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Editors
Dr. P.K. Chhonkar
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From the President's Desk

Family Farming and Food Security

Today 3 billion people, across the world, live in rural areas and many of them belong to small scale farming families. These families usually grow crops, rear few animals, use part of the farm produce for their own consumption, and market the rest to eke out a living. Family farming is of common occurrence, both in developing and developed countries, accounting for nearly 70% of the world's food production. Recognizing the important contributions that family farming has made in improving food security and eradicating poverty, the United Nations General Assembly at its 66th session has designated 2014 as the International Year of Family Farming (IYFF). The fundamental objective of the IYFF is to help, recognize and support the contribution of family farming and small holder farming in eradicating hunger, reducing rural poverty, achieving food security through sustainable production and development of rural areas.

Preservation and sustainable use of natural resources is the main focus of family farms. The highly diversified nature of their agricultural activities gives them a central role in promoting environmental sustainability, safeguarding biodiversity and contributing to healthier and more balanced diets. From generation to generation, family farmers have transmitted knowledge and skills, preserving and improving several practices and technologies that enhance agricultural sustainability. Using innovative techniques such as building terraces and adopting zero-tillage practices, family farmers have consistently succeeded in maintaining production on marginal lands.

In economic terms, family farming is identified with specific entrepreneurial skills, business ownership and management, choice

and risk behaviour, resilience and individual achievements. It is often more than a professional occupation as it reflects a lifestyle based on beliefs and traditions about living and work. It also maintains the rural lifestyle and contributes to the socioeconomic and environmental sustainability of rural areas. Small family farms have great capacity for quick production expansion and key to sustainable food production if appropriate policies are put in place.

It is estimated that of the 500 million small farms, about 87 per cent (< two ha) are in Asia and the Pacific region. China and India account for 193 million and 93 million small farms respectively. About 85 per cent of farms in India have land holdings of less than two hectares, but cover 45 per cent of the cultivated area with total output exceeding 50 percent. The mean farm size in India has registered a steady decline from 2.2 ha in 1950 to 1.8 ha in 1980, to 1.4 ha in 1995-96 and to 1.16 ha in 2010-11. The contribution of small farmers to total farm output exceeds 50 per cent, although they cultivate only 44 per cent of the land. Many studies have also confirmed the inverse relationship between farm/ size and productivity per hectare. Small farmers are characterized by smaller applications of capital, but higher use of labour and other family-owned inputs, and generally a higher index of cropping intensity and diversification. The inverse relationship between farms size and productivity can serve as a sound rationale for land reform policies, including land redistribution for increasing efficiencies and equity gains. Family farms tend to grow a wide variety of cultivars, many of which are land races. These land races, being genetically more heterogeneous than modern varieties, offer greater resilience against vulnerability and enhance harvest security in the midst of diseases, pests, droughts and other stresses. Family farming has an important socio-economic, environmental and cultural role and is associated with family values, such as solidarity, continuity and commitment.

Although family farming has contributed significantly to enhance agricultural production and reduce rural poverty, it is experiencing new challenges due to globalization and trade liberalization. Small farmers often cannot take advantage of higher food prices by expanding production, as they have difficulty in accessing services and credit. Climate change is another challenge that would have an adverse impact on food security and the living conditions of family farmers. They also face an ever-growing risk of increased crop failure, loss of livestock and reduced availability of marine, aquaculture and forest products. They are vulnerable to risk and severity of disasters, like flood, drought, unusual rain, soil erosion, insects, pests, diseases and epidemics.

Governments, international organizations, regional agencies, civil society organizations, the private sector and research institutions have a role to play in providing support and creating an enabling environment for family farming to evolve from level of subsistence to that of prosperity. India has a long tradition of family farming and several models are available for representation, scale up and possible refinement. It would be the endeavour of the National Agricultural Research System and global ARD community this year, to promote and practices of family farming, build on existing country and/or regionally led initiatives and plan to enhance the contribution of family farmers and smallholders towards sustainable farm production and livelihoods.

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Editorial

"Who did what?" It's time to change the authors' credit line in publications

When it comes to apportioning credit, science may learn from the movies and music. Since 1934, the Academy of Motion Picture Arts and Sciences, that awards the Oscars, has maintained an index to film credits, now called the Motion Picture Credits Database. For every film being considered for an award, the contribution of each person who worked on it, from hair stylist to costume designer to the lead actress, is documented. Similarly in the field of music, the lyricist, the singer and the music director who jointly create the symphony, get equal credit in terms of awards and recognition for their labour. Unfortunately science, for all its focus on assessing and quantifying, has nothing like this (*Nature, 489 : 475, 2012*). The main currency in the world of science is authorship. Authorships enable scientists to accumulate citations, which seem to be considered as the 'true' measure of success and importance. Authorships are key for getting visibility, grants and winning promotions, and are also the foundation for a recently proposed algorithm for predicting scientists' success — their future *h*-index (*Nature, 489: 201-202, 2012*).

In recent times owing to the trend of increasingly larger groups of scientists working on scientific projects, the author line in the publications emanating from the work done by the group is correspondingly lengthening. The affiliation of the organizations where the work was carried out by the individual scientist is duly mentioned, but the responsibilities carried out by him or her are invariably not indicated. This creates confusion as each author tends to claim major credit in executing the programme. It is time that specific work done by each individual author of the publication should be mentioned may be as a footnote, for example who planned, designed and conceptualized the work, carried out field work, wrote the publication and responded to the referees, conducted lab tests and did a statistical analysis etc.

This will strengthen the spirit of group work eliminating any imaginary or real hurt felt that somebody else who contributed less took the major credit for the work. Some front line journals have already started this practice. It will curb the widespread phenomenon of 'authorship by authority'.

Life after Death: A Counter view

A report based on a paper published (theamericanscholar.org/a-new-theory-of- the-universe) by Nobel Laureate Robert Lanza, on scientific proof of life after death was show-cased in our column "Global Science News" (NAAS News 13(4):16-17, 2013). According to the theory of 'Biocentrism' proposed by Robert Lanza, conscious life is not an accidental by-product of energy-matter interactions and laws of physics, as popularly believed.

Columnist Jug Suraiya wrote a piece (The Times of India, January 05:2014) entitled "Forget After Life : Get a Before Life" presenting a counter view based on a recent report by a British scientist that is an extension of the work of German physicist Heisenberg, who in 1927 propounded the principle of uncertainty, that state at the subatomic level observation of a molecular event change depending upon how the phenomenon is perceived. The world is what we make it and how we look at it. The 18th century empiricist philosopher Hume called the world was 'not out there' somewhere but only in our perception. Those who long for eternal afterlife are like absent minded-people who look for their spectacles without realizing that they are already wearing them.

There is a possibility that the myth of heaven or hell in life after death was created by few 'wise men' to instil fear in the minds of the people to maintain proper order in the society a classic example of carrot and stick policy. The righteous were supposed to go to heaven which in the words of Noel Coward is an unending cocktail party in which all guests were 20 years old with celestial nymphs (*apsaras*) in attendance, and the sinners who did not abide by the laws and norms of the society go to hell, hauled over the coals, to be deep fried and roasted alive in the hell fires. Therefore, instead of chasing a mirage what we need is to introspect if there is life before the death – a before life? That is the only life worth living.

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Note : *Fellowship may send views/comments to the Editors. Selected entries will be published.*

Changing Soil Ecology and Biodiversity in the Central Himalayan Region*

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Indian Himalayas occupies a unique place in mountain ecosystem of the world. Primarily because of concern about environmental degradation now there is an increasing realization that the natural resources of mountainous areas are sustained. This is important not only for habitation in the hills, but also for the people in the plains. The people of Himalayan region are heavily dependent on vocations such as agriculture, forestry, livestock etc. The dependence of ever increasing population on finite resources coupled with the lack of viable technologies and adequate inputs to mitigate mountain specific constraints is leading to the marginalization of farming and deterioration of soil health. The ecological attributes of soils have implications beyond its quality or capacity for crop production. These are associated with soil-biota; its diversity, food web structure, activity and range of functions performed. The biodiversity *per se* may not be critical for crop production but is important for the continued capacity of the soil to be productive and healthy.

The indicators of soil health are required to account for the multiple dimensions of the soil functions in terms of agricultural productivity, food security, sustainable resources and ecosystem management. The primary importance of soil organisms is as the main driving agents of nutrient cycles enhancing the amount and efficiency of nutrient acquisition by the above ground vegetation and enhancing plant health. This is achieved by optimising the hydrological regimes and soil physical structure by regulating the dynamics of soil organic matter, balancing soil sequestration and greenhouse gas emission as well as the genesis and restoration of soil.

Land-use changes and soil biodiversity

Minimum anthropogenic interventions lead to harmonised natural vegetation and wildlife, and a self-sustained natural ecosystem. The forest soils receive litter fall continuously, therefore, there is concomitant litter decomposition. The release of nutrients is mediated by microbial decomposition. The litter decomposition is regulated by composition of litter that is associated with climatic factors such as temperature and rainfall. But now there are reports which show that conversion of natural vegetation to other land-uses, including agriculture results in changes in the diversity of the soil communities. Changes in the below-ground biodiversity are often thought to influence plants, although there is evidence that the soil community can be functionally more resilient than aboveground biota. As land conversion and agricultural intensification occurs, above ground biodiversity is reduced adversely affecting the economic efficiency of the ecosystem (Fig. 1). This impacts the biodiversity of the ecosystem (micro-organisms and invertebrate animals both above and below ground) lowering the biological capacity of the ecosystem for self-regulation and restoration which is further adversely affected by additional agrochemical and petro-energy inputs.

