NAAS NEWS
RESEARCH EDUCATION AND TECHNOLOGY POLICY FORUM

Vol. 24 No. 2 April-June 2024

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From the President's Desk

Increasing Livestock Productivity in India: Technological Advances

Livestock is an integral part of the Indian society making multi-faceted contributions towards socio-economic, nutritional and religious needs of people particularly the rural population. Farm animals contribute directly through milk, meat, egg, wool and fibre production as well as provide employment to 20.5 million people and livelihood to millions of marginal and landless farmers/labourers. It is estimated that 30% of the total protein requirement for human beings is derived from the animal husbandry. Total milk and egg production in the country is 230.58 million tons and 138.38 billion numbers respectively during 2022-23. Current production of livestock and poultry has increased several folds in comparison to 1950-51 *viz.* 11.7 times in milk, 62.4 times in eggs, 1.33 times in wool and 4.62 times in meat (since 2000). The well-structured research programmes of ICAR has played a pivotal role in technology driven progress in livestock sector of the country.

Technological Interventions

Genetic improvement: ICAR has initiated genetic improvement and conservation programme on cattle, buffalo, sheep, goat, pig and poultry. The conservation and genetic improvement of cattle, initiated in 2010, were carried out in indigenous cattle such as Gir, Kankrej and Sahiwal breeds in their home tracts. Network Project on "Buffalo Improvement" was initiated by ICAR in the year 1993, which included important breeds of buffaloes viz. Murrah, Nili-Ravi, Bhadawari, Jaffarabadi, Surti, Pandharpuri and Godavari for their genetic improvement. Similarly, All India Coordinated Research Projects (AICRP) on genetic improvement of goat, sheep and poultry started in 1971 to improve their performance for milk, meat, fibre and egg production. The poultry strains developed under AICRP have achieved the targets of annual egg production of more than 300 eggs with Athulya (ILM 90) having average annual production of 315 eggs and CARI-Priya having average of 301 eggs with better adaptability to tropical climate.

ICAR is also working on other species such as camel, yak and Mithun. Camel is a multipurpose animal and used for milk, meat, wool, transport, race, tourism, agricultural work, decoration for ceremonial functions, and camel dance for amusement. Yaks play multidimensional socio-cultural-economic role for the pastoral nomads, who rear yaks mainly for earning their nutritional and livelihood security. Mithun (*Bos frontalis*) or "gayal" is a unique bovine species playing central role in improving livelihoods of indigenous tribes of NEH region and symbol of prestige for local tribes.

Large volume of information has been generated on molecular genetic studies such as estimation of population structure using DNA marker such as RAPD, microsatellite, AFLP. Candidate genes associated with different performance traits like growth (Growth hormone, Growth hormone receptor, IGF-1, IGF-2, IGFBP, myostatin, TGFs, Ghrelin, lectin, etc.), milk production traits (Casein genes, beta-lactoglobulin etc.), meat quality genes (Calpains, Calpstatin, myostatin, etc.), wool quality gene (keratin type I, keratin type II gene etc.), immunocompetence genes (MHC genes, cytokines and chemokine genes, TLRs, Lysozyme etc.) have been studied. Expression analysis of various genes and transcriptome analysis using microarray/RNA-sequence in different tissues/ organs under different treatments and/or pathogenic challenges have been carried out to decipher the pathways and genetic milieu under different biological processes and/or disease disposition.

***Nutritional interventions*:** In livestock production system, feeds being the major input cost (70%), needs special attention and necessitates to manage the feed resources efficiently to sustain the present growth rate, which led to increase in animal production. The feed technologies have helped in reducing the cost of animal and poultry feed along with augmenting nutrient availability and improving the feed efficiency. A number of alternate feed resources, supplements and additives were identified and standardized for formulation of low-cost rations as well as for substitution of antibiotic growth promoters in feed. The feed formulations and practices were also standardized for mitigating methane emission and stress especially during summers. For efficient use of feed resources, technologies like fodder block, pellet making, extrusion, complete feed block (total mixed ration) have been developed and adopted by feed industry. Several enzymes like phytase, carbohydrase, proteinase etc. are being used to obtain more animal produce at cheaper cost.

***Methane mitigation strategies*:** Livestock are considered one of the sources for methane emission due to enteric fermentation. Researches on ameliorative measures through dietary approaches have shown that it is possible to reduce the methane production by 10-15% by feeding of more digestible feeds like legumes, concentrate, grains and feed formulations. By feeding balanced ration to the dairy animals under field condition, the reduction in methane emission by 10-15% was achieved. Seaweed products have also been used to reduce methane emission by 15%.

***Reproductive techniques*:** The assisted reproductive technologies (ARTs) such as artificial insemination (AI), multiple ovulation and embryo transfer (MOET), *In-Vitro* Fertilization (IVF) and sperm sexing have been standardized for optimized production. Since beginning, ET has been extensively used for bull production programmes. Intense genetic selection of bulls and use of cryopreserved semen from these selected bulls for Artificial Insemination **(**AI) has brought rapid improvement in dairy industry in the world. Tremendous progress has been made in semen cryopreservation and AI techniques to enable a single bull to be used simultaneously in several countries for up to 100,000 inseminations per year. Presently, about 30% of the total breedable bovines are covered under AI programme. AI is currently used in breeding programmes of ICAR, central and state govt farms and schemes of government. AI with frozen semen has also been standardized in Goat, while, it is practiced with refrigerated semen in sheep. In Pigs, AI with chilled semen is being practiced. Overall conception rate to AI is about 30-35%, which warrants more intensified R&D efforts for improving the AI technology.

The first embryo transfer calf in ICAR was born in 1987 at ICAR-NDRI (National Dairy Research Institute), Karnal. Ovum Pick-up and *in-vitro* Fertilization (OPU-IVF) is a technique for *in-vitro* embryo production (IVEP) has been made available as a tool for utilization of the indigenous cow oocyte / gamete pool for enhancing the maternal contribution to genetic improvement. The indigenous cattle of high genetic merit which are clinically sub-fertile or aged or do not respond to conventional ETT procedures, this is the only technology that may help in obtaining high value oocytes for using in IVF and embryo production.

India produced cloned buffalo in 2009 by cloning at ICAR- NDRI, Karnal. Using simplified buffalo cloning technology, several cloned buffaloes were produced in the country using different types of somatic cells. At Central Institute of Research on Buffaloes (CIRB) and NDRI, so far, 15 cloned bulls from superior males and 1 re-clone calf have been produced. The first cloned bull produced at CIRB 'Hisar Gaurav' was born in 2015 has already produced more than 15,000 doses

of semen. These semen doses have been used both at CIRB as well as at farmers' herds to produce 62 pregnancies, which are growing normally, similar to progenies of bulls born conventionally.

