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From the President's Desk

Livestock Production Strategies –More from less for more

Livestock in general, and animal husbandry, in particular, is making a significant contribution to the national economy and socio-economic development. The contribution of livestock sectors to the national economy in terms of Gross Domestic Product (GDP) is 4.6%. Agriculture and allied sector contributed about 17.4% to the total GDP in 2016-17. Out of the total agricultural GDP, livestock sector contributed about 28.6% during 2015-16. The livestock sector is an important source of foreign exchange too and is performing well in production, value addition and export of dairy, fishery, wool, poultry and other products. The farmers in India maintain mixed farming system i.e. a combination of crop and livestock where the output of one enterprise becomes the input of another enterprise, thereby, enhancing resource use efficiency. Significant crop-animal interactions occur in the rainfed farming systems. Animals provide draft power and manure for cropping, control weeds and utilise residues and by products from cropping system. Population growth, urbanization, income gains and globalization continue to offer tremendous income and business opportunities for many livestock producers. Livestock agri-food systems are being intensified towards more production to meet this demand to satisfy the changing food preferences of an increasingly affluent and urbanized population in a globalized economy. But such rapid growth in production and trade comes not only with opportunities – it also entails risks. The risks include concerns over sustainability of land and water resources, food and nutrition security, livelihoods and equity, health and animal welfare and the environment. India's livestock sector is the largest with a holding of 11.6% of world livestock population, which primarily consists of buffaloes (57.83%), cattle (15.06%), sheep (7.14%), goats (17.93%), and chickens (4.72%) as per 19th Livestock Census, 2012. The number of cows and buffaloes put together is about 300 million. The large population of bovines has serious implications on the limited natural resources of the country. In spite of achieving over 176 million tonnes milk production–the highest in the world, the performance of our cattle has been extremely poor and far below the yield in other countries. The average milk yield of indigenous breeds of cattle has been around 3.54 litres as compared to crossbreds (7.42 litres) and buffaloes (5.92 litres). The average yield figures of indigenous cattle may not include the yield of draft breeds and non-descript cows which are hardly milked due to low yields. Thus, except 15-20% of crossbreds and elite native breeds, about 80-85% of the livestock, particularly the cattle are insignificantly contributing

to the milk production. However, they compete for fodder and feed, resulting in huge shortage of feed resources. Further, their production potential is not realized fully because of constraints related to breeding, health and management. Deficiency of feed and fodder accounts for half of the total loss (50.2%), followed by breeding and reproduction (21.1%), diseases (17.9%) and management (10.5%). Improper feeding also leads to increase in emission of pollutants in the form of methane (*up to 12 percent*) and nitrogen and phosphorus release (*60 to 70 percent*) in soil and water channels, which if not managed properly, could cause water pollution, global warming, erosion of biodiversity, deterioration of human health and decrease in overall agricultural productivity.

It has been estimated that available fodder can meet only 35-40% of their demand for nutrients. Further, most of it is available in the form of agricultural by-products and dried grass collected from community wastelands and forests, which are of inferior quality. Similarly, the concentrates required for feeding the livestock are also in acute shortage. As a result, even the high yielding animals, which are presumably well-fed are suffering from nutritional imbalance and producing 26-51% below the attainable yield. With regard to cultivation of forage crops, hardly 3-4% of the area is being utilized in selected pockets where dairy husbandry is prospering as an important source of income. If we take feed conversion ratios (amount of feed/kg gain) of approximately 2, 4 and 9 for poultry, pigs and cattle, respectively and also consider carcass percentages; a high demand for feed will ensue by 2050. It is a challenge especially when we are faced with increase in population, decrease in arable land, water shortage, food-feed-fuel competition, frequent climate extremes, increasing animal and human health risks and economic instability. Therefore, the production of animal feed can be considered as one of the major hotspots for any future attempt to increase efficiency and reduce environmental impact from livestock production. To transform the current status from negative contribution to profitability, particularly to benefit the weaker sections of the society, there is a need for a drastic change in the future livestock husbandry with a focus on mitigating the ill-effects of unproductive livestock and necessary policies and practices to control them. If this burden is reduced, the huge savings can be diverted for better livestock nutrition, breeding and health and will pave the way for closing the *"yield gap"* between realized productivity and the best that can be achieved using current genetic material and available technologies and management.

Further, free grazing on community lands and forests as well as cultivated fields by such animals not only damages crops, denudes vegetation and accelerates soil erosion but also are a source of huge traffic hurdles and contribute to air pollution in cities as well. With careful planning of livestock inventory and its balanced feeding, it is possible to reduce the ill-effects of global warming at an affordable cost. Similarly, about 39% of the total water used for agriculture is associated with livestock production, mostly in growing feed. Consequently, water scarcity is a major limitation to livestock production in the seasonally-dry tropics. The climate change can further aggravate water shortage problems including adversely affecting a high proportion of smallholder crop-livestock systems in marginal environments. Rising temperatures as a consequence of climate change will increase lignification of plant tissues and thus reduce the digestibility and the rates of degradation of plant species. This may modify animal diets and compromise the ability of smallholders to manage feed deficits. The resultant reduction in livestock production may have an effect on the food security and incomes of smallholders. In this context, the livestock numbers need to be curbed and production technologies with low ecological footprint developed for reducing the carbon footprint of livestock.

Policy makers, scientists and society at large, have not looked at these issues and taken up the challenge to generally improve the Indian Livestock by selecting the best of the bovine by the best method of selection and mitigate the surplus population. Considering the enormity of the challenge and India's strong commitment to Paris Climate Summit targets, a well-planned and funded strategy to reduce livestock numbers will become inevitable soon.