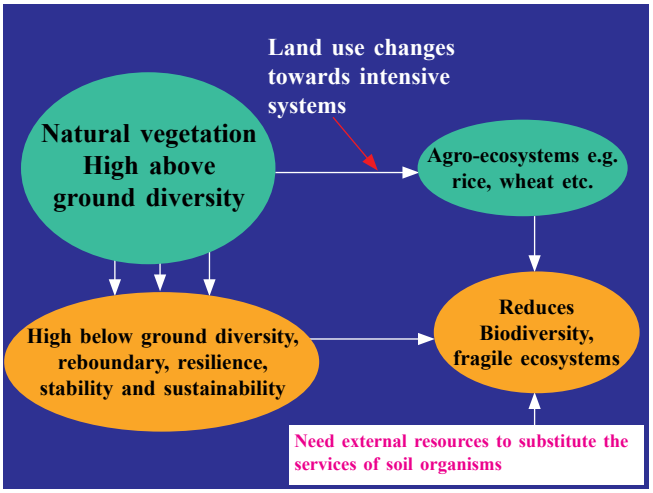

Fig. 1. Land conversion and agricultural intensification reduces below ground microbial biodiversity and the capacity of the ecosystem for self-regulation

Undisturbed forest ecosystem at Binsar and cultivated agro-ecosystems

The Indian Himalayas have been known for the richness of its biodiversity but in recent years intense anthropogenic activity has resulted in biodiversity

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erosion. In a study by us a comparison was made between sites with virgin forests without any anthropogenic activity and intensively cultivated areas in terms of composition of microbial communities and its functioning.

In the Himalayan region, population pressure, increased demand for food, fuel wood, shelter and with coming up of industrial activities have led to drastic change in land use/land cover patterns. Recent studies carried out focusing on development interventions/initiatives in the region reflect the unscientific exploitation of resources leading to increasing environmental degradation.

To assess the soil ecology, particularly the microbial abundance, activity and diversity of this region, recently a detailed study was conducted. One of the experimental sites was Binsar Wildlife Sanctuary (BWS) (Fig. 2), which is a conserved and protected hillarea spread over 45.59 km² and situated at an altitude varying 900 to 2500 meters with an average height of 2412 meters. The BWS hill forest is an ideal site for examining the effects of plant species on soil microbial enzymes and microbial biomass as the BWS is an undisturbed ecosystem. The organic matter specific to a tree species accumulates beneath the tree and can influence the soil microbes and their functional diversity. Forest biogeochemical cycles are shaped by effects of dominant tree species on soils, but underlying mechanisms and extent of impacts are important area of ecosystem research. Oak *(Quercus incana), Deodar* (*Cedrus deodara*) and Pine (*Pinus roxburghii)* are the most important tree species in Binsar wild life tiger reserve hill in terms of area, yield and other forest resource use. Extensive replicated soil sampling was undertaken from this as well as from other sites, where forest land has been converted for agricultural use (Fig. 3).

Soil organic matter, soil enzymes, microbial biomass carbon, population of bacteria, fungi and actinomycetes in soil and the litter of the dominant trees in the BWS hill forest were assessed. Using molecular tools bacterial fingerprints were examined. Similar observations were also made from the adjacent cultivated soils for comparison.

Fig. 2. Area of work in the Central Himalayan region

Results revealed a significant decline of microbial biomass C from a maximum of 1073 mg kg^{-1} in the undisturbed mixed forests to as low as 200 mg kg^{-1} in the cultivated areas. Similarly, wide variations in dehydrogenase (3–15 mg TPF kg^{-1} h^{-1}), acid

Undisturbed forest at Binsar — Towards cultivated system

Fig. 3. Decreasing soil biological characteristics

(158 to 901 mg PNP kg^{-1}) and alkaline phosphatases (58–233 PNP mg kg^{-1}) activities were observed. In undisturbed forest systems, biochemical parameters were almost 200-300% higher than that of cultivated soils. Interestingly, nitrification rates and population of nitrifying organisms were lower in Binsar mixed forest ecosystems, clearly revealing that undisturbed mature forest ecosystem has characteristics to control (or inhibit) N transformations in soil, which is desirable for efficient nitrogen use and minimizing losses. Reduction in microbial abundance of individual groups has been observed from undisturbed forest to cultivated lands. Molecular assessment of bacterial communities showed significant differences between the systems (Fig. 4), but organic farming features were similar to the forest ecosystem.

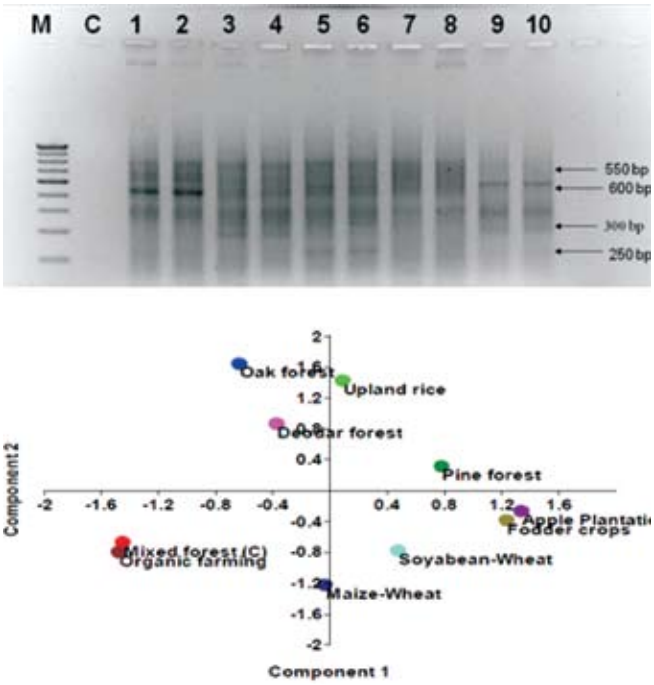

Fig. 4. Genetic fingerprints of soil bacteria from forest and cultivated systems.

Managing soil biodiversity

Biodiversity of soil fauna and flora is an essential part of the biological resources of agro-ecosystems, and must be taken into account in management decisions. The main management options comprise tillage, crop rotation (and sequence) and organic matter management (Fig. 5). The results of several studies indicate that high-input agriculture, particularly tilled agro-ecosystems with narrow crop rotation/short fallow management, leads to a reduction in species richness with dominance of only a few species. On the contrary, management characterized by rotations, no-tillage, organic amendments and maintenance

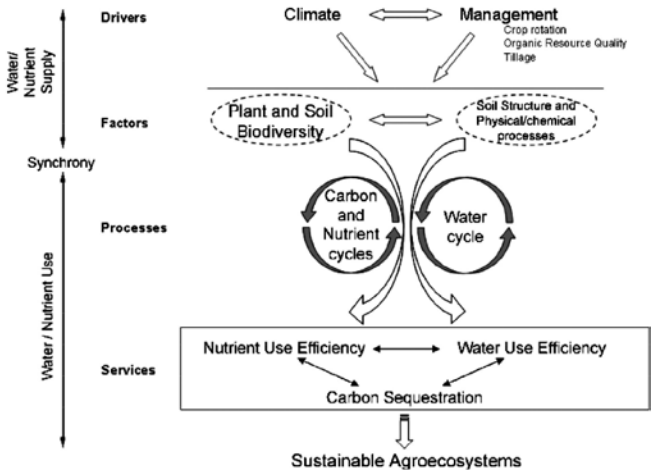

Fig. 5. Conceptual diagram on the relationships between management, plant and soil biodiversity, soil structure and nutrient and water use efficiencies in agroecosystems (Brussaard *et al.* 2007).

of non-productive (''natural'') elements leads to an increase in species richness and population density. Among the potential management approaches, the most appropriate practices for conservation of the soil biota are those associated with sustainable agriculture. In general, these include all management practices that maintain soil cover and return organic matter to the soil as well as ensure that nutrient inputs and outputs are kept in balance. Such practices include: a) integrated soil fertility management i.e., supplementing inorganic sources of nutrients with organics; b) the use of legume cover crops and green manures as pure or as inter-crop; c) agroforestry practices that provide for deep nutrient cycling and/or return of nutrient to the soil through biomass transfer; d) the use of conservation tillage rather than continuous deep ploughing; e) use of farmyard manure and household wastes, with or without composting; f) choice of crops and associated plants which have high nutrient use efficiency.

Conclusions and recommendations

It may be concluded that bringing forest land in the Himalayan region under cultivation has significantly reduced its soil organic carbon pools. Thus maintenance of natural forest or eco-friendly practices such as inclusion of legumes and application of organic manures and incorporating post harvest residues is urgently needed for conservation of soil biodiversity and for sustaining these ecosystems. Further, it may be emphasized that soil biodiversity is central to the sustainability of both managed and natural terrestrial ecosystems. Thus, detailed understanding of the insights into its complexity and functions are a great challenge and opportunity for the benefit of any society. Soil biodiversity should be considered

part of biodiversity action plans at a local scale and gradually upscaled to regional and country level. There will be benefits of optimizing soil biodiversity in all agricultural areas for supporting crop production, environmental protection, and other ecosystem services. The development of appropriate sampling or monitoring schemes requires standardized methods for sampling and characterization of soil biodiversity. Therefore, there is a need for identifying benchmarks or ranges as standards for soil biodiversity in a given soil, under a particular land use, at a particular time and in response to environmental stresses for interpreting and predicting the significant changes in soil biodiversity. Greater recognition is to be given to the intimate relationships between soil biodiversity and the aboveground environment since they are key drivers in maintaining multiple soil functions. These need to be reflected not just in monitoring of soil biodiversity but also in the wider context of environmental quality in the region.

This work presents a first differentiation of genetic fingerprints of the land use system in the central Himalayan region. It appears that forest ecosystem is similar to organic farming in terms of soil microbial genetic community structure. The adverse impact of heavy chemical fertilization is clearly discernible. Automatic Ribosomal Intergenic Spacer Analysis (ARISA) was found to be a very sensitive method for detecting differences between complex microbial communities in natural ecosystems.

