Education, CSK Himachal Pradesh Krishi Vishvavidyalya (HPKV), Palampur, on

Modern Tools and Techniques in Today's Digital World of Communication on October 1, 2020. The lecture was graced by the presence of Padma Shri Dr B.S. Dhillon, Vice Chancellor, PAU, and Convener of the Ludhiana Chapter. The lecture was attended by more than 110 participants, including eminent academicians and agricultural scientists.

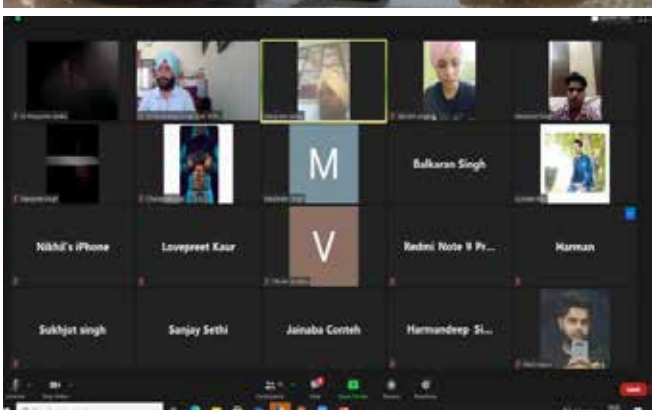
Dr Atul elaborated up on the concept and future of digital communication and virtual reality. He was of the view that virtual reality may be key to not only what we collaborate in future but how we can safely learn in the present. He also recommended researchers to use Microsoft Excel for data analysis and management for better functionality. Dr Atul also detailed upon *Speech to Text Conversion* using Google's technology, which is gaining immense popularity. Moving on to the online platform, the speaker compared various features and pricing plans available on Zoom and Google Meet products, Skype, Microsoft Teams and Cisco WebEx. He enlightened the audience by divulging that while the options available in Zoom include Meetings & Chat, Webinar, Conference Rooms, Phone Systems, Marketplace etc., the Google Meet is by far the best fit for different domains like Education, Healthcare and non-profit organizations. While Google Meet offers several free features for the personal users, there are other features such as G Suite Essentials and G Suite Enterprise exclusively kept for other plans. Elaborating further on Google Meet, he acquainted the audience with its features such as screen sharing, chatting/ messaging and also its integration with other Google products and Microsoft Office apps.

Understanding a scenario where education is to be mostly delivered online, Dr Atul addressed the concerns regarding the best platform for online teaching. He contended that educators should opt for such software that offers features like Screen sharing, Text Chat, Conference recording, File storage, Mobile Apps, etc. As there is a shifting trend towards Virtual Reality (VR), the speaker also focused on future technology, such as Hologram, for communicating virtual thoughts.

Dr Inderjit Singh, Vice Chancellor, GADVASU, appreciated the talk and stressed upon the need to use ICT tools and techniques and congratulated Ludhiana Chapter for organizing the event.

- **Campaign to curb menace of residue burning**

PAU's Krishi Vigyan Kendra at Budh Singh Wala, Moga, organised a webinar on *Role of school/college students in curbing the menace of residue burning* under the aegis of Ludhiana Regional Chapter on October 13, 2020 under the chairmanship of Dr Gurmeet Singh Buttar, Additional Director of Extension Education (ADEE) & NAAS Fellow, PAU, Ludhiana. The webinar was addressed by Dr Manpreet Jaidka, Assistant Professor (Agronomy) and Dr Amandeep Singh Brar, Deputy Director (Trg.). The speakers elaborated on the prospects of students' participation in checking the residue burning in the state. Students were appraised of pros and cons associated with residue burning along with possible remedial measures that can be undertaken to abate the intensity of situation without compromising the sustainability of agricultural systems. Speakers elaborated about the various *in-situ* and *ex-situ* residue management technologies like PAU straw management system (PAU SMS), happy seeder, mulcher, Reversible MB plough, etc. being recommended by the University. Farmers can successfully adopt these technologies depending upon the particular field situation and need, and experience and suitability. Student participants actively interacted with speakers on residue management for their queries. The webinar was concluded with a vote of thanks by Dr Manpreet Jaidka.



- **Mass Campaigning on CRM through School Students**

Ludhiana Chapter of the Academy conduced a Crop Residue Management campaign through school students in district Hoshiarpur on December 7, 2020. Dr Maninder Singh Bons, Deputy Director of Krishi Vigyan Kendra, Bahowal (Mahilpur), District Hoshiarpur visited Sahibzaada Ajit Singh Public School at village Ladhewal (Mahilpur) with his team of scientists and interacted with the students of the school on the advantages and various means of proper management of crop residues. The advantages of the *in-situ* and *ex-situ* management and the technologies available for environmental benign use/ disposal of the crop residues were discussed

with the students. The students were urged to spread the message among their villages to make technology enabled best use of the residues.