Despite the government clamping ban on export of cattle, it still remains an important part of the Indian economy. For one, India is the biggest exporter and fifth largest consumer of beef and the production is only inching up. An estimate suggests that Uttar Pradesh can accelerate GDP growth to 8-10% by focusing on one of the few areas in which it is India's No 1 state - buffalo meat export. It will be prudent to encourage the meat sector by providing state of the art hygienic slaughter houses to exploit dividend of large livestock population to increase farm income instead of bizarre restrictions and export bans. Although the most effective and humane method of elimination of surplus livestock is through modern slaughter houses, but there may be several other alternatives to control population including modern technologies like sexing of semen, selection and culling, breed improvement and conservation and export of livestock. Taken together, these strategies could sustain the water, forests, and soil for food-feed production with far lesser burden on environment.

It is to be understood clearly that there is no silver bullet - we need to incorporate the best of what we know now into solving the food-feed problems and protecting our natural resources. It is up to us to decide what is scientifically appropriate and politically feasible. We can change how we prioritize, govern, tax, ship, produce, etc. Solving it will require well thought ideas, huge cooperation, innovation, and hard work without any pre-conceived ideas and taboos.

(Panjab Singh)
President

Farm Mechanization –Need of the Hour

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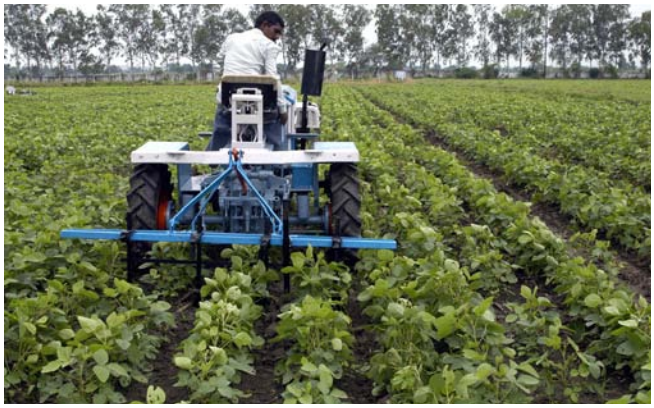
Agricultural mechanization plays a key role in improving agricultural production and productivity in developing countries. However, mechanizing small and non-contiguous group of small farms is against 'economies of scale' for individual ownership of farm machinery. The status of farm mechanization in India is analyzed by the trend in growth of mechanically power-operated farm equipments over traditional human and animal power operated equipments. Empirical evidence conforms that there is a strong positive correlation between farm mechanization and agricultural productivity. Because of the inherent diversity, the mechanization requirements of different agricultural

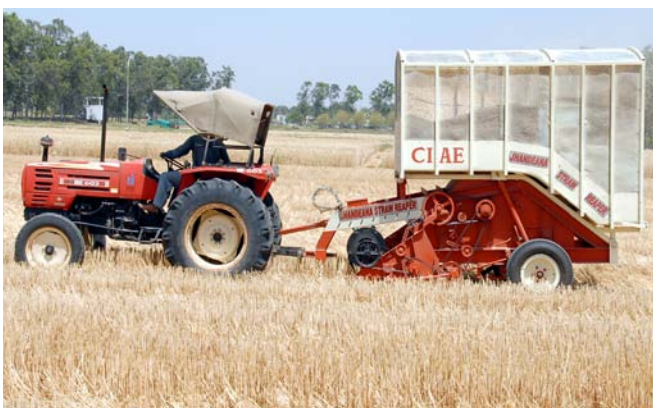


crops are widely varied and crop specific. Most of the critical operations like nursery raising, transplanting, earthing, weeding and inter-culture etc. are generally carried out manually, labour intensive and also involve a lot of drudgery. There is an urgent need for mechanization of farm operations for agricultural production in India for timeliness of farm operations, efficient utilization of farm inputs and reduce drudgery of farm workers. Use of improved implements has the potential to increase productivity up to 30% and reduce the cost of cultivation up to 20%. The Indian farmers are currently adapting farm mechanization at a faster rate in comparison to recent past. Although, the sale of tractors in India cannot be taken as the only measure of farm mechanization, it does reflect the level of mechanization. Indian tractor industry has emerged as largest in the world and account for about 1/3rdof total global tractor production. According to the World Bank estimates, half of the Indian population would be urban by the year 2050. It is estimated that percentage of agricultural workers of total work force would drop to 25.7% by 2050 from 54.6% in 2011. Labour shortage is being experienced during peak seasons due to enactment of the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) and huge demand from the construction and other service sector in cities. The overall work force in agriculture and allied activities has been declining indicating a rise in secondary and tertiary sectors. Thus, there is a need to enhance the level of farm mechanization in the country.

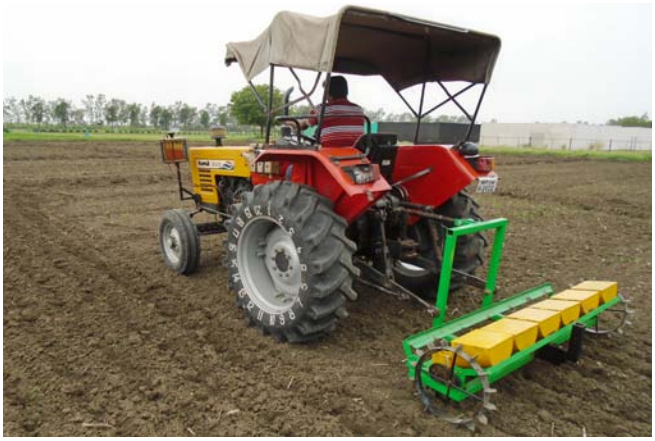
Availability for power to Indian farms has changed considerably over last five decades, increasing from 0.293 kW/ha in 1971-72 to 2.2 kW/ha during 2016-17. Consequently, the share of animate source of power has declined steadily with increase in use of mechanical and electrical power. The share of agricultural workers in total power availability in 1960-61 was about 16.3% which has reduced to 3.6% in 2014-15 with a similar trend for animal power. This has pushed up the energy demand of the Indian farms. During the past four decades a large number of farm tools, implements and machines have been developed for different farm operations and are being used by the Indian farmers. The demand of agricultural machinery and mechanical power source has increased multi-fold. Today the Indian farm machinery industry is worth about Rs. 80,000 crores per annum. There are about 250 medium to large scale units, 2,500 small scale industries, 15,000 tiny industries and 1,00,000 village level artisans in India. Most of them are under un-organized sector except the tractor industry. It is estimated that global demand of agricultural implements will be about US$ 200 billion by 2018 and Asian countries will contribute to more than 60% of it. The Government has implemented various farm mechanization programs in the country through schemes such as Rashtriya Krishi Vikas Yojna (RKVY), Mission for Integrated Development of Horticulture (MIDH), National Mission on Oilseeds and Oilpalm (NMOOP) and National Food Security Mission (NFSM) and lately Sub-Mission on Agricultural Mechanization (SMAM). In order to lay special emphasis on farm mechanization and bring in more inclusiveness, a dedicated Sub-Mission on Agricultural Mechanization (SMAM) for the 12th Five Year Plan (2012-17) was launched by the Government of India. SMAM had