References

Brussaard, L., de Ruiter, P.C., Brown, G.G. (2007). Soil biodiversity for agricultural sustainability. Agriculture, Ecosystems and Environment, 121 (3): 233–244.

India's Agricultural Research System-Managing Change: The Case of All India Coordinated Research Projects

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Recently, a change in the National Agricultural Research System was advocated by Abrol (2013), of which the All India Coordinated Research Projects (AICRPs) constitute a significant component inclusive of 78 projects and its variant, the network projects. Conceptually, the institution of AICRPs had its beginning with the establishment of All India Maize Improvement Project in 1957. In the following years, the concept was extended to other crops and livestock species. The primary aim of these projects as seen at that time was to test new crop cultivars for their performance across a range of agro ecological environments and to define agronomic production practices involving scientists with different disciplinary backgrounds at the State Agricultural Universities (SAU). Subsequently, however, this mode of research was extended to cover virtually all disciplines including those belonging to natural resource management, production system components, plant protection, social science etc. Over the years, other variants in this mode of research 'network', 'project directorates' etc have evolved, got multiplied and became part of the research systems.

Concerns on the soundness and usefulness of this mode of research were being occasionally aired even at the early stages of their becoming operational but only in early nineties recognizing that the concept of AICRPs might not be suited for all areas of research and that some of the projects might have outlived their utility over the period of their existence, and to look into other aspects of the functioning of AICRPs, Indian Council of Agricultural (ICAR) constituted a review committee in 1996 under the Chairmanship of Dr. H.K. Jain. The committee (ICAR 1997) carried out an in-depth analysis in respect of strength and weaknesses of the projects based on extensive interactions and made valuable observations and suggestions towards the efficient and effective functioning of these projects. More importantly, the committee recognized that:

in the absence of a well defined and a sound conceptual framework there appeared no consistent or a coherent approach in establishing AICRPs and that their growth lacked a common thread creating doubts on the soundness of the approach. It was further observed that across a wide spectrum of the scientific community there was a feeling of disenchantment with the AICRP approach.

the approach suffered from several limitations which had resulted in promoting mediocrity in research by discouraging individual initiative, a top-down approach in planning and rigidity in implementation, considerable

duplication of research effort and importantly lack of institutional linkages with the zonal research stations of the SAUs mandated with developing and promoting technologies specific to the local conditions i.e. lack of context of research. A feeling of lack of ownership by the SAUs (due to centralized planning and reporting) and perceived dichotomy in the research were other serious lacunae pointed out by the committee.

the committee viewed that while AICRPs on individual crop or a commodity where testing of a new crop variety under different environmental conditions was relatively straight forward, in contrast, research on natural resource management presented a more complex challenge and where transfer of technology might require community based approaches. For this reason, it was likely that some research programs did not lend themselves to the ACRIP approach.

it was considered extremely important to have clarity on the conceptual framework that underlined the organization of AICRIPs and a consensus on their continued usefulness with such modifications as might be considered necessary at that point of evolution of the system. In defining elements of a framework, the committee emphasized that ACRIP approach should be conceived to provide a coordinating mechanism permitting interaction between scientists and fostering inter-disciplinary linkages rather than defining experimental approaches and developing independent projects. The work program should form an integral part of the research program of the concerned institution and that it was not the intention to create a dichotomy in the functioning within the cooperating institutions. While the emphasis here was at work leading to generation of technologies, clearly, the need was to establish organic linkages with the zonal research station on the one and more upstream applied and strategic research on the other.

Notwithstanding the serious weaknesses it was important to understand the role of such an approach as embedded in the suggested conceptual framework with such modifications as might be considered necessary for the continued usefulness of the projects. The suggested framework and the recommendations made by the committee had the potential of ushering the much needed system wide transformational change. Unfortunately these were never internalized by the System and the institution of AICRP has undergone little substantive change as a follow up of recommendations except perhaps, that new projects in the name of 'network' continue to be commissioned. The committee viewed that the research under AICRP mode constituted only a small fraction of the total research budget and for this reason some of the criticism attributed to these projects would appear misplaced in view of the deficiencies in the system as a whole. While this was true, it should be pointed out that the deficiencies identified were critical to the overall system functioning and that addressing these deficiencies was fundamental to the efficient and effective functioning of the system as whole.

Over time, the nature and magnitude of the challenges facing the agricultural researchers changed. The community has now much broader research agenda and problems that call for a deeper and wider knowledge base to find solutions than has been the case thus far. A departure from the past approaches is now a compulsion and there are no other options. Most importantly the new approaches have to be guided by our enhanced recognition that,

a) individual crop or a commodity focused research must yield a place to cropping and farming system based approaches in developing and promoting farm level interventions,

b) natural resource management issues are location specific and that sustainable use and management call for a greater understanding of natural resource human interactions,

c) natural resource management and productivity enhancement issues are viewed in an integrated way and strategies evolved to find solutions to the problem in an integrated way,

d) climate variability related issues impacting every facet of agriculture and imparting greater vulnerability to resource poor farmers provide an overarching theme to develop and pursue strategies with sustainability goals, and

e) agriculture has to be viewed as being multifunctional i.e. beyond its traditional productivity function.

The system's inability to take corrective measures in response to emerging challenges has resulted in its continued downward slide which is reflected in concerns being expressed by those with a higher stake in the system. Addressing agricultural scientists at the 83rd foundation day of ICAR, Dr. Manmohan Singh (2011) observed "…You must get your research questions primarily from the farmers. This is perhaps the most difficult of the challenges that you must overcome in the years ahead and which can test your commitment and ability".

The Eleventh Plan (2007-08 to 2011-12) document of Planning Commission (2007) envisaged major changes in the system in the plan period. According to the document, the system lacked a clearly stated strategy that assigns definite responsibilities, prioritizes research agenda rationally and recognizes the need to establish a research-technology transfer-development

continuum. There was a need for a major paradigm shift to transform the present commodity centered approach to one which was systems based. It was necessary to take a comprehensive view of the functioning of the research system and make systemic changes in the course of the Eleventh Plan. The 12th Plan (2012-13 to 2016-17) document observes while the Research System had identified some new research priorities and initiated research on climate resilient agriculture, the system was yet to respond to the changes suggested in the Eleventh Plan.

The changes called for in the System are of a fundamental nature and there is a need for developing a shared understanding amongst the principal stakeholders as to what constitutes the elements of change and what are their implications for the stakeholders. While the change process has to respond in an ongoing way the beginning can well be initiated by the institution of AICRPs, the principal mechanism linking ICAR institutes and the SAUs. In my view, the elements of change identified and recommendations made by the ICAR Review Committee (1997) can still be the starting point.

References

Abrol, Y.P. (2013). It is time to change our NARS. NAAS News 13(4): 20-21.

ICAR (1997). Report of ICAR Review Committee on All India Coordinated Research Projects, Indian Council of Agricultural Research, New Delhi - 110 001.

Dr. Manmohan Singh (2011). Address at the 83rd Foundation day of ICAR.

Programmes Held

New Year Get Together at NAAS

To mark the advent of New Year 2014, the Academy organized a get together of it's Fellowship on 1st January, 2014. Dr. N.K. Singh, Secretary welcomed Dr. S. Ayyappan, the incumbent President, Dr. R.B. Singh the outgoing President and Dr. V.L. Chopra, the past President, Prof. Anwar Alam, outgoing Secretary, and newly elected and outgoing office bearers of the academy and other distinguished Fellowship. Dr. R.B. Singh congratulated Dr. S. Ayyappan for the accepting the leadership of the Academy. He gave an account of various activities that the academy engaged itself during the year 2013, which included holding of XIth Agricultural Science Congress at Bhubaneswar in February 2013 on the theme "Agricultural Education shaping India's future", Foundation day and AGM meeting, various Brain Storming Sessions, invited lectures, publications including Policy papers, NAAS News, Journal of Agricultural Research, participation in the international meetings etc. He thanked the fellowship in general and the Executive Council in particular for these impressive activities.

Prof. V.L. Chopra in his brief remarks appreciated the programmes of the Academy and congratulated new entrants into the Executive Council and the new Fellowship to the Academy. He said the Academy has adequately fulfilled it's objective of promoting excellence in the area of agriculture. He advised that we must continue to strive to preserve the legacy of the Academy and take it to new heights.

On this occasion, various Academy publications that included Year Book and Planner, NAAS News, six policy papers based on Brain Storming Sessions held

and a book entitled "Reshaping India's Agricultural Education: A Roadmap" were released.

Dr S. Ayyappan, the President wished the assembly a Happy, Productive and Prosperous New Year 2014. At the outset he conveyed his gratitude to the immediate past President and Executive Council, as well as all the former Presidents and the Fellowship for giving him the opportunity to serve the Academy. He solicited valuable guidance to improve the Academy further to

make it one of the foremost science academies of the country. He said the Year, 2014 has been declared as the UN-International year of Family Farming, which is of direct relevance to Indian Agriculture. It is also the Birth Centenary year of the Nobel Laureate, the late Dr Norman E. Borlaug, his last message was to 'Take science to the Farmer' and we now have an opportunity to provide 'Smart Farming for Small Farmers'. The outgoing office bearers were presented a memento by the President NAAS in recognition of their valuable services rendered to the academy. At the conclusion of the function, the incumbent Secretary, Dr. M.P. Yadav proposed a vote of thanks to the Chair, Members of the Executive Council, distinguished Fellows and the Academy staff.

Biofuels to Power Indian Agriculture (Convener: B.S. Pathak)

The fast growing demand for hydrocarbon fuels and their depleting reserves have raised the specter of a global crisis. Indian agriculture is largely dependent on fossil fuels for meeting its energy needs. India's coal reserves, supplemented with wind, water and solar resources are sufficient to power stationary operations

like pumping water for irrigation for long periods. But it's crude oil reserves are meager making it dependent on oil imports to provide fuel to the transport sector and to agriculture with a fleet of 4.5 million tractors, power tillers and self propelled agricultural machinery. This has made Indian agriculture highly vulnerable to any disruption in the import of crude oil owing to a global shortage of hydrocarbons and continued price rise due to the machinations of the international oil cartel. Bio-fuels offer the best potential to supplement and eventually replace fossil diesel to power Indian agriculture.