***Animal health management*:** ICAR is involved in animal health protection through development of vaccine, diagnostics and therapeutics and continues to serve the nation through protection of its animal wealth. ICAR is also involved in surveillance, monitoring and analysis of livestock diseases in India through a network of collaborative centres. We also work on exotic and emerging animal diseases and also playing very important role in the era of rising global trade with stringent sanitary requirements and biological safety measures and growing threat of novel pathogens by contributing towards animal health management in the country. ICAR has also developed diagnostics against important equine diseases and contributes to the nation-wide sero-surveillance of infectious diseases in equines. ICAR-National Centre for Veterinary Type Cultures (NCVTC), Hisar is a microbial repository of cultures in Veterinary Microbes, Dairy Microbes and Rumen Microbes. ICAR research is focusing on development of next generation diagnostics and novel vaccine candidates for important livestock and poultry diseases. Veterinary Telemedicine is also standardized to provide remote consultation and diagnostics to farmers.

Sustainable Livestock Management Practices

ICAR has developed several modern shelter designs to improve comfort and reduce stress for animals. Several mobile Apps have been developed to provide information to farmers on best practices, and informed decisions about breeding, feeding, and health management. Similarly, the different methods have been developed to recycle animal waste into bioenergy or fertilizers. Adopting these technologies can significantly enhance livestock productivity in India, leading to better economic returns for farmers and contributing to the overall development of the agricultural sector.

Value Addition

The value addition and product diversification are the key requirement for farmers profit and long-term sustainability of livestock production system. Flavoured milk or drink in combination with natural fruits juices or pulps, high milk protein drinks, fermented dairy beverages with unique microbial starter and herb-milk beverage have been developed. Long-life and convenient ready-to-make mixes for paneer, milk cake, *rasmalai, basundi*, *kheer, payasam*, *kunda*, have been developed for such enterprises. Considering the growing demand of ghee as cooking medium within the country and middle-east nations, technology for low cholesterol ghee and Arjuna herbal ghee has been launched. Health foods using judicious blends of milk/milk constituents and cereals/plant commodities, into convenient, long-life forms with proven health benefits to consumers have been developed. Therapeutic virtues of herbs are harnessed by suitably incorporating their bioactive-rich fractions in products like fermented milk, ghee, and sweets. Technology for low sodium cheddar, processed and cottage cheese was developed. Probiotics in dairy products development as an ideal vehicle for delivering the probiotic in diet has been achieved.

Processing of meat is primarily done to add value to meat, provide variety and convenience to the consumers, provide employment, better utilization of low-value cuts and by-products from slaughterhouses, extend shelf-life, facilitate incorporation of non-meat ingredients, better marketing and distribution, better profit and scope for export. Enrobing is the process of making "further processed products" by applying an edible coating, brings several advantages such as value addition, versatility to consumers, and improvement of nutritive value. The products like enrobed eggs and enrobed/ coated meat products are getting popular. Recipes for products like restructured meat products and cured and smoked meat products, heritage products (like Kebbabs, curries, pickle, soups), shelf stable ready-to-eat meat products, fermented meat products and functional foods were standardized and commercialized.

Precision Livestock Farming

Precision livestock farming uses information technology to assess the individual animal with respect to physical resource and bring improvement accordingly to optimize economical farming. This helps us to identify poor performance animals in the flock and cull those individuals from flock. The electronic identification has made it possible to identify individuals in accurate manner at faster pace. Feed is one of the major inputs and varies from 58% to 70% for livestock farming input cost. However, high input cost can be reduced by implementing precision grazing and feeding management. Similarly, the labour cost constitutes 18-25% of farming input cost and can be reduced by effective management and use of technology.

Himanshu Pathak
President

Executive Council Meeting

137th Meeting

The 137th meeting of NAAS Executive Council (EC) was held in hybrid mode on June 04, 2024 under the Chairmanship of Dr. Himanshu Pathak (President, NAAS). After brief welcome address, agenda items deliberated upon by the EC during the meeting were:

- The status of "Smt. Kanak Aggarwal NAAS Girls Scholarship" (@ Rs 3000 per month) from M/s Crystal Crop Protection Ltd., Delhi was reviewed. This scholarship will support 84 undergraduate girl students in agricultural education admitted at various universities.
- Dr. P.K. Joshi presented the status of the NAAS publication entitled "Road Map for Indian Agricultural Research, Education, and Extension during Amrit Kaal 2047".
- Theme "Frontier Sciences and Technologies in Agriculture for a Developed India" for XVII ASC to be held at GBPUA&T Pantnagar during 2025 was finalized.
- EC was informed about (i) first Prof. MS Swaminathan Foundation Day Lecture-2024 to be delivered by Shri M. Venkaiah Naidu (former Vice President) on June 5, 2024; (ii) new conveners identified for NAAS Regional Chapters, effective from January 01, 2024. These include Dr. N.K. Shivakumar Gowda (Bengaluru), Dr. Raman Meenakshi Sundaram (Hyderabad), Dr. Gurbachan Singh (Karnal), and Dr. Basanta Kumar Das (Kolkata); (iii) creation of a NAAS Forum for Young Scientists involving Associates, and Fellows under 45 years of age; and (iv) the appointment of M/s Pawan Shubham & Co. as auditors for 2024-25.

- Dr. Rajender Parsad (Treasurer, NAAS) informed that it was decided during a meeting with the Professional Association of Agricultural Societies (PAAS) to organize workshops on "Digital Agriculture," and conduct capacity-building programs for enhancing Journals quality.
- Prof. Rajeev K. Varshney (Foreign Secretary, NAAS) discussed the collaboration with the World Food Prize Foundation for the International Borlaug Dialogue in October 2024. NAAS will organize a session during the event entitled "Seeds of Opportunity: Bridging Generations and Cultivating Diplomacy".
- Dr. W.S. Lakra (Secretary, NAAS) informed that (i) the review of Academy's Bye-Laws, Rules, and Regulations will be completed by the end of July 2024; (ii) the election process for new EC members will be initiated, as the tenure of some members ends on December 31, 2024; and (iii) 368 nominations/ applications have been received for fellowships, associates, and academy awards including 11 for Parvasi and 5 for Foreign Fellowships.
- Proposal to print only soft copies of NAAS documents, such as Newsletters, Annual Reports, Policy Papers, etc. was approved to reduce costs and save paper. Documents will be made accessible through the NAAS website.

Before concluding the meeting, Dr. Ashok K Singh (Secretary, NAAS) proposed formal vote of thanks.