Kolkata Chapter

Webinar on Biodiversity and soil functions

To celebrate World Soil Day on December 5, Kolkata Chapter of the National Academy of Agricultural Sciences jointly with the Society for Fertilizers and Environment organized a webinar inviting all the Fellows and Associates of the Academy and members of the Society. Keeping the theme of this year Soil Day – Keep Soil Alive; Protect Soil Biodiversity – in mind, Dr T.K. Adhya, Professor, School of Biotechnology, KIIT, Bhubaneswar was invited to deliver a talk on *Biodiversity and soil functions in a changing scenario*. He highlighted the intimate relationship between soil biodiversity and its ecosystem services for existence of all forms of life on earth including humans. The talk evoked lot of interest among the participants and a good discussion followed. Dr Anil K. Singh, Secretary, National Academy of Agricultural Sciences, Dr H.S. Sen, President, Society for Fertilizers and Environment and Professor Biswapati Mandal, Convenor, Kolkata Chapter, NAAS and Secretary of the Society also spoke on the occasion.

Varanasi Chapter

- **Awareness programme among SC farmers to adopt the scientific cultivation**

  An awareness programme was organized at Block Narayanpur of Mirzapur district among the Scheduled caste farmers on November 19, 2020. Dr D.P Singh, Principal Scientist of the academy delivered a talk on scientific ways of vegetable cultivation, briefed about the nutritional and health benefits of the vegetables and also outlined the prospects of agri-based entrepreneurship. Dr Sudhakar Pandey, Convener, NAAS regional chapter Varanasi stressed the role of kitchen garden to get round the year vegetables for consumption and gave significant

tips to establish the kitchen garden. On this occasion, scientists of IIVR Dr B.R. Reddy and Dr A.T Rani also briefed about the cultivation of leguminous vegetable crops and IPM in vegetable crops. More than 100 farmers participated and benefited from the deliberations.

- **Awareness Campaign for School Students on *Career Opportunities in Agriculture***

  A science awareness campaign on *Career Opportunities*


in Agriculture and Allied scienceswas organized among more than 150 students of Science and Agriculture students in 11th and 12th standard at Government Inter College, Jakhini Varanasi on December 22, 2020. During the programme, Shree Ram Ashray Shukla, College Principal and Shree Rajesh Kumar Rai, Lecturer *(Agriculture)* briefed about the objectives of the campaign to the students and teachers. Dr Sudhakar Pandey, Convener of NAAS-Varanasi Chapter provided an overview of the Academy's activities. He also delivered a talk on Career Opportunities in Agriculture and Allied sciences to motivate the students to opt for a career in Agricultural and Allied Sciences. The queries raised by the students related to careers in Agriculture and allied sciences were replied by the experts.

National Agricultural Education Policy

Universal Access to Quality Education a Must for Comprehensive Development[1]

Human resource capital is the greatest treasure of a nation. Ever enrichment of this treasure must therefore be foremost national resolve. It is heartening that the National Education Policy (NEP) 2020 underpins that education is fundamental to unfold human potential, equitable and just society & promoting national development. It further emphasizes that providing universal access to quality education is the key to India's continued ascent and leadership at the global stage in terms of economic, social justice, equity, scientific advancement, national integration, and cultural preservation. Recalling that agriculture is mother of all cultures, NEP 2020 should facilitate creation of a comprehensive National Agricultural Education Policy which will help transform agriculture to build New India.

Agricultural education system in India is currently based on the 74 Agricultural Universities (AUs) which are structured on the Land-Grant pattern of the USA - integrating teaching, research, and extension. These comprise sixty-three State Agricultural Universities (SAUs), three Central Agricultural Universities (CAUs), four Deemed Universities (DUs) and four Central Universities with Agricultural Faculty. The AUs together with ICAR's 106 institutes, 721 Krishi Vigyan Kendras *(Agriculture Science Centres)*, and 69 All India Coordinated Research Projects (AICRP) make the National Agricultural Research and Education System (NARES) – the largest in the world. These institutions have been harbingers of the Green, Yellow, White, and Blue Revolutions and generating the needed scientific manpower, teachers, technologies and their transfer to transform India from ***Ship-to-Mouth*** situation to the ***Right-to-Food*** status, and making the nation a major food exporter and the second largest Agrarian Economy in the world.

Yet, we have miles to go to reach the unreached. World's one-fourth of the hungry and undernourished, and nearly 40% of stunted/wasted children have their homes in India, let alone the huge income and livelihood inequities between farmers and non-farmers. This enigmatic coexistence of food surplus and high incidences of hunger, under-nutrition, and deprivation must be critically analyzed and science-informed policies, including those related to quality education and human resources development, and implementation pathways adopted to break the paradox towards building a zero hunger, equitable, and prosperous India.