Thus biofuels seek to supplement conventional energy resources for meeting rapidly increasing requirement of transportation fuels and meeting energy needs of India's vast rural population by using of non-edible feed stocks and to reduce dependence on import of fossil fuels. The intent is to provide a higher degree of national energy security in an environmentally friendly, cost-effective and sustainable manner. In this backdrop, a Brainstorming Session (BSS) on **Biofuels to Power Indian Agriculture** was held on 23rd December, 2013 under Chairmanship of Dr R.B. Singh. The Convener, Dr B.S. Pathak presented the base paper and explained that ethyl alcohol and bio-diesel, the two bio-fuels produced in significant quantities are used for traction and transport purposes. Brazil, U.S.A., China and European Union are the main producers of fuel alcohol from sugarcane and cereals while; Germany, France, U.S.A. and Italy produce bio-diesel mostly from vegetable oils and fats. India produces ethyl alcohol in relatively small amounts from molasses, mainly for industrial use including production of beverages. The bio-diesel programme, based on large scale plantation of Jatropha has not picked up although technology for converting non-edible oil into bio-diesel is available in the country. These programmes demand a commitment of land and water resources at the cost of food and fodder crops. On the other hand, the growing surplus of crop residues (CR) that have a high content of bio-degradable and zero production cost offers a potential feed stock for bio-fuels without competing with food and fibre crops for resources. At present this surplus is burned after harvest resulting in loss of soil organic matter and air pollution. In 2004, the amount of surplus CR was estimated at about 150 million tons and is expected to increase to 226 million tons by 2015. Investigations suggest that 50% of this surplus can yield 13 million tons oil equivalent (MTOE) fuel alcohol or 15 MTOE methane rich fuel that will be more than the estimated diesel consumption in agriculture in that year.

The Session concluded with following suggestions and recommendations:

Establish a strong Energy Cell to plan and co-ordinate crop residue based bio-fuel research and develop programmes to achieve the goal of adequate immunity for Indian agriculture against the expected hydrocarbon crisis in future. The Cell should have the mandate to:

- Critically review on-going bio-fuel related research, assure good support for promising projects/ researchers and improve interaction among groups engaged in bio-fuel research.
- Develop methodology for forecasting energy requirements of agriculture and propose energy/ energy carrier supply targets for next 10 years at two years interval with a focus on traction and transport fuels.

- Develop integrated projects, using best available information, processes and equipment, and covering all stages from crop residues (CR) logistics to application of the main products, and utilization of by-products, to achieve the following three outputs:

  a. Bio-gasification pilot plant to anaerobically produce 500 m^3 biogas/hr from crop residues, generate power to meet the energy needs of the pilot plant, supply compressed (Syngas) SNG for use as a transport fuel, supply separated CO_2 to chemical industry and convert residues to compost to supply to farmers.

  b. Five ton per day pilot plant to produce ethanol from CR to be supplied to a major petrol supplier and use the sludge as manure.

  c. 500 t/yr pilot plant to produce and supply algal diesel to a tractor manufacturer for extensive testing and use of the residue.

To encourage and promote research on biological conversion (fermentation) of gases to produce fuels and chemicals, production and storage of bio-hydrogen, and support research to improve the performance of family size and community biogas plants.

It is presumed that the Energy Cell will have access to the expertise available in the country and outside through advisory committees and professional consultancy. It is expected that the Cell will organize networks of institutions and experts in the implementation of each pilot project.

Policy and Strategy Issues

1. India's policy to ensure supply of enough electrical power and transport and traction fuels to the agricultural sector for sustaining its growth should be stated and incorporated in the policy documents.
2. Surplus crop residues should be earmarked as feedstock for production of bio-fuels for agriculture.
3. A medium term plan should be prepared to develop, evaluate and demonstrate bio-fuel production processes and technologies using the latest knowledge and the best available materials. Arrangement should be made to implement the plan and monitor the progress.
4. Technical guidance and financial incentives/ assistance should be given to custom operators and entrepreneurs to collect, store, pre-treat and market crop residues, establish and operate bio-fuel production plants and market bio-fuels and by-products.
5. Co-products or non-fuel products, mainly chemicals of crude oil processing account for 29.4% of the total product weight and 49% of total product value. The co-products support the hydrocarbon fuel economy. Biomass processing may possibly yield many, if not all the co-products of crude oil processing that would help in cutting down bio-fuel costs.
6. With the creation of opportunity for utilization of surplus crop residues, including production of bio-fuels, burning of crop residues should be banned.

Biodrainage: An Eco-friendly Tool for Combating Waterlogging (Conveners: S.K. Chaudhari, J.C. Dagar and O.P. Toky)

Introduction of canal irrigation in arid and semi-arid regions without provision of enough drainage causes rise in water-table leading to water logging and secondary salinisation. Presently, about one-third

of the world's irrigated area faces threat of water logging resulting in reduced crop yields, lower profits and abandonment of agricultural lands. The problem is very serious in arid and semi-arid regions where groundwater is of poor quality.

The problems of water logging and salinity can be effectively tackled by conventional sub-surface drainage systems but these are more expensive and sometimes cause environmental problems. The limitations and shortcomings of the conventional engineering based drainage systems call for alternate approaches to keep the agriculture sustainable over the longer periods. Bio-drainage comprising deep rooted vegetation with high rate of transpiration seems to be a promising option. The biodrainage technique is eco-friendly as the biodrainage plantations purify the environment by absorbing greenhouse gases and releasing oxygen into the environment. The

biodrainage technique does not require any disposal of drainage effluents as the biodrainage plantations drain out the filtered fresh water using their bio-energy. On the other hand conventional sub-surface drainage techniques need disposal of drainage effluents., that has become an important issue around the world. In this backdrop, a Brainstorming Session (BSS) on **'Biodrainage: An Eco-friendly Tool for Combating Waterlogging'** was organized at NAAS, New Delhi on 19th December 2013 under Convenership of Dr. S.K. Chaudhari, Dr. J.C. Dagar and Dr. O.P. Toky. Dr. R.B. Singh, President, NAAS presided over the Brainstorming session. Dr. A.K. Sikka, DDG (NRM), ICAR, Dr. P.S. Minhas, Director NIASM, Baramati, Dr. Anwar Alam, Secretary, NAAS, Dr. P.K. Chhonkar, Editor and several distinguished experts in the field participated in the BSS.

In his inaugural remarks, Dr. A.K. Sikka highlighted the importance of Biodrainage as an integral part of the drainage system. Biodrainage should not be looked as a stand-alone system; rather integrated with the engineering solutions of reclamation of saline soils and lowering the water-table. Dr. R.B. Singh in his Presidential remarks underlined the importance of Biodrainage because of environment friendly and ecological benefits. The problem of waterlogged saline soils is not confined to Haryana, Punjab and Rajasthan, but it has emerged as a National problem. The biodrainage technology that requires much less investment as compared to conventional sub-surface drainage, should be used wherever possible.

Dr. S.K. Chaudhari, Convener of the BSS introduced the topic and presented the base paper and highlighted the importance of biodrainage in waterlogged saline areas.

The salient recommendations emerged from the BSS are as follows:

Researchable issues

- Development of biodrainage models with a holistic approach. Generating temporal information on transpiration capacity and hydrological effectiveness with high-density bio-energy plantations of selected salt tolerant species.
- Identifying ideal direction of the ridge-plantation and tree spacing for minimizing effects on under-story crops, and maximising control of water table *vis-a-vis* salinity with agro-forestry systems
- Process based Models (like 3-PG) to predict salinity within the basin under the present and afforested conditions.
- Basic and strategic research on biodrainage and its widespread adoption in waterlogged areas. High potential biodrainage tree species and their clones/varieties may be identified for specific agro-ecological regions
- Comprehensive investigations of fundamental nature involving micro physiological traits and root characteristics should be conducted for high potential biodrainage models.

Pilot level studies in waterlogged hotspots

- Identification of potential waterlogged areas for biodrainage and harnessing the potential of biodrainage in hotspots. Agencies to be identified and entrusted with the task of undertaking biodrainage programmes.
- Superior planting stock of trees (clones of *Eucalyptus*, *Casuarina*, poplar, bamboos, etc.) to be made available to the farmers. Integration of multipurpose trees on farmlands would help remove imbalance in nutrients.

Coupling biodrainage with sub-surface drainage

- Due to high investment cost and community involvement, surface and sub-surface drainage may be integrated with traditional drainage practices.
- Government intervention is required in popularizing biodraining trees in and around the fields in canal commands by way of providing quality planting material, capacity building and minimal maintenance cost.
- Regular sensitization programs on biodrainage may be organized for creating awareness amongst the field functionaries of different government departments and NGOs involved in this area.

Biodrainage plantation as green area

- Provision to be made of enough areas along the canals for interception of seepage through strip plantations with appropriate credit to the adjacent farmers.
- Provision of green areas in urban and sub-urban areas for utilization of available sewage water and utilizing GIS and remote sensing techniques for prognosis of hot spot areas.

Biodrainage for coastal waterlogged areas

- Eucalyptus Plantation can be grown in topographically depressed inland waterlogged areas and Casuarina in coastal waterlogged areas
- In high rainfall areas due to surface water logging, only paddy can be cultivated as intercrop in kharif and after the monsoon season, various intercrops like groundnut, green gram, black gram, cowpea, watermelon can be grown in biodrained areas.

- Accelerated drainage through biodrainage provides time advantage to advance rabi cultivation avoiding market glut. Biodrainage can also be used as a soil stabilizer on raised bed as highway avenue plantation.