31st Annual General Body Meeting

The 31st Annual General Body Meeting (AGM) of the Academy was held in hybrid mode under the Chairmanship of Dr. Himanshu Pathak (President, NAAS) on June 05, 2024. Prior to AGM, panel discussions (2) and special lectures (2) on pivotal topics in the field of agriculture were organized on June 04, 2024.

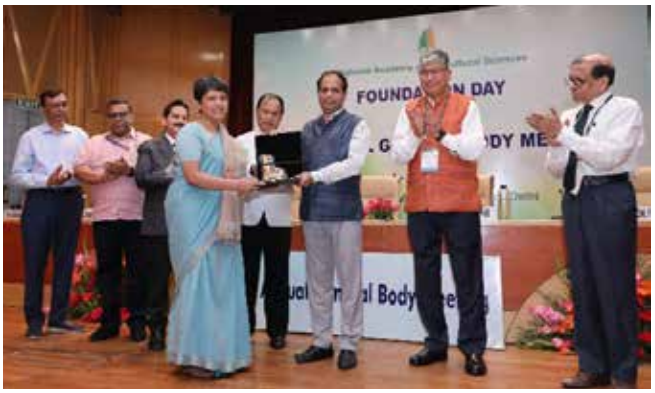
The panel discussion on "Agriculture in Viksit Bharat@2047: Mid Term and Long Term Action Agenda" explored the strategic initiatives and frameworks for advancing India's agricultural sector over the coming

decades. The other panel discussion on “A Roadmap for Second Blue Revolution”, delved into strategies for revolutionizing India’s blue economy, aiming to unlock the vast potential of the country’s marine and fresh water aquatic resources. Besides, there were two evening lectures by Dr. Takashi Yamano (Principal Economist, ADB, Dhaka) on “Climate Resilience to Mitigation: Farmers’ Technology Adoption in South Asia” and Prof. Ashwani Pareek, (Executive Director, NABI, Mohali) on “Cracking Nature’s Code: Ensuring Grains in Salt But No Salt in Grains”.

On June 05, 2024, at the outset, a moment of silence was observed in remembrance of thirteen esteemed Fellows of the Academy, Dr. Vishnu Swarup; Dr. Brahma Singh; Prof. Edward Cocking; Dr. S.D. Tripathi; Dr. Balram Sharma; Prof. MS Swaminathan; Dr. Prem Narain; Dr. S.R. Verma; Dr. Nath Saran Lal Srivastava; Prof. Mohammad Shamim Jairajpuri; Prof. Mam Chand Goel; Dr. Gajendra Bahadur Singh; and Dr. Uma Shankar Singh, who left us for heavenly abode since the last meeting of the General Body. Dr. Ashok K. Singh, (Secretary, NAAS), then welcomed the President, Dr. Himanshu Pathak, the Past Presidents, all Office Bearers and EC members, and esteemed Fellows who were attending the AGM physically and online. Dr. Himanshu Pathak also extended a warm welcome to all the esteemed Fellows as well as the newly elected Fellows and Associates.

Thereafter the listed agenda were dealt by Dr. Lakra (Secretary, NAAS). He mentioned that the Academy organized seven Brainstorming Sessions, four Strategy Workshops, and two Consultation meetings during 2023-24. He also informed that the Academy has been enriched by inducting 33 new Fellows (including one Foreign Fellows and three Pravasi Fellows), and 12 Associates, thus bringing the strength of Fellows to 793 and Associates to 126 as on January 01, 2024. Dr. V.K. Baranwal (Editor, NAAS) informed that the Academy published seven Policy Papers (PP-119 to 125) and four issues of the NAAS News during the year. Besides, four issues of NAAS official journal ‘Agricultural Research’ were printed in time with Springer India Pvt. Ltd. The Academy also published two books entitled “Transformation of Agri-food Systems” and “State of Indian Agriculture” besides Annual Report (2023-24).

The Academy felicitated 2024 Padma Awardees, Dr. Ravi Prakash Singh, (NAAS Fellow) (in absentia), and



Shri Sanjay Anant Patil (a farmer), two industrialists Shri Nand Kishor Aggarwal and Shri M. Prabhakar Rao and two media personalities, Shri Sandip Das and Ms. Laxmi Devi during this session. The newly elected Fellows and Associates were also admitted to the Academy and Young Scientist Awards were presented.

Presidential Address

Dr. Himanshu Pathak (President, NAAS) delivered his address on "Transforming R&D in Agriculture: Recent Initiatives of ICAR". While emphasizing ICAR's nationwide network of agricultural research and development, which includes 113 Institutes, 151 Regional Stations, 77 Universities, 80 PhD programs, 95 Postgraduate programs, and 11 undergraduate

programs, he mentioned that though the Council has made significant achievements in agriculture, however, the challenges faced by Indian agriculture are: high inputs costs and low productivity; limited diversification; degraded soil; depleting water resources' increasing pest and disease issues; significant food losses; high volatility; and climate risks.

According to RBI, India needs 7.6% GDP growth and 4.9% agriculture growth rate to become a developed country by 2047. Opportunities to achieve these targets include:

- New Tools: Leveraging ICT, GIS, AI, and genome editing for product development, delivery, and decision-making.
- Increasing Demand: For quality and nature-friendly food driven by rising incomes.
- Integrated Policy: Facilitating cooperation across partners.
- Increasing Funding: From national systems and private sectors.
- Quality Manpower: Ensuring educated, trained, and committed personnel.
- Partnerships for Impact: Collaborating with national and international organizations, forming public-private consortia in selected research areas, and establishing public-private-peasant-policy partnerships (5Ps) for capacity building.

ICAR Initiatives

Human Resource Management

- Placing people in positions (2921).
- Delegation of power and fast-tracking decision-making.
- Unification of staff and review of the transfer system.
- Online and simple information systems (ARMS, PFMS, APAR).
- Regular capacity-building programs.

Research and Education Management

- Certifying technologies: NRM, protection, and other technologies and products.
- Technology commercialization: Streamlining guidelines.
- Aligning disciplines across the SMDs.
- Social media outreach: One technology, One day.
- Regular review and interactions with institutes and universities.
- Projects: Corpus Fund, Young Scientist Project (YSP), National Priority Project (NPP), Product Delivery Project (PDP), National Agri-education Project (NAP), Vikshit Bharat Project (VBP).

Agricultural Extension

- Feedback management through big data analytics.
- Promotion of nature-friendly farming.
- Customized agro-advisory through Kisan Sarathi.
- Agri-drone application.
- Technology dissemination through PPP mode.

Future Directions

- Raising yield potential, resilience, and bridging yield gaps.
- Integrating modern science with traditional systems for farm upscaling.
- Building capacity: Equipping scientists, staff, students, and farmers with new knowledge and skills.
- Efficient management: Strengthening administration and financial support.
- Transforming agri-R&D: Enhancing profitability, resilience, and productivity.