1 ***Extract of the Brainstorming Session on Transforming Higher Agricultural Education in India held on October 20, 2020***

Asymmetries in the Agricultural Education System

The Rainbow Revolution notwithstanding, India's agrarian progress during the past few years has slackened and serious asymmetries are noted in science–led growth of agriculture. This could partly be attributed to the need of desired quality and responsiveness of agricultural education system in the country, resulting from the following shortcomings:

i) Inadequate academic rigor and contextualization of emerging challenges and opportunities; erosion of Basic Sciences from agriculture courses; poor quality and insufficient academic staff (faculty positions remaining unfilled); widening disconnect between education, research, and extension resulting in knowledge deficit; limited internalization of relevant international trends and developments; indifference of youth towards agriculture;

ii) Disconnect among agricultural education, employment, and industries' requirements; lack of adequate skill, entrepreneurship and experiential learning; overall poor employability of agriculture graduates;

iii) Extensive inbreeding; low access of agricultural education to rural students, especially to the tribal and socially-deprived communities;

iv) Poor system of evaluation, monitoring, impact assessment, accountability, and incentives; limited digitalization; and inefficient governance; and most importantly

v) Inadequate investment and declining financial resources in agricultural universities/colleges; opening of new institutions without matching resources and norms; unmindful splitting of agricultural universities, inadequate resource planning, and poor coordination between Centre and States.

Alleviating the Asymmetries

Keeping in view the NEP, and arising from NAAS's XIth Bhubaneswar Conference and Declaration 2013, recommendations of the ICAR- Committee for developing Policy for Higher Agricultural Education in India-2013, Fifth Deans Committee recommendations-2016, and continued efforts of the ICAR, the following measures and policy actions should be internalized in the new National Agricultural Education Policy for alleviating the persisting asymmetries within a set timeframe.

- Embrace agricultural education for development (AE4D) as an integral component of the national agricultural policy in creating a world-class agricultural university system attuned to face local, national, and international challenges and opportunities
- Establish large Multi-disciplinary Educational and Research Universities (MERUs), ensure and

institutionalize transparent governance, autonomy, meritocracy, judicious allocation of resources, and accountable systems of evaluation (measure to manage), monitoring, and impact assessment

- Minimize inbreeding and promote institutional linkages, focusing on standards, norms, and accreditation; strengthen basic and emerging sciences in agricultural education and research; nurture centers of excellence
- Strengthen and streamline Centre-State partnership with differentiated but reiterative responsibilities, ensure access, equity, and inclusion
- Adopt *Light but Tight* regulation by a single regulator
- Revamp curricula, teaching/learning processes, and pedagogy to attract best of talents and for preparing the *Youth for Leadership in Agriculture*
- Provide support for enhanced student experiences, institutionalize skill development, entrepreneurship and experiential learning programs, and invest on non-formal education and vocational training in agricultural technologies
- Support development of active and long-term international cooperation, rejuvenate and replicate successful collaboration models, and launch South-South, South-North and trilateral collaborations.

Align National Agricultural Education Policy with the NEP 2020

The National Agricultural Education Policy must be aligned with the National Education Policy 2020, which is based on five pillars, namely, Access, Equity, Quality, Affordability, and Accountability to achieve the 2030 Agenda. As India will have highest population of young people in the world over the next decade, this structure will enable the country to provide quality education which will be determining our future. Our educational system must also contextualize new and emerging issues such as the unprecedented Covid-19 pandemic, climate change, increasing biotic/abiotic stresses, socio-economic crises, bio-safety/food-safety concerns, fast diminishing natural resources, including biodiversity, and risk assessment and management. Academic legitimacy of producing More from Less for More would become doubly important.

Given the above, SDG4 *ensure inclusive and equitable quality education and promote lifelong learning opportunities for all* by 2030 is most timely, and the entire education system, from school to higher education, must be configured to support faster learning. Thus, SDG4 will be directly impacting SDG1 (alleviation of poverty) and SDG2 (elimination of hunger) – the foremost goals of agricultural development.

New India must address 21st century development imperatives, and seek revamping of educational structure, regulations and governance to meet SDGs while building upon India's traditions and value systems. We must enhance creative ability and strengthen social, ethical, and emotional capacities of all.

The Prime Minister elaborated the aim of the National Education Policy at the education conclave held on August 7 and led the pledge to implement it effectively, including allocation of Rupees hundred thousand crore to begin with. The NEP envisions an educational system that makes good human being with skill and expertise contributing directly to transforming our nation sustainably into an equitable and vibrant knowledge society. By providing high quality education we shall be making our students a global citizen, rendering NEP as the foundation for New India. Retraining, up-skilling, and retooling of teachers, students, and related staff, bridging gap between education and research adopting a holistic approach, strengthening of vocational education, autonomy to institutions, and establishing a self-sufficient domestic ranking system for Indian educational institutions, are the main planks of NEP 2020. Consequently, the Ministry of Human Resource Development (MoHRD) has been renamed as the Ministry of Education (MoE).

The Vision of the Policy is an equitable and vibrant knowledge society, and its main tenets are:

- Make India a global knowledge superpower
- Students having respect towards *Fundamental Duties and Constitutional Values*
- Pride in being Indian in thought, intellect, and disposition
- Develop knowledge, skill, values, commitment to human rights, sustainable development and global well-being - truly global citizens.

The NEP, being progressive, futuristic, and student-centric, should be duly internalized in National Agricultural Education Policy. It underpins flexibility, multi-disciplinarity, and internationality in consonance with people's needs, aspirations, voices from the ground ***(Janvani),*** and science-informed amalgamation of indigenous and endogenous traditions, knowledge, and cultural heritage ***(Bhartiyata Ka Dharatal)***, ensuring holistic development. It also provides for multiple entries and exits as well as horizontal and vertical mobility, facilitated by *Credit Bank*, thus encouraging aptitude-based choice and self-paced progress according to access, equity, and affordability.