Insurance and market support for biodrainage plantation

- Special insurance coverage of biodrainage plantation against disaster induced damages to be considered. Minimum support price policy especially for pulp producing biodrainage plantation to avoid distress sale by farmers to be put in place.

Carbon Economy in Indian Agriculture (Convener: A. Subba Rao)

The effect of climate change on various spheres of human life, including agriculture, animal husbandry and food production systems, have been already felt across regions of the globe. In India, agriculture sector contributes about 17% of the total greenhouse gas emissions. At the same time, there is a huge carbon sink potential in this sector including land use, land use change and forestry sector. Globally, soil carbon sequestration has about 89% of the mitigation potential. However, identification and adoption of the

best management practices (BMPs) with a low carbon footprint (i.e., low C emission and high C sink) needs to be taken up for different agro-ecological regions of India. An agricultural practice with lower carbon footprints can be a win-win strategy for India. In this backdrop, a brainstorming session (BSS) on "Carbon Economy in Indian Agriculture" was organized at NAAS, New Delhi on 1st February, 2014 under Convenership of Dr. A. Subba Rao, Director, IISS, Bhopal. Dr. S. Ayyappan, President, NAAS and DG, ICAR presided over the Brainstorming session. Dr. R.B. Singh, former President, NAAS was special invitee. Dr. A.K. Singh, former DDG (NRM) and presently VC, RVRSKV, Gwalior, Dr. A.K. Sikka, DDG (NRM), ICAR, Secretaries of NAAS, Dr. N.P. Singh and Dr. M.P. Yadav and several distinguished experts in the field participated in the discussion.

In his inaugural remarks, Dr. A.K. Sikka highlighted the importance of "Carbon economy" in sustaining agricultural production in India. Though agriculture is both a source and sink of greenhouse gases, improving the sink potential through restoration of degraded lands, agroforestry etc to increase soil carbon sequestration needs priority attention. Dr A.K. Singh mentioned about the multipronged strategy including nutrient, water and energy management, required to improve the C footprint of Indian agriculture. He cited the success story of deep placement of urea in Bangladesh, which has reduced the fertilizer consumption by 40%. Dr. R.B. Singh emphasized upon developing technologies which contribute to the 'Green economy' and increasing the greenness index of Indian agriculture. Carbon economy cannot be seen in isolation of food security. He called for developing a 'National system of total C economy' which should cover location specific and ecosystem based analysis. Dr. S. Ayyappan in his Presidential remarks, underlined the need for a multi-partner and multiple approach in the climate change mitigation efforts. Inter-sectoral comparison and developing benchmark methodologies should be focused for ensuring C economy and improving the green economy. He also endorsed the idea of incentivizing farmers for adopting the best management practices which not only improve the C economy, but also yields multiple ancillary benefits such as soil health improvement, increase in water and nutrient use efficiency and reducing degradation of natural resources.

Dr. A. Subba Rao, while presenting the base paper highlighted the importance of C economy in Indian agriculture and contribution of agriculture activities to the GHG emission. Seven presentations were made on soil C sequestration, renewable energy options, enteric fermentation, soil and water conservation, agroforestry and monitoring methodologies.

The salient recommendations emerged from the BSS are listed below:

- Accurate emission estimates are needed for different agricultural enterprises, which include agricultural emissions. This should be done by developing the emission coefficients under Indian conditions.
- Improve the efficiency of water, nutrient and energy use for improving carbon economy. Higher nutrient use efficiency can reduce the requirement of higher fertilizer application thus indirectly improving the C and energy economy. Similarly, modification of microclimate through small interventions like

mulching can help in improving the water and C economy.

- For reducing the emission of greenhouse gases, different interventions available should be used. Adoption studies need to be made to prescribe the best available technologies keeping the totality into account.
- The farmers who adopt the BMPs should be given incentives, which can be monitored through appropriate methodology. Small farmer groups and NGOs can help in monitoring and delivering incentives to the farmers.
- Activities which restore degraded land such as soil and water conservation measures, the adoption of agroforestry systems such as silvi-pastural and horti-pastural systems, afforestation and planting of N-fixing tree species should be taken up.
- The net reduction in the CO_2 equivalent emission (after discounting the sink) should be properly monitored and priced. Identification of some benchmark sites/systems in each agroecological region should be done for repeated measurements of change in soil C stock over time.
- There is a strong need to calibrate and validate the carbon models for each agroecological region which can be used for monitoring both emissions and sequestration, under the dominant cropping and farming systems prevalent in the region.

For further details on BSS log on http//:www.naasindia.org

Special Lecture by Dr. Sonny Ramaswamy

Dr. Sonny Ramaswamy, Director of the USDA's National Institute of Food and Agriculture (NIFA), gave a presentation in the Academy on **"Setting the table for a flatter, hotter, more crowded earth"** on 27th January, 2014. In his lecture, Dr. Ramaswamy highlighted that by 2050, the global population will exceed 9 billion people, sustaining this population, in the context of changing climate and diminishing land and water resources, is the paramount question. Are we prepared to feed, cloth, and shelter everyone one on Earth without wreaking havoc on the environment? It has been estimated that we will need to increase food production from anywhere between 50 and 70 percent or even double food production from today with diminishing resources. The challenges we face are complex, with all manner of feedback loops. We need to "crowd source" the best intellectual resources to find solutions. There are some short-term or proximate questions to address– for example, a single insect problem. But when we address that in isolation, another problem emerges– we cannot address issues in piecemeal fashion– we need a comprehensive or systems approach. But we can't put all our eggs in one basket; we still need deep disciplinary knowledge from a fundamental perspective that we can draw on and bring together to address our challenges.

Round table on GM Crops for Nutritional Security

National Academy of Agricultural Sciences organized a Round Table on '**GM Crops for Nutritional Security**' under the Chairmanship of Professor M.S. Swaminathan, Founder Chairman and Chief Mentor, M.S. Swaminathan Research Foundation, Chennai, on **12th February 2014.**

The Round Table group discussed the potential of GM crop technology in solving the entrenched low farm productivity, malnutrition and hidden hunger problems in a large section of Indian population, particularly, women and children in the underprivileged sections of our society and resolved the following:

1. GM crop technology is a promising, relevant and efficient technology for low-input high-output agriculture for crop improvement where conventional breeding tools have not been effective. GM technology will be a tool to improve agricultural crops for their nutritional value, nutrient & water use efficiency, productivity, tolerance/resistance to biotic and abiotic stresses.
2. The present de facto moratorium on the field trials of GM crops should be lifted at the earliest. It is putting the clock back in relation to progress in harnessing the benefits of GMO technology in agriculture. Confined field trials are essential for

the evaluation of productivity performance as well as food and environmental safety assessment. The non-conductance of regular field trials is a handicap as well as disincentive in harnessing the benefits of a wide array of transgenic material available with different research organizations. Many of these research materials have excellent resistance to diseases, pests, drought and salinity as well as improved nutritional quality. Much of this work has been done in research organizations committed for the general public good and by young researchers who are getting increasingly discouraged due to lack of clear policy on the future of GM crops.

3. The Indian Biosafety regulatory system is in compliance with the international regulatory consensus based guidelines. The system, put in place under the Environment Protection Act (1986) should dynamically evolve, update, adopt and implement the biosafety protocols and procedures. The bill on the Biotechnology Regulatory Authority of India (BRAI) introduced by the Government needs to be pursued further taking into account the observations by all stakeholders. Meanwhile the existing three tier system of IBSC, RCGM and GEAC has done a good job and should be strengthened with adequate infrastructure and technical support to continue with the confined field trials so that the research progress is not halted.
4. The Agricultural Biotechnology Committee chaired by Prof. M.S. Swaminathan submitted its report in 2004 for a Parliament approved Regulatory Agency as well as conducting All India Coordinated Trials with GMOs, taking all necessary precautions. In the process, it is required to consider risk assessment a genuine concern of the opponents of GMOs on a scientific basis.
5. After biosafety clearance by the GEAC, ICAR should play a key role in the commercial release of the GM crops to prevent undue proliferation of a large number of hybrids/varieties.
6. The national regulatory system should integrate capacity building as a necessary operational requirement to keep pace with scientific advancement through international collaborations to evolve as the most effective system including collaborations with countries such as USA, Australia, Canada, Norway and Brazil.
7. Scientists should communicate with public and policy makers about the safety and benefits of GM crop products and remove the undue fears and apprehensions about GM crop adoption. A media resource centre may be set up for providing up-to-date scientific information to media representatives and dispel any misinformation.
8. The Academy may set up two Committees on the pattern set up by the Royal Society of London, a. Committee on Public Understanding of Science, b. Committee on Political Understanding of Science.
9. Until the time a Parliament approved autonomous National Biotechnology Regulatory Authority comes into existence, RCGM & GEAC should have full time chairpersons as recommended by SAC to PM and GEAC should issue 'Decision Documents' at the time of allowing field trials of a GM event and at the time of final release of a GM event.
10. The GEAC should function like a statutory body and make final decision on approval of the GM event for environmental release. The "No-Objection" certification from state governments for conduct of confined field trials is not required as their products will not get to farmers or consumers.
11. Agriculture is a state subject and it is important that the State Agricultural Universities and State Departments of Agriculture are involved in the implementation of the field trials but without losing time. Some states are declaring themselves an organic state which precludes the use of GM crops. However, organic farming would require effective methods to face the challenge of pests and diseases.
12. Nutritional security involves attention to balanced diets and nutrition literacy. The Food Security Act 2013 will ensure that all needing social protection against hunger will be able to get the needed calories. However, it is required to attend to other nutritional problems such as protein hunger and hidden hunger caused by the deficiency of micro-nutrients and vitamins.
13. There is need for a PAN-political support for promoting genetic engineering research in our country to harness its full potential.
14. Return from investments in biotechnology research is very high. Public and private sectors should develop a joint strategy which will help to ensure the inclusiveness of access to improved technologies among all farmers, small or large.
15. To achieve a zero hunger challenge of the United Nations by 2025, we must double the small farm productivity. Such an increase will be possible only through the intelligent and intensive applications of new technologies such as Biotechnology.