Prof. M. S. Swaminathan Foundation Day Lecture

Academy's Foundation Day Lecture was renamed as Prof. M. S. Swaminathan Foundation Day Lecture, a befitting tribute to the Father of the Green Revolution. The first Prof. M.S. Swaminathan Foundation Day Lecture was delivered by Shri M. Venkaiah Naidu, Hon'ble Former Vice President of India, on June 05, 2024. Highlighting the legacy of Prof. M.S. Swaminathan, Shri Naidu praised his pioneering contributions to agricultural science which transformed India from a food-deficit to food surplus country. According to him, Prof. Swaminathan's work

in promoting high-yielding varieties, sustainable farming practices, and modern irrigation techniques significantly increased crop yields, ensuring food security and alleviating poverty. His vision extended beyond Green Revolution, advocating for the Evergreen Revolution, a sustainable approach to agriculture integrating modern technology and traditional wisdom. His efforts in developing the Plant Variety Protection and Farmer's Right Act in 2002 and his influential reports, including the National Commission on Farmers Report, were praise worthy for their impact on agricultural policies and farmers welfare.

He concluded his lecture by reaffirming Prof. Swaminathan's legacy, which continues to shape agricultural policies and practices, ensuring food security and promoting sustainable development. Prof. Swaminathan's vision and leadership would remain a guiding force for India's agricultural progress and sustainability, marking him as a saviour of farmers and an advocate for ecological stewardship.

NAAS Programmes

Strategy Workshops

"Maize to Ethanol in India: Prospects and Strategies" (Conveners: Dr H.S. Jat and Dr T.R. Sharma)

The Academy organized a strategy workshop on "Maize to Ethanol in India: Prospects and Strategies" in hybrid mode on April 03, 2024 under the

Chairmanship of Dr. Himanshu Pathak (President, NAAS). Dr. B.S. Dhillon (Former VC, PAU, Ludhiana) Co-chaired the session.

The National Biofuel Policy (2018) laid a renewed emphasis on the ethanol production programme in the country and this has become one of the major priorities of 21st century. The government of India is aiming for 20% Ethanol Blended with Petrol (EBP) by 2025-26 and 30% by 2030 for which maize has been identified as one of important feedstocks. By 2025-26, bioethanol demand is expected to reach 14 billion liters, with 50% coming from maize. To meet this demand, 9-10 million tonnes of maize grains are needed annually and further demand will be 18-20 million tonnes to meet the target of EBP30. A sustainable technological and policy framework is thus

needed to enhance maize production. As per ICAR-Indian Institute of Maize Research vision 2030, the total maize production requirement for various sectors including ethanol would be 63-65 million tonnes by 2030. Targeted productivity and area expansion will be sufficient to meet out the maize demand for ethanol blending target. Besides, improved ethanol process optimization (enzymes and process cardinals) are crucial for sustainable and higher recovery. Essential requirements to meet the increasing demand of maize production for ethanol blending are:

Intervention needed

Enhancing coverage under single cross hybrids, seed availability, regional seed hub creation, crop management practices, and maize drying facilities are key to expanding maize in India. Tapping rice fallows, expanding upland areas in Eastern India, western Indo-Gangetic plains, and intercropping with wide spaced crops are also essential. Apart from ethanol, 25-30% the distiller's dry grain and soluble (DDGS) is produced which has 25-30% protein & 10-15% fat. DDGS is currently used in the feed sector to the extent of 3-5%. Improving DDGS quality with reduced aflatoxin contamination and proper drying is crucial for remunerative prices and its utilization in feed/food industries.

Planning required

The Indian government has set EBP targets for E20&30, which require proper planning in different phases. Short-term planning (<3 years) should focus on developing catchment areas, demonstrating high-yielding single cross hybrids, adopting best PoPs, with better ethanol recovery, exploring alternate seed production sites, Capacity building of distilleries and stakeholders, creating drying facilities, and mapping maize suitability. Mid-term planning (3-5 years) should focus on developing high-yielding hybrids, creating storage facilities, seed hubs, improving DDGS quality, process optimization for better ethanol recovery, expanding maize areas, and gene editing. Long-term planning (>5 years) should focus on linking maize prices to ethanol prices and establishing stable management systems from harvesting to ethanol production and self-sustaining ethanol distilleries through research and policies linkages.

Policy support

Maize can support the EBP programme in India, but it requires support from policies for greater impact. Sustainable policies for storage facilities, drying, technology targeting, hybrid seed production, crop management practices, and maize mechanization hubs are needed. CSR funds from IT and services sectors can help to create maize hubs and research sustainable ethanol production. The linking of the ethanol prices with maize prices on regular basis is required for sustainable bioethanol production. The government of India have taken initiatives in this direction by announcing remunerative prices for maize ethanol (Rs. 71.86/ litre), maize purchase at minimum support price (Rs 2090/quintal) by NAFED and NCCF, incentivization of maize cultivation under NFSM/crop diversification/catchment area development/ PPPAVCD schemes, supporting the research project to ICAR for ethanol, etc. ICAR-IIMR, in collaboration with partners, is implementing research projects funded by MoA & FW, GOI, focusing on developing catchment areas around the distilleries, high-yielding hybrids, and optimizing ethanol recovery processes.

"Carbon Farming" (Conveners: Prof Biswapati Mandal, & Dr. VK Sehgal)

The Academy organized a strategy workshop on 'Carbon Farming' in hybrid mode on May 04, 2024 under the Chairmanship of Dr. Himanshu Pathak (President, NAAS). Around 30 experts belonging to public and private organizations participated in the workshop so as to formulate a policy document to support government initiative to launch 'Carbon Mission' for the country to impart resilience against natural and anthropogenic stresses and degrading natural resources, to improve partial factor productivity of

agricultural inputs (including fertilizer, water, etc), and to combat climate change for achieving carbon neutrality in agricultural systems. The issues deliberated upon involved: (i) identifying the optimal practices – crops, cropping systems, and management for C-farming for different agro-ecologies; (ii) problems associated with measurement of C-yield; (iii) restoration of degraded land through C-farming; (iv) economic potential of C-farming and (v) empowerment of farmers for C-farming etc.

Panel Discussions

The Academy organized two panel discussions on "Agriculture in Viksit Bharat@2047: Mid Term and Long Term Action Agenda" and "A Roadmap for Second Blue Revolution" in hybrid mode on June 04, 2024 under

the Chairmanship of Dr Himanshu Pathak (President, NAAS). Dr. K.M. Bujarbaruah (Vice President, NAAS) Co-chaired the sessions.