'Small and Marginal Farmers' at the core of the interventions with a special emphasis to promote 'Custom Hiring Centres (CHCs)' through 'the rural entrepreneurship' model. States such as Punjab, Haryana, Uttar Pradesh, Madhya Pradesh, Uttarakhand, Gujarat, Maharashtra, Karnataka and Tamil Nadu have maximum number of registered and unregistered CHCs catering to the machinery and equipment requirement of the farmers.

Small and scattered land holdings, high initial cost of equipments, non-availability of high-tech precision equipments, poor quality of equipments available in the market and poor after sales services are some of the major challenges for mechanization of Indian agriculture, which hinder faster growth of farm mechanization. The custom hiring of mechanical power for tillage, irrigation, harvesting and threshing is preferred by those farmers who can't afford to own machines. The present trend in agricultural mechanization is for the high capacity machines to be used for custom hiring and for contractual field operations. However, timely availability of these machines to small and marginal farmers is of a major concern in spite of large number of Custom Hiring Centres being established. A strong backup infrastructure of repair and maintenance at rural level needs to be built-up. This will certainly help in gainful employment of rural youth. For this purpose, appropriate policy level interventions are required to impart skill to rural youth with credit support. Level of mechanization of horticulture and allied agricultural sector is still very low, R&D efforts need to be strengthened to overcome challenges of these sectors.



Women in rural India play a major role in shaping the economy of the country. In Indian agriculture, women perform four different types of roles *viz*., as a worker (a source of power), as an operator (a controller), as a manager (a farmer) and as an entrepreneur (a business person). At present, most of the Indian women carry out the role of workers only. The tools/equipments available have been primarily developed for male workers, and women workers have to use these whenever required. As a result, the output is lower and may lead to many occupational health problems. To make them capable for other roles, it is necessary to design machines suitable for them and upgrade their skills for



operating these machines. Also for the roles of manager and entrepreneur, their knowledge base will have to be suitably updated. Hill agriculture, which covers about 20% of cultivated land, has little access to mechanization. This situation has to be improved by developing and promoting package of technology for mechanization of hill agriculture to achieve higher productivity.

The future investment in agricultural mechanization will be guided by a number of factors. Sales data gathered over the past years indicate growing preference for tractors in the 41 to 50 hp or higher hp range. High capacity machines including rotary tillers, harrows, laser levellers, high clearance sprayers, planters, high capacity threshers and self-propelled and tractors drawn combines will also be preferred in future. The custom hiring of mechanical power for tillage, irrigation, harvesting and threshing will be preferred by those farmers who can't afford to own machines. The present trend in agricultural mechanization is for the high capacity machines to be used for custom hiring and for contractual field operations. Hand operated tools and implements will also likely to grow very slowly. Animal operated implements will decrease due to the continued decrease in the number of draft animals. In contrast, the use of power operated farm equipments will increase rapidly. Mechanization of hill agriculture and horticultural activities are areas where mechanization has to go in a long way to increase the farmer's income by reducing labour requirement. The future R&D must focus on development of electronic and sensor based precision equipments, Unmanned Aerial Vehicles (UAVs), robotics, Internet of Things (IoT) for precise application of costly inputs, accurate detection/ forecast of diseases, etc.

Business and enterprise friendly policies, laws, and regulations as well as physical and institutional infrastructures, which encourage commercial activities and entrepreneurship in farming, input supply, produce handling, processing and marketing as well as in manufacturing, will be key factors to the success of agricultural mechanization in the different states of India.

105th Executive Council Meeting

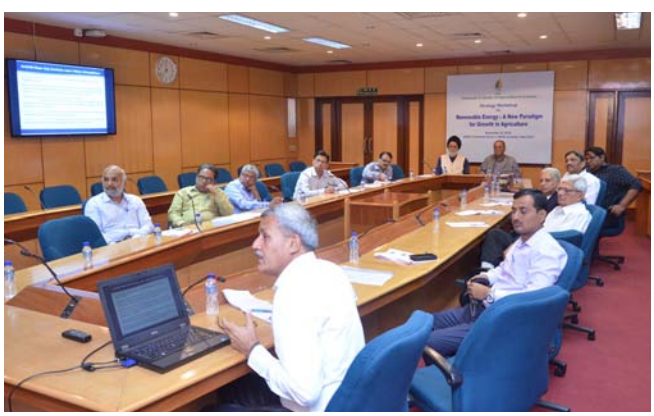
The 105th Meeting of Executive Council (EC) was held on 14th September, 2018 under the Chairmanship of Prof Panjab Singh, President, NAAS. The salient points of the meeting were:

- The 14th Agricultural Science Congress (ASC) team made a presentation to update the EC about the status of preparations of the Congress.
- Dr C.D. Mayee, Vice-President of the Academy and Chairman, Conveners' Group presented the recommendations of Sectional Committees under various disciplines for the year 2019 for the award of NAAS Fellowship. The names of the scientists recommended by Conveners' Group were approved by the Executive Council for inclusion in the panel for election to NAAS Fellowship - 2019 as per guidelines through ballot. Similarly, the recommendations on Pravasi and Foreign Fellowship for the year 2019 were also accepted by EC.
- The EC also approved the selection of ten scientists as Associates of the Academy with effect from 1st January, 2019.
- The Executive Council appreciated the efforts and time put in by the Sectional Committees and the Conveners' Group in evaluating and recommending the nominees to election of Fellowship and selection of Associateship.
- The EC considered the recommendations of Judging Committees constituted for selection of nominees for Memorial, Endowment, Recognition and Young Scientists' Awards of the Academy for the biennium 2017-2018 and accorded its approval.
- The EC was also appraised that the Academy has completed and submitted its Report for ranking of ICAR institutions. Further, the Academy has been assigned the task for preparing guidelines for deciding academic standing of the Scientific Societies.
- Dr R.A. Mashelkar, former DG, CSIR to be given the 4th Dr A.B. Joshi Memorial Lecture Award during XIV ASC in February, 2019.
- The issue of merger of Pravasi and Foreign Fellowship was discussed and it was decided that presently five Fellowships in two categories for scientists working abroad, (i) Pravasi Fellows (3 Fellowships/year) for scientists of Indian origin who are/have working/worked abroad and (ii) Foreign Fellows (2 Fellowships/year) for non-Indians may be merged as Foreign Fellows with number of Fellowships restricted to only two to be elected every year.

Programmes Held

Strategy Workshop on "Renewable Energy: A New Paradigm for Growth in Agriculture"

A strategy workshop on "Renewable energy: A New Paradigm for Growth in Agriculture" was organised at the National Academy of Agricultural Sciences, New Delhi on 25th September, 2018 under the Chairmanship of Prof Panjab Singh, President, NAAS. The workshop was convened by Dr O.P. Yadav, Director, ICAR-CAZRI, Jodhpur. Delegates from national and international organisations working on renewable energy aspects participated in the workshop.



During the opening remarks of the workshop, Prof Panjab Singh stressed the importance of renewable energy use in agriculture sector, as the present day agriculture is becoming more energy-intensive than ever before. At the start of the workshop, Dr O.P. Yadav presented the overall scenario of renewable energy generation through Agri-Voltaic System, biomass & waste utilization, solar PV greenhouse, thermal solar gadgets and co-generation through three-in-one system consisting of farming and electricity generation from solar and wind resources. The utilization of renewable energy in agriculture would include replacement of fossil-fuel-based farm operations with renewable-energy-based operations; use of solar PV pumping; use of solar cooking for food processing; solar dryer for value addition; solar water heating; solar PV sprayer/duster etc. The Agri-Voltaic System is particularly useful for crop production, PV generation and rainwater harvesting together from a single land unit. The RESCO model, in which private investor could be the power producer and farmer would be the owner of land for crop production, was considered to be a good choice for establishment of Agri-Voltaic System in farmers' field. Dr K.K. Singh, Director, ICAR-CIAE, Bhopal presented different options for biomass-based energy generation, its present status in the country and future policy requirements.

Dr J.S. Samra, Ex-CEO, National Rainfed Area Authority delineated the options for bio-CNG generation from a range of items viz., biomass residue, animal slurry, slaughter-house wastes, food waste, dairy wastes, sewage and sludge etc. He emphasized the use of anaerobic digestion technology for bio-CNG generation from these wastes. Dr Shilp Verma from IWMI-Tata Water Policy Programme presented two case studies of cooperatives on solar PV pumping system in which farmers generate income by selling the surplus electricity and pumped water to surrounding farmers. These presentations were followed by discussions, from which, the following points emerged:

(i) Solar PV modules can be treated as one crop in Agri-Voltaic System, which has the potential to improve the land productivity. The major problem is of storage. The grid connectivity is most crucial component to make this system successful.

(ii) There is huge scope of implementing solar PV pumping system in agricultural fields with due care taken for protection against excessive groundwater depletion.

(iii) Solar PV pumps may be connected to net meter to sell the surplus electricity to grid for additional income generation by the farmers.

(iv) Solar drying is another avenue that has lot of scope in agriculture sector, especially for post-harvest processing and value addition. Government incentives and support may be required for manufacturing and custom hiring of solar dryer and other potential solar thermal and PV devices and implements in rural hinterlands.

(v) Harnessing wind energy ranks first among all renewable energy sources in India. However, there is a scope of generating wind and solar energy together utilizing solar-wind hybrid system. Government policy may be required to establish such hybrid system in agricultural fields to develop three-in-one systems (solar + wind + farming). Such hybrid system has vast potential to increase land productivity.

(vi) For biomass-based electricity generation, there should not be any conflict in use of biomass for animal feed and energy generation. The straight approach of using the biomass could be to utilize spare crop residues and using the animal wastes for energy generation.

(vii) Recent advanced 3G/4G technology needs to be followed for clean biomass based energy generation. Transportation of biomass from field to digester often hinders the process of energy generation from it. Briquetting, bailing, biochar production technology etc. have been developed since long but their replication in field is comparatively less. Energy generation from biomass is a way forward to biomass management and needs to be incentivised.

(viii) Aggregation of various sources of energy needs to be done to use other logistics in a more holistic and economical way.