Salient Decisions of the 87th Meeting of Executive Council

XII Agricultural Science Congress

The Council approved holding of XII Agricultural Science Congress on the theme 'Sustainable Livelihood Security of Smallholder Farmers' along with subthemes to be held on 3-6 February, 2015 at NDRI, Karnal, with Dr. A.K. Srivastava, Director NDRI as its convener.

AGM and Foundation day celebration

The Council approved the AGM to be held on 4 -5th June, 2014, at which Foundation Day Lecture 2014 will be delivered by Bharat Ratna Professor C.N.R. Rao, National Research Professor, Chair Scientific Advisory Council to the Prime Minister, who has kindly agreed to our request.

Silver Jubilee Celebration of the Academy

EC approved the programmes related to organization of Silver Jubilee Celebration of the Academy from June 2014 to April 2015. It was also decided to organize commemorative seminars on "25 years of achievements and output in different area along with a way forward till 2030" on the occasion.

Inter-Academy meeting

It was approved by EC to organize an inter-academy discussion on the theme of "Food and Nutritional Security of India", wherein Presidents of the national academies such as INSA, NASI, NAVS, NADS and IASc may be involved.

Youth in Agriculture

EC also approved a day long youth convention with the theme of "Youth in Agriculture.

Award Commemorate Silver Jubilee of NAAS

The Council approved to institute NAAS Silver Jubilee Awards one each for an eminent scientist, industrialist and a farmer.

NAAS score for Scientific Journals

Recommendations of Dr. S.L. Mehta committee on NAAS rating of the Journals was approved effective 01.01.2014 and can be accessed from the NAAS website.

Setting up of New Chapters

Setting up of new chapters of NAAS was approved by EC. The centres along with the names of respective convener are Bhubaneswar (Dr. T. Mohapatra), Kolkata (Dr. Biswapati Mandal), Karnal (Dr. A.K. Srivastava), Nagpur (Dr. K.R. Kranthi), Bangalore (Dr. (Mrs) Shailaja Hittalmani), Coimbatore (Dr. C. Ramasamy), Cochin (Dr. A. Gopalkrishnan), Chennai (Dr. Ajay Parida), Jodhpur (Dr. J.C. Tarafdar), Guwahati (Dr. K.M. Bujarbaruah) and Ludhiana (Dr. B.S. Dhillon).

Global Science and Technology News

PM pushes for more funds to science and technology

The Prime Minister Dr Manmohan Singh, a Fellow of the Academy in his inaugural address at the 101st Indian Science Congress, in Jammu on 3rd February, 2014, emphasized the need for increasing the annual expenditure on science and technology to at least two per cent of the GDP and urged the corporate sector to join hands with the government in realizing the goal. Among the projects announced were, National Mission on High Performance Computing with an outlay of Rs 4,500 crore, setting up of a National Geographical Information System with an outlay of about Rs 3,000 crore and a Neutrino-based Observatory in Tamil Nadu at a cost of about Rs 1,450 crore. A National Mission on Teaching will also be launched to enhance the esteem of teachers, he said. Stating that India

Prime Minister Manmohan Singh and J&K Chief Minister Omar Abdullah at the 101st Indian Science Congress, in Jammu on Monday. PTI

will partner with the international scientific community in the establishment of world's major research and development projects, Dr. Singh announced the

country will join the European Organisation for Nuclear Research (CERN) as an associate member. He also referred to the global interest in the effort of the country's scientists to develop a fast breeder reactor and added that he was hopeful that the prototype, currently under construction in Kalpakkam, will be completed this year. "It will be a great day for Indian science and technology because we will be one of the few countries in the world with leadership in a completely new area of nuclear technology that can contribute non-polluting electrical power," Singh told the delegates attending the congress. He referred to the advances made in the field of meteorology, especially the accurate forecast of the site of landfall during the recent cyclone in Orissa. Dr Singh said, "I would also like to see the continued improvement in our monsoon prediction capability through the recently launched Monsoon Mission so that we avert the kind of calamities that we saw in Uttarakhand last year." He also referred to the establishment of a new department for Health Education and Research, saying the development of rotavirus vaccine, a new drug for malaria and many other leads emanating from the collaborative research are all reassuring developments.

Dr Singh emphasized launching a national drive for an 'Ever-Green Revolution' so as to ensure food security, besides improving land and water productivity. The use of bio-technology has great potential to improve yields, he said, adding that while safety must be ensured **"we should not succumb to unscientific prejudices against Bt crops".** Affordable innovations for healthcare, sustainable agriculture, clean energy and total solutions for water related challenges are some areas where Indian science can seek global leadership, he said. "Our basic research must be directed to make new discoveries with innovative efforts to develop affordable solutions,"

A 'Virtual Liver' developed by IISc Professors Awarded US Patent

Strand Life Sciences, founded by professors at the Indian Institute of Science (IISc), Bangalore, was awarded a US patent, last week for The virtual liver"—a ready-to-use software simulation that will be used for pre testing drugs as it mimics normal liver functions and generates likely outcomes of new drugs before the drug is tested on animals and humans. Industry estimates suggest that nearly 50% of new drugs fail to pass through the clinical trial stage as the drugs are shown to have side effects, in particular, toxicity issues. Of that, 60% of the cases relate to liver injuries, given that the liver is responsible for flushing out toxins from the body.

"The software will also be awarded patent rights in the European region shortly," said Dr. Kalyanasundaram Subramanian, Chief Scientific Officer of Bangalore-based Strand Life Sciences. Founded in 2000 by a clutch of computer science and mathematics professors, Strand has captured a 30% share of the global genomic market through its core business of selling software that allows research labs, academics, and pharmaceutical companies to do biological data mining and interpretation.

In 2007, Strand began work on the virtual liver, and applied for patent rights in 2011. The virtual liver allows the industry to reduce the number, time, and expenditure associated with animal and human trials and yet is able to understand the side-effects of drugs on the liver." We wanted to combine simulation along with experimental methods to predict toxicity early on. The simulation is made on a rat model and a human model. Based on their outcomes, we know how a drug will react," said Subramanian.

This line of work will lead to the production of other organs like a 'virtual kidney', which like liver is adversely affected by toxins produced in the body. The possibility of use of these "virtual organs" in testing of GM foods using simulation modelling cannot be ruled out.

Based on a report appearing in The Times of India

The World Food Prize - 2013

Three distinguished scientists — **Dr Marc Van Montagu** of Belgium, and **Dr Mary-Dell Chilton and Dr Robert T. Fraley** of the United States — will share the 2013 World Food Prize for their independent, individual breakthrough achievements in founding, developing, and applying modern agricultural biotechnology. Each conducted groundbreaking molecular research on how a plant bacterium could be adapted as a tool to insert genes from another organism into plant cells. Their research is making

2013 World Food Prize Laureates
Dr Marc Van Montagu, Dr Mary-Dell Chilton and Dr Robert T. Fraley

it possible for farmers to grow crops with: improved yields; resistance to insects and disease; and the ability to tolerate extreme variations in climate.

Van Montagu, Chilton and Fraley, each conducted groundbreaking molecular research on how a plant bacterium could be adopted as a tool to insert genes from another organism into plant cells, which could produce new genetic lines with highly favorable traits.

The revolutionary biotechnology discoveries of these three individuals, each working in separate facilities on two continents, unlocked the key to plant cell transformation using recombinant DNA. Their work led to the development of a host of genetically enhanced crops, which, by 2012, were grown on more than 170 million hectares around the globe by 17.3 million farmers, over 90 % of whom were small resource-poor farmers in developing countries.

During the period 1996-2011, according to the International Service for the Acquisition of Agri-biotech Applications (ISAAA) report, 328 million tons of additional food, feed and fiber was produced worldwide by biotech crops. As the world grapples with how to feed the estimated 9 billion people who will inhabit the planet by the year 2050, it will be critical to continue building upon the scientific advancements and revolutionary agricultural discoveries of the 2013 World Food Prize Laureates.

First Comprehensive Test to Detect Genetic Modification in Food

As the abundance of genetically modified (GM) foods continues to grow, so does the demand for monitoring and labelling them. The genes of GM plants used for food are tweaked to make them more healthful or pest-resistant, but some consumers are wary of such changes. To help inform shoppers and enforce regulations, scientists are reporting in American Chemical Society's journal *Analytical Chemistry* the first comprehensive method to detect genetic modifications in one convenient, accurate test.

By the end of 2012, farmers were growing GM crops on more than 420 million acres of land across 28 countries. That's 100 times more than when commercialization of GM crops began in 1996. But doubts persist about the potential effects on the environment and human health of these biotech crops, created by changing the plants' genes to make them more healthful or more able to resist pests. In response, policymakers, particularly in Europe, have instituted regulations to monitor GM products. Although researchers have come up with many ways to detect genetic modification in crops, no single test existed to do a comprehensive scan, which is where Yang and Tao come in. They developed a test they call "MACRO," which stands for: multiplex amplification on a chip with readout on an oligo microarray. It combines two well-known genetic methods to flag about 97 percent of the known commercialized modifications, almost twice as many as other tests. It also can be easily expanded to include future genetically modified crops.

1. Ning Shao and others (2013). MACRO: A Combined Microchip-PCR and Microarray System for High-throughput Monitoring of Genetically Modified Organisms. Analytical Chemistry, 2013; : 131222110642000 DOI: 10.1021/ac403630a

Why there is a drought of Nobel Laureates in India?