"Agriculture in Viksit Bharat@2047: Mid-term and long-term action agenda" (Convener: Dr. Bikash Mandal)

A comprehensive presentation on the vision and action plans for agriculture in Viksit Bharat@2047 was made by Dr. Bikash Mandal (ADG International Relations, ICAR. Subsequently, the panellists (Dr. D K Yadav, ADG Seeds; Dr. R Bhatta, DDG Animal Science; Dr. Shubhadeep Ghosh, ADG Marine Fisheries; Dr U S Gautam, DDG Agriculture Extension; Dr. P S Birthal, Director, ICAR-NIAEP and Dr. Niyati Singaraju, IRRI, New Delhi) made brief presentations on reshaping R&D in crop production, animal husbandry and fisheries; revamping extension services; policy support and empowering youth and women in agriculture respectively.

Indian agriculture in *Viksit Bharat* has been envisioned not as a State subject but as a global agri-powerhouse. For India to be the global food basket, the mid-term (2030) and long-term (2047) macro goals have been set for the productivity of all categories of food, farm mechanisation, reduction of postharvest loss, crop insurance coverage, artificial insemination coverage etc. It has been aimed to achieve global export of agricultural commodities and the income of farmer to be 10% and 6x by 2047 respectively.

In order to realise the goals of *Viksit Bharat*, five major thrust areas have been identified: (i) sustainable agriculture, resilient to climate shock and resource depletion, (ii) high productivity, diversified cluster based approach for end-to-end value chain based production and processing, (iii) best-in-class technology and R&D integration, (iv) robust domestic market and export linkages and (v) large-scale farming and postharvest management with cooperatives & FPOs. In addition, big-ticket ideas are necessary for development of agri-innovation cluster through early Government's policy interventions and stakeholder collaborations.

For successful achievement of the set targets of *Viksit Bharat*, higher R&D investment is critical requirement. A present, India's R&D expenditure is 0.7% of GDP. The mid-term and the long-term target has been projected to be >1.5% by 2030 and >3.5% by 2047. Successful planning of agriculture system during the *Amrit Kaal* will hold the key for sustaining national food security and global leadership in agriculture.

"A Roadmap for Second Blue Revolution" (Convener: Dr. J.K. Jena; Co-convener: Dr A. Gopalakrishnan)

Dr. J.K. Jena (DDG, Fisheries Science), in his initial presentation, projected 24 million tonnes and 40 million tonnes as the target for fish production to be achieved by 2030 and 2047 respectively. To achieve these targets, there is a need for an increased focus not only on ongoing programmes on species diversification, with a special thrust on high-value species, especially in brackish water aquaculture and open-sea mariculture, but also on the adoption of non-conventional farming systems, including that of farming of non-food species *viz*., ornamental fishes, pearl oysters/mussels, and seaweed. He emphasized on (i) ensuring quality seed production of diversified species while overcoming the issues of inbreeding, hybridization and backcrosses; (ii) increased research focus on genetic improvement programmes through selective breeding, marker-assisted selection, genomic selection and genome editing for important cultivable species; (iii) new feed ingredients especially as an alternate source of fish meal; and (iv) strengthening the disease surveillance programme, besides intensified research for innovations in therapeutics, diagnostics and vaccine development. Besides focusing on increasing production, aspects of sustainability and resilience need dire consideration.

The Panellists (Dr. P.K. Sahoo, Director, ICAR-CIFA, Bhubaneswar; Dr. Akshaya Panigrahi, Principal Scientist, ICAR-CIBA, Chennai; Dr. V.V.R. Suresh, Pr. Scientist & Head, ICAR-CMFRI, Kochi; Dr. P. K. Pandey, Director, ICAR-DCFR, Bhimtal; Dr. B. K. Das, Director, ICAR-CIFRI, Barrackpore; Dr. K. Ambasankar, Pr. Scientist & Head, ICAR-CIBA, Chennai; Dr. Iddya Karunasagar, Advisor (Research & Patents), Nitte University, Mangalore; Dr. B. K. Behera, Chief Executive, NFDB, Hyderabad) shared their view points to accelerate adoption and propagation of genetically improved varieties of Indian fish species among farmers. The panel experts felt a pressing need for more awareness campaigns, provision of financial incentives, formation of aquafarming clusters, improving domestic marketing networks, end-to-end value chain development, fostering R&D partnerships, and advocating supportive policies. The genetically improved varieties of rohu, catla, prawn and magur, which have not penetrated beyond 10% of the culture

area; need to be propagated and replaced fully with the normal species. Other important approaches include propagation of region-specific species, round-the-year seed production, cluster farming, water budgeting, carbon credit and carbon neutral aquaculture, hatchery accreditation and guidelines, high-value fish production in biofloc and intensive seed production in RAS & biofloc, fortified feeds, feed for broods and larval stages; alternate proteins, tailored feeds and mineral supplements, engineered nutrients, farm level diagnostics and health products.

Activities of the Regional Chapters

Coimbatore Chapter

- The NAAS Coimbatore Chapter organized a workshop on April 24, 2024 in collaboration with ICAR-Sugarcane Breeding Institute (SBI), Coimbatore on "Climate Resilient Sugarcane Agriculture for Greener and Sweeter Tomorrow". 99 participants including scientists, young professionals and students from different colleges attended the workshop.

- A seminar on "Role of AI and IoT in Agriculture and Its Scope in Intellectual Property Management", was jointly organized with ICAR-SBI, Coimbatore on April 30, 2024 for the benefit of research scholars and PG students from various colleges in Coimbatore.

- Arranged Interaction on May 05, 2024 with tribal women from three tribal hamlets Ramarane, Mavanatham and Galithimbam of Sathyamangalam Tiger Reserve, Erode District, TN on vegetable garden and balanced diet.

Hyderabad Chapter

On the occasion of 10th International Day of Yoga 2024, the NAAS Hyderabad Chapter organized yoga activities under the theme *"Yoga for Self and Society" in collaboration with* ICAR-Indian Institute of Rice Research, Hyderabad and Society for Advancement of Rice Research. Dr. N. Adilaxmi, an eminent Bharatnatayam expert, delivered a talk on dance mudras, which can reduce stress in day-to-day life and serve as a powerful healing tool. A meditation session was conducted by Shri Anand

Hippalgoankar, Heartfulness Meditation Trainer, for stress free balanced life.