From Land Grant to World Grant Agricultural University System

In the spirit of ***Reform, Perform and Transform***, and recognizing that local and global are no longer independent, India's Agricultural University System should change from Land-Grant to World Grant system, as happened in many Land Grant Universities in the USA. The new curricula, courses and contents should keep evolving, dynamically encompassing the new global initiatives, such as Global Green Economy; Knowledge Economy; Global Zero Hunger Challenge etc. Reiterating the role of Agriculture and Social

Sciences as pivotal agents of change, it is suggested that Agriculture, Arts, and Humanities (A), be amalgamated with Science, Technology, Engineering, and Mathematics (STEM), thus transforming ***STEM*** into ***STEAM***. India should move towards ranking of its AUs for raising the level of knowledge domains, meritocracy and governance as per the indicators suggested by the National Academy of Agricultural Sciences (NAAS), making our students globally relevant and truly global citizens.

Synergizing excellence and relevance, new approaches towards building qualified human resources, for instance, custom-designed Massive Open Online Courses (MOOC) and establishing internship, innovation and incubation Centres are being popularized in NARES. It has also prepared a roadmap for mentoring, emphasizing the need for matching the experience and wisdom of mentors with the learning needs of mentees, thus building bridges across the hierarchy levels, empowering change management, enhancing work ownership and sharing of responsibility, and expanding learning ecosystem and good practices. This is in line with the programs of the Department of Science and Technology (DST), especially Innovation in Science Pursuit for Inspired Research (INSPIRE) and the Global Initiatives of Academic Network (GIAN) of the Ministry of Human Resources Development (MoHRD), now Ministry of Education (MoE). Thus, rejuvenated agricultural education would transform the agrarian economy, and attract foreign students, rendering the Government's *Study in India* initiative a success.

As enunciated in the NEP 2020, the NARES should assess the manpower needs of the fast transforming, knowledge-intense agriculture to make necessary adjustment in curricula and skill development, emphasizing on experiential learning and exposure to national and international issues. More technological interventions are likely in the disciplines of ICT, digitalization, biotechnology, nanotechnology, agro-processing, precision agriculture, and systems simulation. Pluralistic approach and public-private partnership focusing on business/marketing/income orientation is needed for making the local extension sensitive to the challenges at micro level, strengthening the feedback mechanism, and setting the right priorities. Promoting entrepreneurship and Agri-Startups, encouraging market-led extension strategies, and intensive use of electronic media should be duly covered in the educational programs, thus mutually synergizing the Scientific Social Responsibility (SSR) and Corporate Social Responsibility (CSR).

As emphasized in the NEP, digitalization, information and communication technology (ICT) systems, and Artificial Intelligence (AI) will be comprehensively included in the new agricultural education system. Further, online teaching, training, learning technology sharing and market access will be actively promoted. The necessary quality technology infrastructures must be ensured for uninterrupted running of the system to institutionalize the Open Distance Learning mode (ODL) of agricultural education.

Reshape Agricultural Education from Primary School to MERU Level

Agriculture *(in a comprehensive sense)* should be an eminent part of education right from Primary School – High School – College – University system. The National Agricultural Education Policy would call for retraining the teachers at various levels to promote flexibility, multidisciplinary and internationality. The teacher should no longer be *just filling a pail, but be lighting a fire*, and *good teaching is more giving of right questions than giving of right answers*. We should ask a question whether our education system is producing such leaders who would navigate us through the changing water, and build the needed values to reach the unreached and to render our AUs world-class.

The National Agricultural Education System should produce professionals with significant skills to find solutions to the veritable challenges faced by Agriculture, like low productivity, low profitability and income of farmers, increasing volatilities of climate change and market uncertainties and poor access, persisting high incidences of undernutrition, hunger, poverty, inequity, environmental degradation, shrinking and diminishing natural resources – soil, water, biodiversity. An institutionalized multidisciplinary approach is needed to solve the problems. The establishment of Multidisciplinary Educational and Research Universities will meet these requirements.

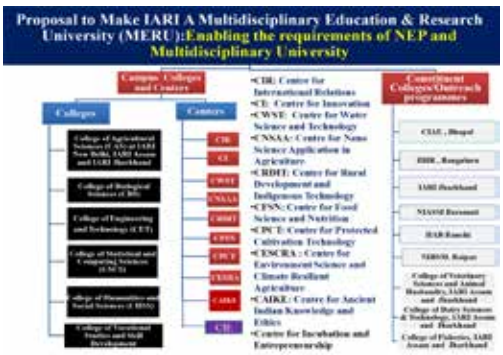
Agriculture should be seen as an industry and commercial enterprise. Increasing mechanization, automation, use of resources conserving technologies, data management, using Big Data Analytics and ICT will be the order of the day. Blockchain technologies, biosensors, non-fossil fuel, renewable energy, solar power, waste management etc. will greatly impact agric-food systems, hence must be internalized in Agriculture curricula.