In a damning interview published in The Times of India (January 01:2014), Chairman of the Nobel Committee for Chemistry Sven Lidin said that Indian institutes, academics and scientists, invited to nominate Indians for the Nobel Prize, are "letting invitations rot in their drawers". This year, not a single Indian nomination was received for the Nobel Prize for Medicine. In other categories like economics, physics and chemistry, just 10% invitations sent to Indian institutes or scholars seeking nominations were responded to. Interestingly, most of their responses were nominations for non-resident Indians. The response rate from India is abysmally low," "It is not just the case with nominations for physics, medicine and chemistry, but also economics. It is a serious worry for us."

Lidin said Indian universities do not take the nominations seriously. "In some cases, they aren't even aware of breakthrough work being conducted by individuals scientists or groups and hence don't know whom to nominate," said Lidin, who is visiting India to look for nominators. He said they are never sure that they were reaching the right people to nominate. In some cases, say for example, an institute director is not well versed with chemistry as a subject because his specialization has been physics and hence he does not nominate when asked to do so for a Nobel in Chemistry.

Lidin said the Nobel Committee is now travelling extensively across the world to search for the best people and institutes to be asked to nominate.

"Quest for nomination is a big responsibility for us. Science in India and China are incredibly strong and has a very long academic tradition. But the number of Nobel winners is very low." Lidin said institutes with Nobel laureates are usually very good with nominations. "That is why universities in the UK, the US, Germany and France nominate a large number of scientists and end up winning the most prestigious prize more often.''

Nominations for the Nobel Prize can be made only through invitation. The Nobel Committee sends out invitation letters to individuals qualified to nominate - former laureates, scholars, academics and higher education institutes and universities in every country. It bases its assessment on nominations received before a particular date. The Committee then assesses the candidates' work and prepares a short list, which is later reviewed by permanent advisers specially recruited for their knowledge of specific candidates. Around October every year, the Committee chooses Laureates through a majority vote.

Source: Kounteya Sinha (2014). TNN Jan 1, 04.26 AM IST

Report calls for Reduction in the Use of Antibiotics in Farming

A new study has linked the growing crisis of antibiotic-resistance to the overuse of antibiotics in agriculture. The paper, published ahead of the European Antibiotics Awareness Day on 18 November, 2013 in the medical journal The Lancet, calls for immediate action in human and veterinary medicine. The report reveals that in some countries huge amounts of antibiotics are used in agriculture, aquaculture, and intensive farming - up to four times the amount used in human medicine. The scientists claim that any increase in antibiotic resistance in farm animals is likely to spread to humans since there is little separation of the types of antibiotic used in human beings and animals. The report recommends a worldwide ban on the use of antibiotics in healthy animals to promote growth or prevent disease. "The common goal should be to preserve the effect of antimicrobials for future generations of human beings, but also for animals. Antimicrobials should only be used when needed", the report says. To this end, "health orientated systems for rearing of animals" should be developed which do not rely on high levels of antibiotic use. The Alliance to Save Our Antibiotics, a campaign by the Soil Association, Compassion in World Farming and Sustain, welcomed the report. Tom MacMillan, director of innovation at the Soil Association, said: "This startling new report shows that the routine use of preventative antibiotics in farm animals is something that needs to be phased out for the good of both animals and humans."

The Lancet Infectious Diseases (2013). **13(12)** : 995.

Editors' note: The Academy has organized a Brain Storming Session on Antibiotics in Manures and Soil - A Grave threat to Human and Animal health. A policy paper No 43 brought out based on deliberations can be downloaded from the NAAS website. (http://www.naasindia.org)

First GMO rice to be launched in Philippines in 2016

The first genetically modified rice to be commercially available could be approved for production in the Philippines in two to three years, despite strong opposition from environmental groups. Officers of both the International Rice Research Institute (IRRI) and the Philippine government's agriculture department said the newly developed "golden rice" had completed field trials, despite vandalism at one test field.

According to Dr. Achim Dobermann, deputy director-general of IRRI "Golden rice is in the pipeline and a lot of the principal development and research has been completed." He stressed that at the moment, there is no GM (genetically-modified) rice officially released in any country. He said that depending on the length of the approval process, it could take a minimum of "two to three years" before seeds are ready to be distributed to farmers.

According to Dr. Antonio Alfonso, coordinator of the Agriculture Department's biotechnology programme field trials of the rice, a genetically-modified organism (GMO), have been completed in the Philippines and it is now set to undergo tests to determine if it is safe to consume and propagate. Golden rice has been genetically modified to produce vitamin A, which is lacking in the diets of many people in developing countries, leading to weakened immune systems and blindness, and often resulting in death. However many environmental groups oppose GMOs, saying they will have harmful side effects which will irreversibly spread even to non-GMO crops. The Southeast Asia office of environmental group Greenpeace condemned the efforts to promote golden rice.

Editors' note: Also see "Feeding Experiments show no adverse effect of GM Bt rice: Chinese study" in the column "Science Spectrum: Editor's pick" NAAS News this issue.

Note: *Fellowship is requested to send their inputs for this column at editors.naas@gmail.com Entries selected for publication will be duly acknowledged*

Feeding Experiments Show No Adverse Effect of GM Bt Rice: Chinese Studies

Feeding rats with genetically modified Bt rice currently under development in China for 90 days has shown no adverse effect. Animal feed experiments with rats were conducted by a group of scientists led by Er Hui Wang and others (2013) at the National Center for Food Safety Risk Assessment, Beijing. A new type of genetically modified insect resistant rice named TT51 was created by inserting a synthetic fusion gene of CryAb/CryAc into a high yielding parental rice cv. MingHui63. This provided farmers an alternate route to control Lepidopteron rice pests reducing pesticide use thus preventing pollution through pesticides a major environmental concern in rice cultivation. There has been speculation that transgenic foods may produce unintended outcomes that affect the reproductive functions of human beings or animals (Zhang and Shi 2011). In this study particular emphasis was paid on reproductive markers – serum sex hormones, sperm parameters. Flours of Bt rice, its non transgenic counter part as control and an additional common rice procured from the upper market was selected as an additional negative control. These diets were fed for a period of 90 days after which the rats were killed and analyzed for various parameters.

The rodent feeding studies have been recommended to assess the potential adverse effect of transgenic crops (EFSA, 2008).The results of this study indicated that feeding Bt rice caused no significant differences in body weight gain, food consumption, hematology, serum chemistry (Table 1), serum sex hormone levels, histopathological changes and sperm parameters in rats fed with its parental line and control (rice commonly available in markets).

No group related histopathology changes were observed for tissues of the brain, heart, liver (Fig. 1 A-C) kidneys (Fig. 1 D-F), spleen, thymus, prostrate, seminal vesicle, epididymis and testes (Fig. 1 G-I).

Screening of the newly engineered cultivars for their environmental impact is mandated and therefore carried out extensively before their release commercially. However feeding experiments to evaluate possible adverse impact particularly that of edible types is most crucial. In this connection the Chinese study showcased here on the effect of feeding transgenic rice is path breaking.

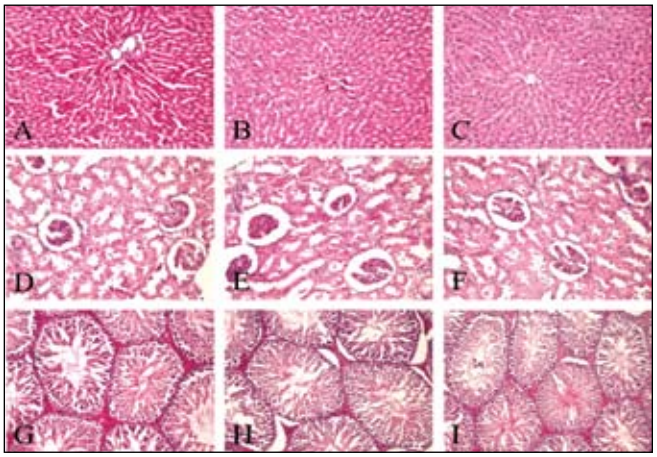

Fig. 1. Photomicrographs of liver (A-C, the control group, the MingHui63 group and the TT51 group), kidney (D-F, the control group, the MingHui63 group and the TT51 group) and testis (G-I, the control group, the MingHui63 group and TT51 group) tissues of rats stained with H&E × 200.

Table 1. Serum chemistry mean values mean

Items	AIN93G	MingHui63	TT51
ALT (U/L)	26.13 ± 3.98	29.63 ± 7.48	31.13 ± 7.57
AST (U/L)	104.50 ± 12.80	119.38 ± 17.61	92.25 ± 14.68
ALP (U/L)	40.50 ± 4.81	41.50 ± 10.76	43.63 ± 6.44
ALB (g/L)	38.46 ± 1.52	38.01 ± 1.81	38.56 ± 1.24
CHOL (mmol/L)	1.97 ± 0.27	2.18 ± 0.14	1.85 ± 0.35
CREA (mmol/L)	71.69 ± 10.38	68.40 ± 4.54	70.85 ± 5.09
GLUC (mmol/L)	5.35 ± 0.65	5.95 ± 0.83	6.62 ± 0.99
BUN (mmol/L)	6.09 ± 0.56	6.54 ± 0.89	5.85 ± 0.86
CA (mmol/L)	2.59 ± 0.08	2.56 ± 0.07	2.56 ± 0.11
PHOS (mmol/L)	2.05 ± 0.15	2.11 ± 0.14	2.23 ± 0.18
TP (g/L)	61.43 ± 1.99	60.80 ± 2.01	61.98 ± 2.38
TRIG (g/L)	1.42 ± 0.71	1.32 ± 0.76	0.81 ± 0.20

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References

Er Hui Wang, Zhou Yu, Jing Hu, Hai Bin Xu (2013). Effect of 90 –day feeding of transgenic Bt rice TT21 on reproductive system in male rats. Food and Chemical Toxicology. 62: 390-396.

European Food Safety Authority (2008). Safety and nutritional assessment of GM plants and derived food and feed: the role of animal feeding trials. Food Chem. Toxicol. 46: 52-70.