Lucknow Chapter

IARI Mega Universities (Lucknow Hub) students interaction with the President (NAAS)

Dr. Himanshu Pathak (President, NAAS), during his visit to ICAR-Indian Institute of Sugarcane Research (IISR), Lucknow, interacted with IARI-Lucknow Hub students on April 14, 2024. While addressing the students, he emphasized that for quality education in the country, students need to acquire better skills and knowledge by using modern facilities available at ICAR Institutes. He appreciated the efforts made by ICAR Institutes located at Lucknow for extending all support to the students to acquire quality education. He also mentioned that there was no short cut to success, and perseverance is the only key to the success. Besides Dr. R. Viswanathan (Director, ICAR-IISR Lucknow; Nodal Director, IARI-Lucknow Hub & Convener NAAS Lucknow Chapter), Dr V B Patel (ADG, Fruits and Plantation Crops); Dr. T. Damodaran (Director, ICAR-Central Institute for Subtropical Horticulture, Lucknow); Dr. U.K Sarkar (Director, ICAR-National Bureau of Fisheries Genetic Resources, Lucknow); Dr. A.K. Dubey (Head, ICAR-Central Soil Salinity Research Institute Regional Research Station, Lucknow) and teaching faculty from Lucknow hub participated in the interaction meeting.

- A workshop on "Promotion of Climate Resilient crops/ varieties/ seeds' under *Mission LiFE (Lifestyle for Environment)* was organised on April 26, 2024 in collaboration with IISR-Lucknow. Conserving precious natural resources and living in harmony with nature were the main focus of the workshop. Oral and poster presentations were made by under graduate and post graduate students. 58 students from Amity University, Integral University, SRM University, IT College, and SR Institute of Management and Technology participated in the event. A special lecture on "Climate Change and Its Effect on Agriculture" was also delivered by Dr Atul Kumar Singh,

Scientist D and Head, Agro meteorology, Indian Meteorology Department, Lucknow.

Ludhiana Chapter

- The NAAS Ludhiana Chapter in association with The Crop Improvement Society of India, Ludhiana organized a special lecture on "Genome Editing Enables Crop Improvement" on April 29, 2024. The lecture was delivered by Dr Bing Yang, Professor, Division of Plant Science and Technology, University of Missouri, USA and event was chaired by Dr Ajmer Singh Dhatt, (Convener, NAAS-Ludhiana Chapter and Director of Research, PAU, Ludhiana). Dr. Yang, while interacting with the students and faculty members, highlighted that the genome editing tools could have significant impact enabling scientists to improve resilience to existing and

emerging diseases and pests as well as extreme weather conditions. He stressed that with the availability of sequences of many plant genomes, technologies for genome editing have become the most promising and popular tools for scientists to understand complex genomes and quickly manipulate genes for food and nutritional traits. Dr. Dhatt apprised the audience that the genome editing technologies allow precise and targeted genomic changes and hold immense promise for defining the genetic and molecular basis for valuable traits, as well as for the manipulation of valuable genes/traits into cultivated varieties in a timely and economically sound manner.

Awareness Programmes

- The NAAS Ludhiana Chapter in association with Krishi Vigyan Kendra, Bahowal, Hoshiarpur at Government Middle Smart School, Village Bahowal, Block Mahilpur, District Hoshiarpur organized an awareness programme on "Processing Techniques for Agricultural Produce" and "Significance of Soil Testing" on April 29, 2024. 25 school children participated in this awareness programme. Dr. Ajaib Singh, (Assistant Professor, Agricultural Engineering, PAU) introduced the participants to various processing techniques relevant to agricultural commodities, including drying, sorting, grading, packaging, and value-added processing like juicing and canning. Another programme emphasizing the crucial role of soil testing in optimizing fertilizer utilization, enhancing crop yields, improving soil health, and mitigating environmental degradation was also held. Basic knowledge on soil composition and nutrient management and method of soil sampling was imparted to the students.
- An awareness programme in association with Krishi Vigyan Kendra, Bahowal, Hoshiarpur was organized at Sahibzaada Ajit Singh Public School, Ladhewal, Block Mahilpur, District Hoshiarpur on "Role of Women Empowerment in Rural Upliftment and Nutritional Management of Anaemia in Adolescent Girls and Women" for school girls on May 17, 2024. 114 school girls participated in this awareness programme. Dr. Maninder Singh Bons (Associate Director, Training) addressed the issue of women empowerment as a cornerstone for rural development, including skill development, education, and entrepreneurial opportunities. Dr. Sukhdeep Kaur (Assistant Professor, Home Science) highlighted the importance of iron-rich foods and balanced diet by providing detailed nutritional guidelines to combat anaemia, particularly prevalent among adolescent girls and women. Practical tips on diet modification and the inclusion of locally available nutritious foods were shared to ensure accessibility and affordability.
- An awareness programme on "Dietary management of Anaemia" was organized on May 23, 2024. 35 girls and women from different villages of the

District at Moga Krishi Vigyan Kendra, Budh Singh Wala, Moga participated in this awareness programme. Dr. Parminder Kaur (Professor, Home Science) appraised them regarding health and nutritional status of the rural girls in Punjab and the increasing incidence of anaemia. Dr. Prerna Thakur (Assistant Professor, Vegetable science) emphasized the importance of green leafy vegetables in combating anaemia and motivated them to cultivate these at home scale levels. She also urged them to plant citrus fruits in their homes and at farms.

- An awareness programme in association with PAU-Krishi Vigyan Kendra, Sangrur, on "Promotion of Household Water Conservation" at KVK, Sangrur was organized on May 31, 2024.

The programme included sessions on water conservation methods and interactive discussions empowering participants with the knowledge to implement sustainable water use at home. Dr. Vitasta (Assistant Professor, Home Science) discussed simple measures like fixing leaks to more comprehensive strategies like rainwater harvesting. The programme also featured a discussion session involving a local woman who has successfully implemented water conservation practices, serving as inspirational role model.

- A training session in association with the Department of Extension Education & Communication Management, PAU, Ludhiana was organized on "Sensitizing Farming Families for Sustainable Water-Use Behaviour" was organized in village Rampur on May 06, 2024 to foster awareness and adoption practices for sustainable water use behavior among local farm families. Dr. Vinay Kumar, (Agronomist) highlighted the condition of water in Punjab and also discussed the advantages of various water saving technologies like drip irrigation system, laser leveler, small beds for wheat etc. A film was also shown to encourage the farming community to make sensible use of water at household level.

Varanasi Chapter

- The NAAS Varanasi Chapter organized a workshop on June 19, 2024 for Horticulture Officers from Odisha to create awareness about the nutritional and medicinal benefits of various types of vegetables. Dr. Nagendra Rai, (Convener, NAAS Varanasi Chapter and Director, IIVR), provided detailed information on climate-tolerant high-quality vegetable crops developed by the Institute. Dr. D.R. Bhardwaj (Principal Scientist, IIVR) stressed upon crop diversification by growing more vegetables.