NEP 2020 envisions Higher Education Institutions to focus on research and innovation by setting up:

- Start-up incubation center
- Technology development centers
- Centers in frontier areas of research
- Greater industries-academic linkages
- Interdisciplinary research including humanity and social science research.

With the above in mind, several AUs and other agricultural education institutions have initiated the restructuring process. For instance, IARI, the foremost Deemed University, has proposed the following model for being transformed as a MERU.

The MERU will give due importance to pluralistic and innovative extension approaches as these are critical for faster delivery of information and technology. Competencies of extension agencies especially youth (including women) as *Technology Agents* need to be improved by systematic



capacity building so as to enable them to respond better to emerging challenges. To achieve this, there is need for better knowledge sharing, skill development and mentoring of youth, making them an integral part of *Plough-to-Plate Agri-Food System* promoting agri-preneurship through a dedicated *Agri-Youth Innovation Corpus* Fund for rural start-ups. Further, as mentioned in the above outlay, colleges of vocational studies and skill development will be established so that the intensity of vocationally trained persons is increased from 26% to 50% by 2035

Quality Assurance in Agricultural Education

The NEP 2020 emphasizes *universal high-quality education is the best way forward for developing and maximizing our country rich talents and resources for the good of the individual, the society, the country, and the world.* With this spirit, quality assurance in higher agricultural education, pursued by ICAR/ DARE/SAUs, involves accreditation, framing of minimum standards for higher education, academic regulations, personnel policies, review of course curricula and delivery systems, support for creating/strengthening infrastructure and facilities, improvement of faculty competence and admission of students through All India Examination. The ICAR's Fifth Deans' Committee Report 2016 has restructured the course curricula to underpin relevant practical skills, entrepreneurial aptitude, self-employment, leadership qualities and confidence among graduates, and attracting and retaining youth in agriculture. Further, the Committee had recommended that all degrees in the disciplines of Agricultural Sciences should be declared as professional course degrees, and sought to achieve global level of academic excellence. It had also suggested norms for establishing new colleges.

Being Vocal for Local, region-specific courses such as Coastal Agriculture, Hill Agriculture, Tribal Agriculture etc have been formulated. New degree programs and courses have been recommended in emerging fields like genomics *(biotechnology)*, nanotechnology, GIS, precision farming, conservation agriculture, secondary agriculture, hi-tech cultivation, specialty agriculture, renewable energy, artificial intelligence, big data analytics, mechatronics, plastics in agriculture, dryland horticulture, agro-meteorology and climate change, waste disposal and pollution abatement, food plant regulations and licensing, food quality, safety standards and certification, food storage engineering, food plant sanitation and environmental control, emerging food processing technologies, sericulture, community science, and food nutrition & dietetics. These will need additional high quality human resources and shift in pedagogy.

In compliance with the Student READY program launched in 2015, the Deans' Committee has designed one year program in all the UG disciplines comprising (i) Experiential Learning, including International Experiential Learning wherever feasible; (ii) Rural Agriculture Work Experience; (iii) In-Plant Training/ Industrial Attachment; (iv) Hands-on Training (HOT) / Skill Development Training; (v) Students Projects, and (vi) the Agricultural Science Pursuit for Inspired Research Excellence (ASPIRE) program.

The ongoing World Bank supported National Agricultural Higher Education Project (NAHEP), built on the preceding World Bank projects, particularly NATP and NAEP, is poised to strengthen the capacities of faculty and other staff at all levels, foster linkages of the national system with global knowledge economy, facilitate International Experiential Learning, promote learning-centred education, fortify partnership with private industries, and augment digitalization and online distance learning.

The NAEP must have provisions to attract youth and empower women in agriculture. India, with largest population of youth (nearly 400 million between 10-24 years age group) in the world, has only 5 per cent of the rural youth engaged in agriculture though over 60 per cent of the rural people derive their livelihood from faming and allied activities. Hence, a paradigm shift is needed from *Youth as a Farmer* to *Youth as Value Chain Developer and Agri-preneur*. Zonal platforms for Motivating and Attracting Youth in Agriculture (MAYA) may be established in different parts of the country to facilitate this shift. The AUs must lead this movement by igniting the young minds with emerging and new cutting-edge technologies. Further, a gender perspective into NAEP is necessary to effectively address the inequity and related socio-economic challenges. It is encouraging that the number of girl students in AUs has significantly increased and this must continue.

An Agricultural Education Board should be established as a single regulatory body in Mega-ICAR to be responsible for ensuring high quality of education and creation and judicious implementation of the regulatory mechanisms to reshape the system to ensure that the proven and needed technology/ product, reaches the end-user soonest towards meeting the SDGs. The four verticals of the Higher Education Commission of India (HECI), namely, National Higher Education Regulatory Council, National Accreditation Council, Higher Education Grants Council, and General Education Council should correspondingly be represented in the Board.