Saving the Harvest: Experts' Meet

The National Academy of Agricultural Sciences (NAAS) organized a meeting of the experts to envision strategies to minimize the post-harvest losses to the agricultural produce in the country. Saving the Harvest: Experts' Meet was held on September 26, 2018 at NAAS, New Delhi and was Chaired by Prof Panjab Singh, President, NAAS. The main objective of the meeting was to identify the causes, select potential solutions adapted to local and product specificities, and develop recommendations for the consideration of the Government, processing industry and other stakeholders to minimize the pre and post-harvest losses of agricultural produce, milk, meat, marine and poultry products.

According to the FAO estimates, nearly 30% of the cereals, 40 to 50% of fruits and vegetables, 20% of oilseeds, meat and dairy products, and 35% of fish are lost globally. The losses are greater in the tropics and semi-tropics due to the extraneous factors of climatic conditions and limited availability infrastructure for harvesting, storage, transportation, processing, cooling facilities, packaging and marketing systems. This is further compounded by the social and cultural conditions, and inadequate regulations to minimize the post-harvest losses. India is no exception. Although accurate estimations of the magnitude of losses and waste are not available, the losses of major agricultural produces at the national level were estimated to be of the order of Rs. 92,651 crores based on the production data of 2012-13 at 2014 wholesale prices (Annual Report: 2016-17, Min. of Food Processing Industries). The actual post-harvest losses may be much greater as the above estimates are based on assumptions of less than 6% loss of cereals, less than 16% of fruits and vegetables, less than 11% of marine fish, etc. A FAO study suggests that the food loss in India is nearly 40%.

The variability in the estimates suggests a need for more comprehensive studies. There can be no doubt that losses to food are unacceptably high, and warrant urgent science-based solutions to strengthen the schemes launched by the Government for reducing the post-harvest losses.

The country achieved a record production of food grains, pulses and oilseeds in India in 2017, it was around 277, 24 and 30 million tonnes, respectively; the horticultural production was around 300 million tonnes; and sugarcane around 353 million tonnes. The growth in the production of the dairy, meat, poultry and fish sectors is also impressive. To utilize these gains for achieving nutritional security and meeting the SDGs, there is a strong need for developing viable solutions and strategies to minimize the pre and post-harvest losses. The major challenges in reducing the food losses include, lack of appropriate storage system, cold chain, adoption of good agricultural practices, infrastructure for processing and value addition, modern marketing system, quality deterioration and food wastage, and inefficient utilization of by-products. Detailed discussions were held on the available approaches for reducing the food losses and it was decided that a Policy Brief may be developed to recommend implementable science-based solutions for reducing the food losses for the consideration of the Government.

Activities of Regional Chapters

Bihar, Assam and entire North East Regional Chapter

The NAAS-Regional Chapter Meet (Bihar, Assam and entire North East), jointly organized by NAAS, New Delhi; ICAR-NRC on Mithun, Medziphema, Nagaland; ICAR Research Complex for NEH Region, Umiam and ICAR-RCER, Patna, was held at ICAR-NRC on Mithun, Medziphema, Nagaland on 10th July, 2018 and at ICAR Research Complex for NEH Region, Barapani on 11th July, 2018.

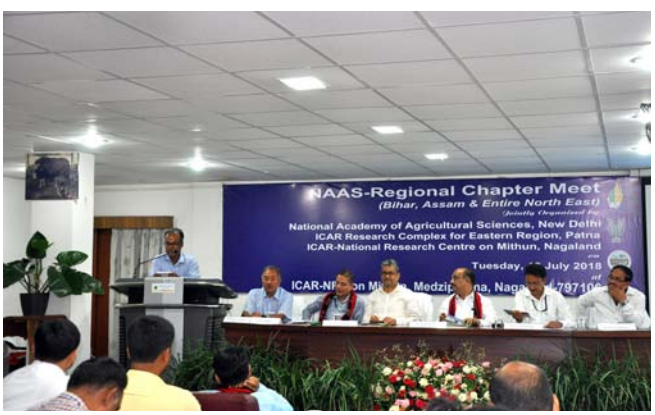
The brief of the meetings held at ICAR-NRC on Mithun, Nagaland and ICAR Research Complex for NEH Region, Barapani is as under:

ICAR-NRC on Mithun, Nagaland

The meeting at ICAR-NRC on Mithun, Nagaland was Chaired by Dr Ashok Kumar, ADG (Animal Health), ICAR, New Delhi. Dr B.P. Bhatt, Director, ICAR-RCER, Patna; Dr A. Pattanayak, Director, ICAR-VPKAS, Almora; Dr Avijit Mitra, Director, ICAR-NRC on Mithun; Prof Sapu Chankija, Professor, SASARD, Nagaland; and Dr D.J. Rajkhowa, Joint Director, ICAR Research Complex for NEH Region, Nagaland Centre were present. More than 30 participants including Scientists from ICAR-NRC on Mithun, ICAR Research Complex for NEH Region, Nagaland Centre and the faculty from Nagaland University also participated in the meeting.

Dr Avijit Mitra, Director, ICAR-NRC on Mithun in his welcome address thanked the NAAS Regional Chapter for holding its first ever meeting to discuss the issues of agricultural development of NEH in general and Nagaland in particular. He pointed out that both agriculture and animal husbandry in Nagaland are highly location specific and need location specific attention and solution. Scientific methods of animal rearing including proper breed, health care and feed need to be popularized in all the North Eastern states.

Dr A. Pattanayak presented in brief the agenda of the regional chapter and brief objective of the regional meetings. He also briefed about NAAS and the various awards, Fellowships and Associateships given by it to encourage quality science and education in the country.



Prof Sapu Chankija, Professor, SASARD, Nagaland presented a brief about the overall biodiversity of NE Hills with special reference to Nagaland. He said that NE Hills is the only region where snow clad mountains have both north and south aspects (Himalayas) and east and west aspects (Patkai range). Thus, even in snow clad mountains there are broad leaved species in Patkai range. He also said that out of 7000 species endemic to India, about 3000 are endemic to NE region. Talking about shifting cultivation, Dr Chankija said that although shifting cultivation is environmentally unsafe, it presents a good source of germplasm to exploit crop complementarities. Shifting cultivation is also a good source of plant growth promoting microorganisms. In his opinion the minor fruits and vegetables, medicinal plants and traditional foods need more scientific insight not only for academic purpose but also for adding economic value to them. This will encourage their commercial cultivation and thereby saving them from extinction.