सब्जियों के अधिक उत्पादन को दें बढ़ावा

आइआइवीआर में संस्थान व नास के संयुक्त तत्वावधान में ओडिशा के उद्यान अधिकारियों के प्रशिक्षण में बोलते डा. राकेश दुबे ● जागरण

जागरण संवाददाता, वाराणसी : उच्च गुणवत्ता वाली सब्जियों की प्रजातियों के बीज को आइसीएआर के भारतीय सब्जी अनुसंधान संस्थान से लें और अधिक से अधिक मात्रा में प्रयोग कर गुणवत्ता युक्त अधिक उत्पादन को बढ़ावा दें। यह आह्वान किया है राष्ट्रीय कृषि विज्ञान अकादमी, वाराणसी चैप्टर के संयोजक एवं शहंशाहपुर स्थित आइआइवीआर के निदेशक डा. नागेंद्र राय ने। वह बुधवार को संस्थान एवं अकादमी के संयुक्त तत्वावधान में ओडिशा राज्य से प्रशिक्षण पर आए उद्यान अधिकारियों के बीच वैज्ञानिक सोच विकसित करने एवं सब्जियों पर पड़ रहे जलवायु परिवर्तन के प्रभाव पर एक दिवसीय कार्यशाला में बोल रहे थे।

उन्होंने अधिकारियों से अपने भोजन में अधिक से अधिक सभी प्रकार की सब्जियों के सेवन का आह्वान किया। संस्थान द्वारा विकसित जलवायु सहिष्णु सब्जी फसलों एवं उनकी उच्च गुणवत्ता युक्त प्रजातियों के बारे में विस्तार से बताया। प्रधान विज्ञानी डा. डीआर भारद्वाज ने विस्तृत चर्चा की। नास-वाराणसी चैप्टर के कोषाध्यक्ष डा. राकेश कुमार दुबे, डा. ईदीश्वर प्रसाद, मनीष, शिवम, प्रदीप, यशपाल व समर सिंह आदि उपस्थित थे।

- One-day awareness programme for farmers (25) and FPOs (14) from Mirzapur, and Sonbhadra districts of Varanasi was organized on June 20, 2024 to create awareness about the importance and techniques of vegetable cultivation in the changing environment and also to increase farmers' income so as to make them self-reliant in changing economic conditions.


बदलते पर्यावरणीय परिवेश में सब्जियों की खेती पर जोर

जागरूकता कार्यक्रम

राष्ट्रीय कृषि विज्ञान अकादमी के वाराणसी चैप्टर ने किसानों को किया जागरूक

वर्गीकृत

Publications

Memoir

A volume entitled "Prof M.S. Swaminathan: A Memoir" (compiled and edited by Dr. V.K. Baranwal and Dr. R.K. Jain) was released by Shri M. Venkaiah Naidu, Hon'ble Former Vice President of India, during Foundation Day programme on June 05, 2024. The memoir includes 34 reminiscences from eminent scientists, policy makers, fellows of the Academy and students. The memoir will serve as a valuable resource for future generations of scientists and agricultural enthusiasts.

Policy Papers (PP)

PP-126: Milk vs Plant Based Dairy Analogues: Myths and Facts

PP-127: Seaweed Farming and Utilisation

Annual Report (2023-24)

The Academy released its Annual Report (2023-24) during 31st Annual General Body meeting.

Forthcoming Programmes

Brainstorming Sessions

- Strategies and Policy Design for Enhancing the Global Footprint of Indian Spices (Convener: Dr. Prasath Duraisamy)
- Cellular Fish Meat Production: Prospects and Challenges (Conveners: Dr. C.N. Ravishankar and Dr. A. Gopalakrishnan; Co-convener: Dr. Mukund Goswami)
- Underutilized Wild Fruit & Vegetables for Nutritional and Health Security: Policy Perspectives (Convener: Dr. T.K. Behera and Co-convener: Dr. Oliver King, MSSRF)
- Climate Adaptive Conservation of Aquatic Genetic Resources (Convener: Dr. U.K. Sarkar)
- Agrivoltaics in Agriculture (Convener: Dr. A.K. Sikka; Co-Convener:Dr. P. Santra)

- Artificial Intelligence and IoT in Agriculture (Convener: Dr. Rajender Parsad)
- Enhancing Investment in Research for Indian Agriculture (Convener: Dr. P.S. Birthal)
- Promotion of Agricultural Export: Prospects and Challenges (Convener: Dr. Anjani Kumar)

Strategy Workshops

- Crop Protection Solutions: Group MRL & Minor Uses of pesticides (Convener: Dr. P.K. Chakrabarty)
- Water Security: Is Quantum or Management the Issue? (Conveners: Dr. Anil K. Singh and Dr. K. Palanisami)

Obituaries

Dr. U.S. Singh
(1954 - 2024)

Dr. Uma Shankar Singh, a distinguished alumnus of G.B. Pant University of Agriculture and Technology, Pantnagar and human being par excellence, passed away on May 09, 2024, leaving all his family members, friends and entire agriculture fraternity in a state of deep shock, disbelief and despair. Dr. Singh was a leading light, explorer, and leader in the field of agriculture in general and plant protection in particular globally. His sudden demise has created a large void which will be extremely difficult to fill.

Dr. Singh, affectionately called Umesh/Guruji in his friend circle, started his journey on January 1, 1954 from a small village, Nakaha, district Sultanpur (UP). His initial journey prior to 2008 centered around Pantnagar, initially as Student and subsequently as Faculty from 1975-2008. After attaining his graduation in Biological Sciences in 1975 from Delhi University, he completed M.Sc. and Ph.D in Plant Pathology from GBPUA&T, Pantnagar. His academic excellence was further visible when he successfully completed his post-Doc from International Rice Research Institute (IRRI), Los Banos, Philippines during 1990-92.

Dr. Singh started his professional inning also from GBPUA&T, Pantnagar, where he served for more than two decades in various capacities (1983-2008), including Professor (Plant Pathology), Coordinator of mega projects (IPM and Biological Control), Joint Director (Research) and Officer-Incharge, Rural Bio-Resource Centre, Precision Farming etc. His contributions during this period in the area of eco-friendly management of biotic and abiotic stresses, aetiology and management of mango malformation and shisham wilt etc. were well recognized as he not only received Outstanding Scientist Award from GBPUA&T, Pantnagar in 2004, but also recognized as Uttaranchal Ratan in 2005 by the State Government. Besides, he received Pesticide India Award (seven times), M.J. Narsimhan Academic Merit Award, Sipani Krishi Anusandhan Award etc. He has more than 80 research papers in national and international journals, 9 Books with 16 volumes and 3 Bulletins to his credit. He was popular among students and guided several M.Sc. (11) and Ph. D (7) students.