R.B. Singh
Former President, NAAS

Forthcoming Programmes

- Strategy Workshop on 'Potential of Transgenic Poultry for Biopharming' (Convener: Dr Tarun Kumar Bhattcharya)
- Strategy Workshop on 'Waste-to-Wealth: Use of Food Industry Waste as Animal Feed' (Convener: Dr N.K.S. Gowda)
- Brainstorming Session on 'Gender and Nutrition Based Extension in Agriculture' (Convener: Dr Ashok K. Singh)
- Brainstorming Session on 'WTO and Indian Agriculture' (Convener: Dr P.S. Birthal)
- Brainstorming Session on 'Contract Farming for Commercial Agriculture' (Convener: Dr Anjani Kuamr)
- Strategy Workshop on 'Sericulture for Enhancing Farmers' Income' (Convener: Dr M. Mahadevappa)
- Strategy Workshop on 'Entrepreneurship for Quality Fodder Production' (Convener: Dr Ajoy Kumar Roy)
- Strategy Workshop on 'Drudgery Free Agriculture' (Convener: Dr N.S. Bains)
- Strategy Workshop on 'Quality Planting Material for Promoting Agricultural Diversification' (Convener: Dr V.K. Baranwal)
- Policy Brief on 'Road Map to Rehabilitate 26 million ha Degraded Lands by 2030' (Conveners: Drs Ch Srinivasa Rao, J.C. Katyal and Anil K. Singh)
- Strategy Workshop on 'Impact of Covid 19 on Animal Health and Dairy Industry' (Convener: Dr R.K. Singh, Former Director, IVRI)

Fellows' Views

Research based Knowledge is Fundamental to Quality Teaching

University is the highest seat of learning, generation of new information, knowledge, and technology besides grooming graduates. Research facilitates latest information for teaching and seminars through national/international interaction. Research presentation, improves communication skill of students and staff. Using latest research publication of self and outside in teaching improves analytical skill of students. Peer review publications -strength of individual scientist and the institution - a basis for sound, consistent and reproducible technology increase confidence and inspire students. And, research activity improves infrastructure, and equipment which also helps training. Comparing to these advantages of teaching with research, teaching with mere Text Book as practiced in most of the universities in India is bland and perhaps main reason for us not figuring with in top 100 universities of the world.

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Extremotolerant Microbial Cultures in Ameliorating Agro-economy

The normal and extreme (natural as well as man-made) environments support a variety of microbes. Microbial strains capable of tolerating extreme conditions *(e.g., high and low temperatures, alkaline, saline and dry conditions)* could be useful in developing sturdy biofertilizers as well as biopesticides for application in agriculture. Such microbial cultures will also be useful in making composts from agricultural residues. This process generates composts which are useful in enhancing soil fertility. Extremotolerant microbes can be used as sources of sturdy enzymes *(enzyme cocktails)* useful in converting agro-residues to sugars that can be fermented to a biofuel-bioethanol. Thus, microbes aid in generating wealth from agricultural wastes/ residues. Stubble burning can be averted in case crop stubbles are used in generating useful products, which also improves farmers' financial situation.

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Buffalo Cloned Bull is Half the Herd

Since the birth of the first buffalo clone in 2009, India has been at the forefront in buffalo cloning research worldwide. To achieve growth at a faster rate, the best productive animals need to be multiplied through scientific and applicable interventions. Buffalo cloning is a reproductive technique used to produce multiple copies of superior animals *(like Xeroxing),* particularly the elite breeding bulls. Scientific studies done by Indian researchers demonstrated that cloned bulls have normal fertility, and their progenies have normal growth and health. At present, India has fifteen cloned-bulls of superior nature. Our country needs to support production and utilization of superior bulls, as *bull is half the herd.*

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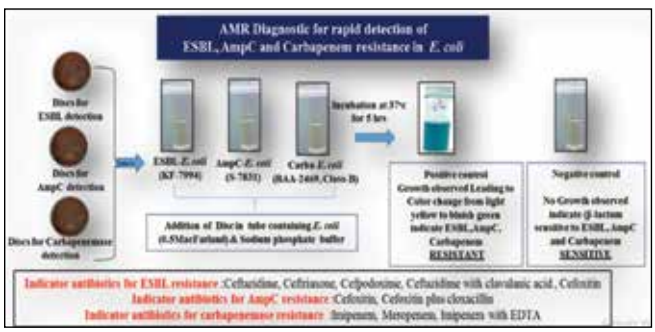
AMR Diagnostic-Rapid Detection of ESBL, Amp-C & Carbapenem Resistance in *E. coli*

Anti Microbial Resistance (AMR) is one of the emerging concerns in health, animal and environmental setting. Development of diagnostic for AMR bacteria will contribute immensely towards judicious use of antibiotics. Currently, AMR testing before prescription of antibiotics is not being

practiced and broad-spectrum antibiotics are given directly to the animals without antimicrobial susceptibility test (AST). Current innovation was designed for development of Rapid *AST assay* for the detection of Extended-Spectrum-β-Lactamase **(ESBL)**, AmpC β-lactamases **(ACBL)** and Carbapenase **(Carbapenem)** resistance in E. coli directly form colonies without going for multiple enrichment and processing within 5.0 h of incubation as indicated in Figure.



Some of the companies like Hi-media, and Sigma Aldrich, USA may come forward for such technology and can start supplying ready to use product to hospitals like AIIMS for detection of ESBL, ACBL and Carbapenem resistant E. coli within 5h as against 48h in conventional methodology. This is an emerging global Issue like Covid-19 pandemic and need research interventions on priority to mitigate the usage of AMU and AMR.