Dr D.J. Rajkhowa, Joint Director, ICAR Research Complex for NEH Region, Nagaland Centre presented a brief overview of the various farming systems of Nagaland and suggested that animal-based systems are the most profitable. Dr Rajkhowa

said as there are lessons to be learnt from the water harvesting in Jabo and Apatani systems, there is an immense research need to make the rainwater harvesting and its utilization more efficient. Similarly, more scientific research is needed to address the problem of soil acidity, especially the sub-surface acidity.

Dr Ashok Kumar made a presentation on transboundary diseases. He informed that India has been identified as a 'Hot spot' for high impact emerging and re-emerging infectious diseases due to a number of risk factors like large human and livestock population and rapidly expanding farming system. The disease management programmes like FMD Control programme has successfully resulted in drop in the occurrence (92%) of the disease during last 13 years. Transboundary diseases pose a serious challenge to agriculture and the north eastern region has great threat for transboundary diseases due to its shared international boundary with five neighbouring countries and uncontrolled migration. Strategies to address transboundary diseases include restriction on entry, early disease detection, early warning including forecast and early prevention and control. He further emphasized on research for developing fast and efficient diagnostic and prophylactic tools along with strengthening management systems comprising capacity building, skill development, policies, legal framework and operational strategies. There is a need to strengthen cross boundary cooperation in surveillance, diagnostics, epidemiology and containment for combating this menace.

Convener of the Chapter, Dr B.P. Bhatt, in his address highlighted the researchable issues in agriculture for the North Eastern Region which need to be addressed and suggested to take up some studies.

ICAR Research Complex for NEH Region, Barapani

The meeting was Chaired by Dr Anil K. Singh, Secretary, NAAS. Dr Ashok Kumar, ADG (Animal Health), ICAR, New Delhi; Dr B.P. Bhatt, Director, ICAR-RCER, Patna; Dr A. Pattanayak, Director, ICAR-VPKAS, Almora; Dr N. Prakash, Director, ICAR Research Complex for NEH Region, Barapani; Dr A. K. Tripathy, Director, ICAR-ATARI, Guwahati; Dr B.C. Deka, Director, ICAR-ATARI, Shillong; and Dr. S. Bandopadhyay, ICAR-IVRI Regional Station, Kolkata also participated in the meeting. More than 100 participants from ICAR Research Complex for NEH Region, Barapani and faculty and students from CAU, Manipur participated.

At the outset, Dr N. Prakash welcomed all the dignitaries and briefed them about the physiographic and overall agrarian scenario of the North Eastern hills.

Dr Arnab Sen, Head (Animal Health), ICAR Research Complex for NEH Region, Barapani made a presentation on "*A profile of vulnerability of the North East in context of exotic and emerging livestock diseases of moderate to severe threat potential*". He enlisted some of the newly reported animal diseases in NEH region like PRRS of Pig (introduced from Myanmar), occurrence of Bovine Viral Diarrhoea in Pig, Leptospirosis in Bovine, Swine FMD, Chandipura Encephalitis etc. The strategies suggested by him included establishment of state of art diagnostic laboratory and early warning system and development of desired human resources.

Dr A. Pattanayak made a presentation on "*Crop genetic resources of North East India: Approaches for a better insight*". He enlisted the availability of wide diversity of different crops in the region including cold tolerant, Aluminum tolerant, drought tolerant germplasm of rice, water logging tolerant germplasm of maize, different vegetables, spices and underutilized fruits. Further, he highlighted the need for increasing the utilization rate of the unique germplasm, which is very low at present viz., 80 out of 7000 germplasm in rice, 16 out of 3000 germplasm in maize, 4 out of 700 germplasm in rice bean. For this, there is a need to have a relook at characterization methods with special emphasis on characterization for mixed cropping, site of diversity and spatial characterization and change in diversity. He emphasized on the sustainable goals for the crop genetic resource management in NEH region that include, greater investment to ensure mainstreaming of biodiversity conservation, regular census and monitoring of biodiversity to assess risk, regulate access and impose benefit sharing for the utilization of genetic resources of the region.

Dr G. Kadrivel, Principal Scientist (Animal Reproduction), ICAR-RC, NEH Region made a presentation on "*Indigenous animal biodiversity and conservation strategies in the North Eastern region of India*". He enlisted the indigenous breeds of animals like pigs, cattle, buffalo, sheep, goat, poultry and other species like pony, horse, mithun and yak and emphasized on the need to conserve the indigenous breeds for their economic potential, climate resilient traits, scientific use and cultural interest. He highlighted a need for precise and reliable estimation of different important economic traits of indigenous breeds, their documentation and registration and e*x-situ* and on-farm conservation.

Dr S. Bandopadhyaya briefed about '*Epidemiological studies and economic impact of Gastro Intestinal Parasitic infestation in livestock*' and indicated a gradual decline in the rainfall pattern and increase in the temperature in Meghalaya, which might offer a possibility of decrease in the incidence of Gastro Intestinal Parasitic infestation in livestock in future.

By adoption of proper disease control strategy like 3 times use of anthelmintic drug during pre monsoon, monsoon and post monsoon, an approximate loss of Rupees 30 million can be avoided in Meghalaya alone.