After 2008, his journey centered around two international Institutes on rice (IRRI) and potato (CIP, International Potato Center). He joined IRRI in 2008 as South Asia Regional Coordinator of Stress Tolerant Rice Program. He was instrumental in establishing IRRI South Asia Regional Centre (ISARC), Varanasi in 2018 and became the first founding Director (ISARC). Under his leadership, a program on "Seeds without Borders" was formalized to accelerate the regional cooperation on seed sharing, for which he was awarded David and Betty Hamburg Award for Science Diplomacy 2023 from American Association for Advancement of Science (AAAS). Besides he played a crucial role in faster spread of newly released stress tolerant rice variety (Swarna Sub-1) in a short period.

Dr. Ajay Kohli (Deputy Director General for Research, IRRI) in his condolence message has rightly said, ***"Dr. Singh's demise is an immense loss to the agricultural research community. He was not just an excellent scientist and an empathetic mentor, but a very able administrator as well. His vision was to take the products of agricultural research to farmers to help alleviate poverty and hunger in South Asia. We have not just lost a visionary researcher, scientist and administrator but I have also lost a dear friend."***

Realizing his strength in developing networking and partnership with various Central and State agencies in the Country, he was offered the position of South Asia Regional Coordinator at International Potato Centre (CIP) in 2020, where he continued till 2021. He re-joined CIP in March 2024 as a Lead, South Asia Regional Platform and Strategic Advisor to Director General.

Dr. Simon Heck (Director General, CIP) rightly said ***"I've had the privilege of working with him closely over the past year and witnessed first-hand his positive impact on people wherever we travelled.***

He could speak with equal ease and respect to Prime Ministers and farmers alike."

While he was associated with International program (2008 onward), he continued to significantly contribute towards National Agricultural Research, Education and Extension System (NAREES) in various ways as Member, Research Advisory Committee (RAC) of various ICAR Institutes; Member, Academic Council (AC) of various SAUs; Member, Governing Board of Jharkhand Agriculture Development Council (JADC); Honorary Faculty, Aligarh Muslim University; Member, Apex Committee on Pesticide Research and Development Policy, Government of India; Member, Kishan Samridhi Ayog, State Government of Uttar Pradesh; Foreign Secretary, NAAS etc.

He was considered as a "Scientist always on wheel" in his friend circle and will always be remembered as soft spoken mentor, teacher, guide and friend of everyone.

Dr. Mukesh Gautam
Former Director Agriculture (UP) and
Agriculture Expert, World Bank Funded Project, Lucknow

Dr. K. Alagarswamy
(1937-2024)

Dr. K. Alagarswamy, former Director, ICAR- Central Institute of Brackishwater Aquaculture, Chennai passed away at Chennai at the age of 86 on June 17, 2024. Dr. Alagarswamy was born on August 13, 1937 and joined ICAR at ICAR-Central Marine Fisheries Research Institute, Kochi as Research Assistant on July 31, 1959. He was appointed as Scientist (S3) on May 08, 1978 Central Inland Fisheries Research Institute, Barrackpore. He became the Director of ICAR-CIBA on April 11, 1988 and retired on April 01, 1997.

Dr. Alagarswamy was an eminent scientist trained in Japan on Pearl culture and he was first person to produce pearls from mother oyster at Tutucorin. He is considered as the father of Indian pearl culture. He was instrumental in developing the infrastructure at CIBA headquarters and in acquiring the land at Muttukadu Experimental station of CIBA. He had several national and international publications to his credit.

Dr. W.S. Lakra
Secretary, National Academy of Agricultural
Sciences, NASC, DPS Marg, New Delhi

Prof. Harpal Singh
(1942 – 2024)

Prof. Harpal Singh was born on July 15, 1942 in Muzaffarnagar, Uttar Pradesh. He graduated from Agra

University, Agra in 1960 and joined Uttar Pradesh Agricultural University, Pantnagar. He completed B.V.Sc. & A.H. in 1964 and M.V.Sc. in 1966. Thereafter, he obtained his Ph.D. degree from University of Illinois, USA in 1971.

He started his professional career as Assistant Professor, Department of Surgery and Radiology, Pantnagar from 1966. In four decades of his professional career, he had accumulated an impeccable and impressive track record of assisting institutions in areas of academics, recruitment and assessment. He had multitalented skills at planning, organizing, delegating, administering, recruitment and assessment. He occupied various positions during his tenure at Pantnagar like, Professor & Head, Department of Surgery and Radiology; Dean, College of Post Graduate Studies; Dean, Student Welfare; Director Administration & Monitoring; and Dean, College of Veterinary Sciences, He also acted as founder Dean College of Fishery Sciences.

He was recipient of various coveted awards such as Ram Lal Agrawal National award (1992 and 1995), and Jawahar Lal Nehru award (1994); and Fellow of National Academy of Agricultural Sciences, National Academy of Veterinary Sciences, Indian Society for Veterinary Surgery etc. He was member of various committees in ASRB, UPSC, VCI. He held the responsibility of Member, Research Advisory Committee, Central Arid Zone Research Institute (CAZRI) Jodhpur, and Member, QRT on Directorate of Cropping Systems Research, Modipuram. He was Life member of various scientific societies like – Indian Society of Veterinary Surgery, Indian Science Congress Association, and Association for the Advancement of Veterinary Research. He also held the position of President, Indian Society for Veterinary Surgery (1992-94). More than two-hundred publications have been contributed by him including 111 Research papers and 11 Books/Lab. Manuals/Compendium. He has guided several research scholars for Masters (11) and Ph.D. (7) degrees. Prof. Harpal Singh organized Summer Institutes (ICAR) and Second Annual Conference and National Seminar of Indian Society for Veterinary Surgery (1979). It is mentioned that he has been an active sportsman and champion wrestler.

Prof. Harpal Singh passed away on June 17, 2024 at his hometown in Muzaffarnagar (Uttar Pradesh). He has left his wife, one son and one daughter and three grandchildren.

Dr. M.S. Chauhan
Vice-Chancellor, G.B. Pant University of
Agriculture and Technology, Pantnagar

Announcement

XVII Agricultural Science Congress

"The XVII Agricultural Science Congress will be organized by the National Academy of Agricultural Sciences (NAAS) in collaboration with the GB Pant University of Agriculture and Technology (GBPUA&T) at Pantnagar, Uttarakhand during the month of February 2025. The President of NAAS, New Delhi, warmly invites you to attend and actively engage in the Congress deliberations. The theme of the Congress is "Frontier Science and Technologies in Agriculture for a Developed India".

Editors: Drs. Virendra K. Baranwal and Rakesh Kumar Jain

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