Zhang, W, and Shi, F. (2011). Do genetically modified crop effect animal reproduction ? A review of ongoing debate. Animal. 5: 1048-1059.

Fellows' Views

Phosphorus, not nitrogen will dictate India's future food security

Phosphorus is as crucial as water and is second only to nitrogen as the most limiting element for plant growth. Phosphate rock (RP) used in the manufacture of phosphate fertilizers is non-renewable resource that is continuously getting depleted. Further, world's sixty seven percent of the RP is mined in just three countries: USA, China and Morocco. India mainly imports it from a single source – Morocco.

"The peak Phosphorus" a term coined by White and Cordell (2010) refers to the point where demand for P will outpace its supply. At this point in time owing to likely sharp rise in the price of RP the cost of fertilizer input will cause spiralling of food prices. The supply of RP may 'peak' as early as 2033, after which this non-renewable resource will become increasingly scarce and expensive. We are completely unprepared or underprepared to deal with the shortages in phosphorus inputs that will result in an alarming drop in production and the hike in food prices that will follow. Not in the far distant past in 2007-08, when the demand for phosphate fertilizer outstripped RP supply, its price in the international markets skyrocketed by 800%.

No serious thought has been given about what 'peak phosphorus' means for the country's food security. A radical rethink of how adequate phosphorus levels may be maintained for crop production without over reliance on imported mined phosphate is crucial for ensuring our future food supplies. We have to address to future shortages and prevent further environmental damage from phosphate pollution.

What needs to be done is to commercialize the available technologies for utilization of low- grade indigenous rock phosphates as fertilizers in acid soils and beneficiation technologies to upgrade its P_2O_5 content to at least 25-30%. Suitable technologies are to be developed for producing phosphate rich compost using low- grade RP and mine tailings. Another initiative may be used of *Arbuscular mycorrhizae* (AM) in both field and horticultural crops that will increase fertilizer use efficiency of P by increasing its mobility in soil and reducing fixation. Using biotechnological approaches to transfer genes to create plant types that may mobilize more P from acid/alkaline soils could be the other route. Development and implementation of sustainable technologies and strategies for the recovery of P from the organic wastes for reuse in agriculture should be a priority. Effective and inclusive governance and associated institutional arrangements to ensure long-term P security of the country through a combination of regulatory and economic instruments and a mission mode approach is needed to reduce dependence on import of P and making the country resilient against unethical price manipulation by international cartels.

White, Stuart and Cordell, Diana (2008). Peak Phosphorus: the sequel to Peak Oil. Sustainable Phosphorus Future

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Nanoparticle intervention for improving plant P nutrition

Phosphorus is highly immobile nutrient with only 1-3% of the total phosphorus and only 15% of the applied fertiliser P is available to plants. It leads to a continuous build up of P in soil through fertilizers. The problem is further aggravated since the rock phosphate the basic raw material used to manufacture P fertilizers is non renewable and will be exhausted in the near future. During the last two decades a lot of work has been done on phosphate biofertilisers to recycle P fixed into soil. But even with the intervention of the best developed organisms, the amount of available P into the rhizosphere seldom exceeds 6% of the total P that is far below the amount required to eliminate P fertilization.

Therefore, the focus should shift to recycle native fixed P in an efficient manner to avoid/reduce the

application of chemical P fertilizer by increasing P use efficiency. The possible way out is application of nano-P fertilizers on plant leaves which requires as low as 640 mg P ha^{-1} enhancing use efficiency from 15% to 57%. Moreover, there is little scope to fix added P in soil by Fe, Al, Ca, owing to foliar application of nano P fertilizers. The other possibility is enhancing release of phosphatases and phytase enzymes by the plant roots through the application of Mg, Fe and Zn nanoparticles. These enzymes will release additional amounts of plant available P from organic –P sources not acted upon by the conventional P biofertilisers. Attempts are also needed to develop efficient organisms or plant types that can release more organic acids to mobilize unavailable inorganic P fractions in soil.

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Protecting our arable lands: Draw 'red lines' before it is too late

According to Chinese government, China needs a minimum of 120 million hectares of arable land to feed its people (Kong, 2014). That is the 'red line' for food security that officials have pledged to protect. The author has raised concerns about the supply of enough food for the future generations. It is stressed that "China is growing more food on less land, a situation that leaves little scope for expansion". Further, the amount of available land has peaked and as good quality arable land is lost to development and contamination, it is replaced by marginal and lower quality alternatives. The situation is similar in India where prime agricultural land around all cities has been used for housing, urban infrastructure, industries, recreation and other non-agricultural uses. All over India housing colonies and malls are located on what was prime agricultural land only a generation back? The process will continue until the population keeps growing. Urbanization will further enhance the demand.

The Academy organized a brainstorming on carrying capacity of Indian agriculture, mainly from the productivity viewpoint. (Policy Paper No. 51). Proceeding further on the same lines, robust estimates on minimal cropping area required to meet the food needs of a growing population the ' Red line ' agreed by all stakeholders are urgently needed in the country and for each state. Greater awareness of the red line would be necessary at all levels of decision making, for converting agricultural land to non-agricultural uses. Based on the available area, the required productivity levels for different crops can be set as targets for breeders and agronomists.

In this context, it is pertinent to mention that human population is likely to stabilize soon in China, on the contrary the estimates for India indicate that this may be not possible to achieve before 2075. In 2050 the projected population of India will be around 1748 million exceed that of China (1437) and the country will be most populated in the world. The 'red line' will be still blurred.

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Abrol Y.P. (2013) NAAS News 13(4)
Kong, Xiangbin (2014). Nature. 506 : 7

Note: *Fellowship may post comments on views published in this column at editors.naas@gmail.com*

Awards and Honours

Dr. Raj Paroda, Past President, NAAS and Ex-Secretary DARE & DG ICAR has been bestowed with the Silver Jubilee Commemoration Medal of the Indian National Science Academy for his significant contributions in the field of conservation and utilization of India's plant genetic resources for crop improvement.

Dr. Bushan L. Jalali, Formerly Director of Research, Haryana Agricultural University was conferred the Lifetime Achievement Award-2013, by Indian Society of Mycology and Plant Pathology.

Prof. (Dr.) M.P. Yadav has been conferred with the "Excellence in Virology Award" by the Indian Virology Society for his landmark contributions to Veterinary Virology. The award was given on 17th December, 2013 on the occasion of the Asia-Pacific Congress of Virology (VIROCON 2013)

Brainstorming Sessions for 2014

1. Climate Resilient Livestock Production
   (Convener: Dr. Khub Singh)
2. Breaking low-productivity syndrome of soybean in India
   (Convener: Dr. S.M. Virmani)
3. Reservoir Fisheries Development in India: Policy & Management Options
   (Convener: Dr. W.S. Lakra)
4. Practical and affordable approaches in implement precision
   (Convener: Dr. S.R. Verma)
5. Hydroponic Fodder Production in India
   (Convener Dr. H.S. Gupta & Dr. M.P. Yadav)
6. Linking Farmers with Market
   (Convener Dr. Anjani Kumar)
7. Livestock Breeding Policy in India
   (Convener Dr. M.L. Madan and Dr. M.P. Yadav)

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ANNOUNCEMENTS

XII Agricultural Sciences Congress

The XII ASC will be organized from **3-6 February 2015** at the National Dairy Research Institute, Karnal. The theme of the Congress is "Sustainable Livelihood Security of Small Holder Farmers". Various sub-themes under which all scientific programmes will be organized are as follows:

Sub-Themes

1. Livelihood security for small holder farmer
2. Skill and human resource development for diversification of employment and income opportunity
3. Empowerment of women in agriculture
4. Intensification of livestock production for small holder and land less farmers
5. Attracting youth in agriculture
6. Group dynamics of small holder farmers, SHG, Producers Companies, Cooperatives and contract farming
7. Linking small holder farmers with the market and prevention of post-harvest losses
8. Credit flow and insurance support to small holder farmers
9 Mechanization & Post Harvest technologies for small farmers
10. Natural resource management & climate change: International perspective
11. Policy matter issues for the protection of small holder farmers

Dr. A.K. Srivastava, Director, NDRI, Karnal will be the Convener of the Congress (website: http://*agricongress2015.in,* Email : *info@agricongress.in*).

NAAS Silver Jubilee Celebrations

Following Activities/Scientific Programmes will be organized during June 2014 – April 2015 to mark Silver Jubilee of the Academy.

- National Level Silver Jubilee Symposium highlighting 25 Years of Achievements and Way Ahead upto 2030 in the respective areas of the different sections of the disciplines of the Academy will be organized. Names of the prime movers along with the places of the activity are listed below.

Crop Sciences	Dr. Ajay Parida at Chennai
Horticultural Sciences	Dr. H.P. Singh at Bangalore
Animal Sciences	Dr. K.M. Bujarbaruah at Guhawati
Fisheries Sciences	Dr. W.S. Lakra at Mumbai
NRM	Dr. B. Mandal at Kolkata
Plant Protection	Dr. K.R. Kranthi at Nagpur
Agricultural Engineering	Dr. Anwar Alam at Bhopal
Social Sciences	Dr. Mahtab S Bamji at Hyderabad

- Half a day commemorative Seminars highlighting the major establishment in the last 25 years.
- Discipline-wise Panel Discussions for half a day with 20-25 participants will be organized
- Special Lectures to be delivered by Eminent Agricultural Scientists (Half a day programme)
- Inter-Academy Meeting on the theme 'Food and Nutritional Security in India' wherein Presidents of the INSA, NASI, NAVS, NADS and IASc may be invited.
- A day long Youth Convention on the theme 'Youth in Agriculture'
- Debate competition among the students to be organized on one of the following topics:
  (a) Alternate Vocations to Agriculture for Rural Youth
  (b) GM Crops for Long Term Food and Nutritional Security
- NAAS Silver Jubilee Awards are proposed – one each in Eminent Scientists, Industrialists and Farmers category.

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