Dr Anil K. Singh, Secretary, NAAS, outlined the role and different activities of Regional Chapters and emphasized on two particular activities, where the Regional Chapters can play a very important role. The first is to interact with state departments and provide technical and scientific inputs in implementation of various schemes and programmes and secondly in mentoring young professionals. He also briefed about the different events being organized by NAAS viz. Biennial Agricultural Science Congresses and International Agricultural Science events and informed the audience about the forthcoming Agricultural Science Congress to be held in New Delhi in February, 2019. He suggested that NAAS can partner in agriculture development through actualizing Government schemes viz. RKVY, PMKSY, PMFBY, SHM, Soil Health Card, Paramparagat Krishi Vikas Yojana, MIDH, DD Kisan etc.

Based on the deliberations of the delegates at Nagaland and Barapani, following salient recommendations were made to initiate studies on:

- Survey and documentation of area under shifting agriculture for North East
- Biomass consumption vs crop productivity and sustainability of shifting agriculture
- Leaching losses in shifting vs settled cultivation
- Indigenous knowledge of soil and water conservation, particularly in *jhum* fields
- Ecosystem services: Protocol development for North East
- Carbon credit in different farming systems
- Rehabilitation of degraded lands through agro forestry interventions
- Protocol development for organic agriculture
- Accreditation/certification of mother blocks, particularly in fruit crops
- Large scale demonstration of scientific rice-fish cultivation
- Low input sustainable livestock production system
- Development and popularization of integrated farming system models in the region to achieve the target of doubling farmers' income,
- The available biodiversity of the North Eastern Hills can be important source for specific traits
- Need to develop and promote scientific cultivation of medicinal and aromatic plant diversity to prevent soil erosion in the region,
- Identify genes in different crops for tolerance against soil acidity
- Promote organic farming by identifying specific blocks in the region, where the prevailing practices are purely organic in nature and do not include application of external inputs
- Detailed study of indigenous farming systems through a comprehensive documentation of their historical background as well as the features, which distinguish them from other farming systems.

Fellows Views

Need Salt-Tolerant Rice Varieties with Reproductive Stage Tolerance for Better Economic Return to Farmers from Stress Prone Environments

India has an approximate area of 6.73 million hectares of land under salt-affected soils as well as one of the longest coast lines of 7516 km, majority of which will be definitely affected by Sea Level Rise (SLR) due to future scenario of climate change. Rice responds to salinity differently at different growth stages. Seedling and reproductive stages are the most sensitive among all the growth stages. The mechanisms of tolerance at the reproductive stage are more critical from economic point of view because of the direct correlation to the grain yield depending on the degree of stress and inherent level of tolerant mechanisms. Therefore the reproductive stage salinity tolerance has much relevance and provides better means for breeding salt-tolerant rice crops with yield stability. Identification of promising source of salt tolerance and their incorporation into high yielding genetic background will help to tap the potential of unexplored areas of harsh and stress prone environments.

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Pollinator Decline Effects on Global Crop Yield and Ecosystem Crisis

The population of honeybees and other species that pollinate plants life are declining at alarming rate which has threatened the existence of plant life and this downward trend could damage dozens of commercially important crops. A decline in pollinator populations is one form of global change that actually has credible potential to alter the shape and structure of terrestrial ecosystems. The decline in pollinator population and diversity presents serious threat to agricultural production and conservation and maintenance of biodiversity in many parts of the world. One indicator of the decline in natural insect pollinators is decreasing crop yields and quality despite

necessary agronomic inputs. There is a need for discussion in the context of the world scenario on the causes of pollinator decline and future strategies to overcome the impending crisis.

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Innovative Technologies for Sustainable Agriculture & Food Security

Sustainability in agriculture and food security is major concerns of policy makers and farmers. Conventional agriculture is based on fossil fuel and imported source of energy. It has polluted air, water and food. Under these circumstances, innovative technology can be a path for sustainability. Cosmic energy from earth, planets, stars and sun are freely available. Mediation of their energy through use of BD-calendar, inclusion of plants, use of bio enhancers prepared from humped cow for different crop activities can assure sustainability in agriculture. But, if it can be integrated with Homa Therapy which is based on that "You heal the atmosphere and healed atmosphere will heal every one". Agnihotra is science of pyramidology, biorhythm of nature, burning of organic substances, and sonic power of chanting specific mantras. The resultant ash is full of subtle energy and used for number of crop activities i.e. enhancing N-fixation, P solubility and improving water quality. Numbers of field evidences from different parts of the world are available.

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Climate Change and Dryland Agriculture

Sustainable food production and food security are a major concern and are likely to be exacerbated by projected climate change and variability. It is expected that changes in meteorological patterns such as precipitation and temperature will result in decreasing the mean yield of all crops especially due to drought and high temperatures - the main constraints for crop productivity. This in turn will adversely impact food and nutritional security in regions where the bulk of the population is dealing with chronic hunger and malnutrition.

India and several other countries face the challenges of climate change and variability especially frequent droughts, high temperatures, nutrient poor soils and salinity.

Drylands cover more than 40% of world's land area and are home for one third (2.5 billion people) of the global population. Indian agriculture is well-placed to find improved adaptation and resilience in agricultural production and food supply through high quality science and technology.

We need to collaborate with national and international partners to find strategies by which farmers around the world can adapt to the immense challenges facing global food production systems especially in the drylands. I support the call to use the best available science and technology to guide action on climate change.

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Forthcoming Programmes

- Strategy Workshop on 'Management of Transboundary Movement of Pathogen and Pests' (Convener: Dr R.K. Jain)
- Strategy Workshop on 'Development and Adoption of Novel Fertilizer Materials' (Convener: Dr (Mrs.) C. Varadachari)
- Policy Brief on 'Need for Uniform Policy on Fish Disease Diagnosis and Quarantine' (Convener: Dr P.K. Sahoo)

Change of Addresses

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Obituaries

Prof S.K. Mukerjee
(1926 - 2018)

Prof Sunil Kumar Mukerjee was born in Bhagalpur, Bihar on 5 May 1926. He got his primary and secondary education at Patna High School and B.N. College, Patna. He graduated in B.Sc. (Hons) from Science College, Patna in 1947 and obtained his M.Sc. in 1949 and Ph.D. in 1953 from Delhi University. He also did Post Doc, as Commonwealth Scholar from Manchester University, U.K. in 1960. He was UNESCO Fellow, Shemyakin Institute of Natural Products, Moscow, USSR in 1965.