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Ex-situ Management of Straw

Air pollution and ill health due to biomass burning is on the radar of several stakeholders. A subsidy of Rs. 1152 crores were disbursed in the capital region during past two years for the machinery for in-situ management. Punjab state ordered compensation @ Rs. 2500 per acre for not burning and deployed 8000 nodal officers to enforce the ban. President of India has ordered a fine of Rs. one crore or 5 years imprisonment or both. In spite of all that burning events are increasing after 2018. It calls for alternative *ex-situ* management.

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Vegetable Therapy

The present pandemic, in addition to loss of life, high cost of hospitalization and resultant isolation and loneliness is leading to depression of mind. Depression is manifested in anger, fear, sleeplessness, obesity and tight bowel movement. Incidences of suicide among young and children are reported to be on rise.

The nature has built in remedies against above maladies. Vegetable therapy is one such pro-nature prescriptions against depression. There is enough space, water, organic manure and biocontrol measures to grow 'clean vegetables and not cleaned vegetables' preferred by the family members in and around homes. All sorts of vegetables like amaranth, lettuce, palak, tomatoes, chillies, capsicum, cucurbits, bitter gourd, snake gourd, ash gourd, cucumber, musk melon, water melon, cabbage, cauliflower, broccoli, carrots, radish, beet root, onion, garlic, and leek can be grown in home containers. Collection of seeds, nursery raising, transplanting, plant care, micro irrigation, fertigation, use of biocontrol agents and ultimately harvesting at the most edible stage are all done by family members. Daily observation by nearness to plants takes away family members from the agonies of depression. Nutrition garden, kitchen garden, terrace garden, container garden, protected cultivation-hydroponics, aeroponics, aquaponics- are methods of growing of vegetables. It is proved scientifically that vegetable growing is an effective way of managing depression. Many psychologists recommend vegetable therapy to deranged children including those suffering from autism. Social distancing, wearing of mask and washing of hand after touching new arrivals are recommended by public health authorities and need to be followed.

Need for New Microbial Management Protocols in Aquaculture

The idea of considering microbial management protocols is to focus more on disease prevention then on cure, and to improve good aquaculture practices that ultimately will reduce the use of antibiotics and limit further antimicrobial resistance. Good biosecurity protocols in disease prevention require disinfection, however, disinfection kills not only the putative pathogens but a wide diversity of good bacteria with different important roles in the water and when ingested also in the animal. Following disinfection a new colonization takes place and with the stocking of animals and introduction of food the limited number of bacteria can benefit from high levels of nutrients. And that's when the problems start: r-strategist bacteria, particularly the Vibrio's are the first to benefit from these conditions and bloom, whereas the good bacteria, the so-called K-strategists require more time to develop and to eventually outcompete the r-strategists. Adding probiotic bacteria can help but many times this is not enough to control the bloom of opportunistic Vibrio's. Often this can be too late, when the r-strategists reach sufficiently high densities to switch on virulence by their quorum sensing mechanism.

In conclusion we need to expand our knowledge on the role of bacteria in aquatic ecosystems. We urgently need more concerted efforts in microbiome studies using advanced analytical tools and involving different culture systems and species. This should allow us to update Good Aquaculture Practices with more targeted microbial management protocols to better prevent disease outbreaks and reduce the need for disease treatment and use of antibiotics.

Patrick Sorgeloos

Obituary

Dr Anand Swarup

Born in Shahgarhi, Etah, India on May 15, 1950, Dr Anand Swarup received his early education (1960-67) at Radhey Lal Arya Intermediate College, Ahan, Aligarh. He did his graduation and post-graduation from the R.B.S. College Bichpuri, Agra (1967-71) and went on to complete his Ph.D. from the Indian Agricultural Research Institute, New Delhi (1972-76). He was a DAAD Fellow at the Institute of Soil Science and Forest Nutrition, Goettingen, Germany (1980-81).

Dr Anand Swarup worked as Soil Scientist (1976-82) and Sr. Soil Scientist (1982-97) at the Central Soil Salinity Research Institute, Karnal; Project Coordinator (1997-2002), Indian Institute of Soil Science, Bhopal; Head, Division of Soil and Crop Management (2002-06), Central Soil Salinity Research Institute, Karnal; Head (2006-2011), and Principal Scientist (2006-12), Division of Soil Science and Agricultural Chemistry, Indian Agricultual Research Institute, New Delhi.

Dr Swarup was recognized for his outstanding contributions to soil chemistry and fertility, plant nutrition, integrated nutrient management etc. through FAI Silver Jubilee Award of Excellence 1990, PPIC-FAI Award 1994, ISSS 12th International Congress Commemoration Award 1996, TSI-FAI Award 2006, SCSI National Fellow Award, FAI Golden Jubilee Award of Excellence 2008, 13th Dr B.V. Mehta Memorial Lecture Award of ISSS 2009, World Management Congress Lifetime Achievement Award-2009. Dr Swarup also contributed immensely to science as Vice-President, Indian Society of Soil Science (2007-08), and President, Delhi Chapter of Indian Society of Soil Science (2009-10 & 2011-12).

Dr Anand Swarup, a distinguished researcher and fellow of the Academy, left for his heavenly abode on October 20, 2020. On behalf of the Fellowship fraternity, to which Dr Anand Swarup belonged to, the Academy prays to the Almighty to grant peace to the departed soul, and strength to the bereaved family to bear this great loss.

Announcements

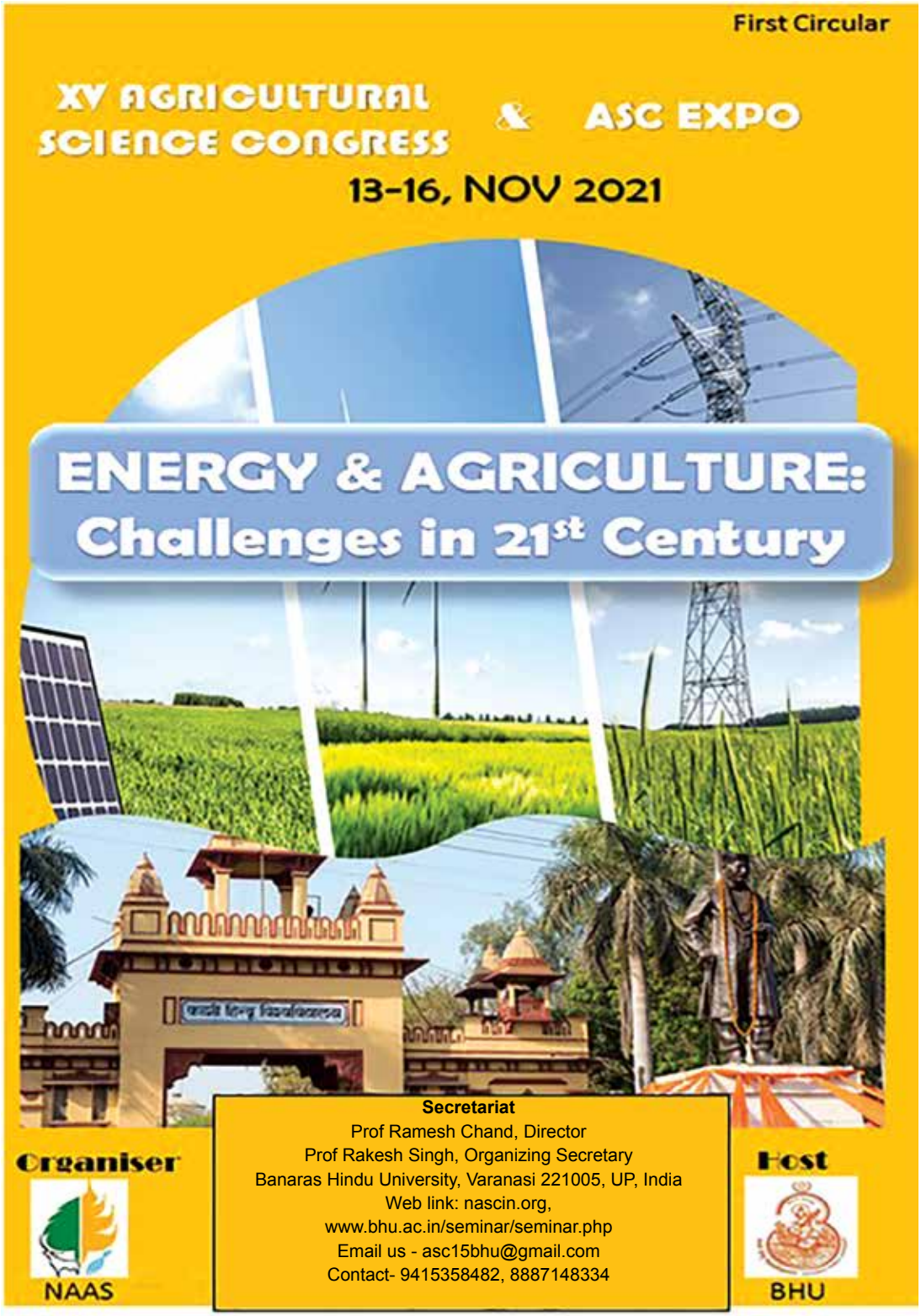
Young Scientist Awards

Young Scientist Awards (Six award for the sections: (i) Plant Improvement, (ii) Plant Protection, (iii) Natural Resource Management, (iv) Animal Sciences and Fisheries, (v) Agricultural Engineering and Technology, and (vi) Social Sciences) Scientists below the age of 35 years are eligible for this award. Each award comprises of a citation and gold plated silver medal. For details, please visit Academy Website at www.naasindia.org or write to the Executive Director, National Academy of Agricultural Sciences, NASC, DPS Marg, New Delhi-110012. Tel 011-25846051, Email: naas-mail@naas.org.in

Last date for receipt of nominations in the Academy is March 31, 2021

Academy Fellowships

Nominations are invited for Election of Fellows and selection of Associates of the Academy for 2022. The last date of receipt of Nominations is March 31, 2021. Nomination forms and relevant details are available at website: http://www.naasindia.org.



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