His main research areas were Agrochemicals: (Technology, Synthesis, Analytical & Photochemistry); Natural Products Chemistry and Organic Chemistry.

Prof Mukerjee started his career as Lecturer, 1953-60, Reader, 1960-70 and Head, 1970-84 at Department of Chemistry, Delhi University, Delhi. Subsequently he joined as ICAR Chair of Prof of Eminence, Division of Agricultural Chemicals, IARI from1984-86. He also served as a Member of Govt. of India delegation to USSR to study use of Agrochemicals, 1972; Chairman, ICAR Committee to study the effect of Bhopal Gas on Agricultural Crops and Plants, 1984; Consultant, Scientific Commission of Bhopal Gas, Govt. of India, 1986-89. He was also serving as Consultant, Ozone Cell, Ministry of Environment & Forests, Govt. of India from 1993 to date.

Prof Mukerjee was the recipient of Patna University Gold Medal, 1947; Delhi University Exhibition Prize, 1949; Commonwealth Scholarship, U.K. 1960-62; UNESCO Fellowship, 1965; INSA-JSPS Visiting Scientist, Japan, 1978; UGC - National Lecturership, 1981; Life Time Achievement Award, Pesticide Society of India, 2001.

Prof Mukerjee was fellow of Royal Society of Chemistry, U.K.; Indian National Science Academy; Society of Pesticide Science, India and elected fellow of National Academy of Agricultural Sciences in 1990.

Prof Sushil Kumar Mukerjee passed away on 24th August 2018 and in his sad demise the Academy has lost an esteemed Fellow and an international famed scientist. The entire Fellowship mourns his demise and pays homage to the departed soul.

Prof V.S. Vyas
(1931 - 2018)

Prof Vijay Shankar Vyas was born in Bikaner, India on 21 August 1931. He got his education at the University of Bombay, Sardar Patel University and Indian Institute of Management, Ahmedabad. His research areas were Agricultural Policies, Rural Credit, Land Reforms, Panchayati Raj Institutions.

Prof Vyas started his career as Visiting Scholar at the Center for Asian Studies of the Boston University, USA and Senior Fellow of IDRC, Canada. Currently he was serving as Professor Emeritus, Institute of Development Studies, Jaipur and Chairman, Ajit Foundation for Social Development.

Prior to this, he acted as Member, Agricultural Prices Commission, Government of India; Director, Agro-Economic Research Centre, Vallabh Vidyanagar; Professor of Economics and Dean, Faculty of Humanities and Social Sciences, Sardar Patel University; Director, Indian Institute of Management, Ahmedabad; Senior Advisor, Department of Agriculture and Rural Development, The World Bank, Washington, D.C.; Director, Institute of Development Studies, Jaipur; Member, Economic Advisory Council to the Prime Minister; Deputy Chairman, State Planning Board, Rajasthan.

Prof Vyas also served as Vice Chairman, Board of Trustees, International Center for Tropical Agriculture, Cali (Columbia), Member, Board of Trustees, International Food Policy Research Institute, Washington D.C., USA; Member Governing Board, Institute of Development Studies, Sussex University, U.K., Member, National Commission on Integrated Water Planning, Scientific Advisory Committee to the Cabinet, and Central Board of the Reserve Bank of India; Chairman, Expert Committee on Rural Credit, Working Group on Crop Production in 11th Five Year Plan and Task Force on Credit and Marketing of the National Commission on Unorganized Sector; Member, Steering Committee on Agriculture for 12th Five Year Plan.

Prof Vyas was recipient of many awards and honours: IAEA Elmhurst Memorial Gold Medal, 1991; Padam Bhushan, 2006; D.Sc. (h.c.) MPUAT, Udaipur to name a few.

Prof Vijay Shanker Vyas passed away on 11th September 2018 and in his sad demise the Academy has lost an esteemed Fellow and an international famed economist and policy planner. The entire Fellowship mourns his demise and pays homage to the departed soul.

14th Agricultural Science Congress on Innovations for Agricultural Transformation

February 20-23, 2019

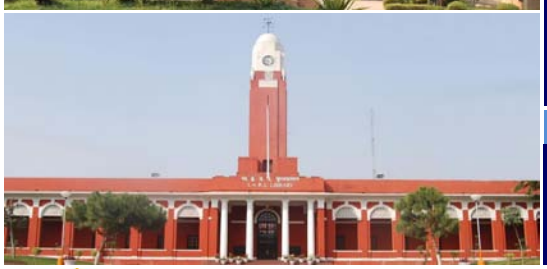
Venue: National Agricultural Science Complex (NASC), New Delhi - 110012

ASC -2019

We cordially invite the scientific and student fraternity to participate in large numbers to make the event a grand success.

Prof. Panjab Singh
President
National Academy of Agricultural Sciences

Dr. A. K. Singh
Director, IARI
Chairman, Local Organizing Committee



Theme Areas

- Plant Sciences (Field Crops)
- Plant Sciences (Horticultural Crops)
- Natural Resource Management
- Plant Protection
- Food Science & Value Addition
- Animal Sciences (Livestock, Dairy & Poultry)
- Fisheries
- Engineering & Information Technology
- Social Sciences
- Agricultural Education

Special Attractions

- Panel Discussion
- Students' Elocution Contest
- Farmers' Session
- Poster Presentation
- Agri Expo-2019

Important Dates

Submission of abstract opens on	: Aug 16, 2018
Last date for submission of abstract	: Nov 15, 2018
Communication for acceptance	: Nov 30, 2018
Regular registration closing date	: Dec 15, 2018

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