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From the President's Desk

Monsoon Preparedness 2014

Over fifty percent of the cultivated area in the country is rain-fed and hence, strongly influenced by the south-west monsoon, spread from June to September, that accounts for about 75% of the total annual rainfall. Consequently, any deviation from the normal schedule of the onset, withdrawal, quantum and distribution of rainfall during the monsoon season has visible impact on agricultural production in the country.

India Meteorological Department (IMD) has forecast that rainfall over the country for the 2014 south-west monsoon to be around 93% of the Long Period Average (LPA). On a regional basis, 85% rain is predicted for northwest India, which is a high-output region for agriculture and any major shortfall in crop yields could reflect in food prices of the main crops in *kharif* season, mainly, rice, soybean, maize and cotton.

In a large country like India with highly diverse agro-climatic zones, it is not uncommon to encounter simultaneous droughts and floods in different parts. It is not possible to prevent these events, but their impact, on the community at large and agriculture in particular, can be minimized. The management of severe droughts during 1987, 2002 and 2009 and also during the year 2012 is a testimony to this fact. In India, drought essentially occurs due to the failure of the south-west monsoon (June – September). Technological interventions in the form of improved tillage practices, Resource Conservation Technologies (RCTs), precision farming, that promote soil and water conservation and simultaneously enhance input use efficiency; development and spread of crop varieties/ hybrids that are resistant/tolerant to different forms of abiotic and biotic stresses, have improved the resilience of agriculture towards certain natural calamities. Similarly, improvement of livestock breeds, health care and new feed formulations have resulted in sustaining animal production even during years of sub-normal rainfall. The following table highlights the agricultural production that the country could achieve during the years of drought.

Production of major food items during drought years

Year	Average Rainfall (June-Sept)		Food grains	Milk	Fish
	mm	Departure (%)		million tonnes	
1987-88	709.0	-19.0	140.35 (119.7)*	46.7	2.96
2002-03	737.1	-19.2	174.77 (113.86)	86.2	6.20
2009-10	689.8	-22.7	218.11 (121.33)	116.4	7.99
2012-13	819.5	-7.6	257.13 (120.16)	132.4	9.01

**(area-million hectares)*

An often used proverb – forewarned is forearmed, holds good in the present context as the impending *El Nino* effect has been predicted well in advance. The country needs to brace for a 'sub-normal' monsoon. Hon'ble President of India, Shri Pranab Mukherjee, in his joint address to Parliament in June, 2014, stated: "My government is alert about the possibility of a subnormal monsoon this year and contingency plans are being prepared. Do not need to be alarmist, but we need to prepare for less than normal rain."

In order to ensure food, to meet the needs of welfare schemes and bring in stability in food prices security during the periods when production is short of the normal demand during bad agricultural years, the government has set buffer stock norms. As per the existing buffer stock norms for food grains, we need to have 11.8 and 20.1 million tonnes of rice and wheat, as on 1st July every year, respectively. The month-wise food grain stock figures of the Food Corporation of India, show that as of 1st June, the total food grain stocks stood at 62.2 million tonnes comprising 21.0 million tonnes of rice and 41.5 million tonnes of wheat. However, this comfortable situation should not make us complacent.

The NARES and ICAR, in collaboration with other Ministries and Departments, are continuously monitoring the situation and updating the advisories on its website. Recognising the distinct agro-climatic conditions and their specific needs, more than 500 District Level Contingency Plans covering 23 states are in place, to tackle aberrant monsoon situations adversely affecting crops, livestock and fisheries. All the 500 district plans are placed in the 'farmer portal' of the Ministry of Agriculture, Government of India (http://www.farmer.gov.in) and also in the ICAR/CRIDA website (http://www.crida.in) for operational use.

Considering the importance and gravity of the issue, the National Academy of Agricultural Sciences organized a Brainstorming Session on Monsoon Preparedness on 7th June, 2014 in New Delhi. With inputs from the National Initiative on Climate Resilient Agriculture (NICRA), the brainstorming resulted in following action points that include:

- Ensuring seed availability of short duration varieties and contingent crops, establishment of crop and fodder seed bank, community nurseries and seed villages, and Feed Blocks and Animal Vaccines.
- Revival of water bodies, repair and maintenance of tube wells and pumps, and demonstration of climate resilient agricultural practices such as direct seeding options for short duration varieties in paddy for delayed situations; *in situ* moisture conservation practices and crop residue recycling; zero-tillage, planting of millets, cotton, pulses and oilseed crops in ridge-furrow or raised bed systems to ensure adequate drainage in case of excess rains.
- Strengthening custom-hiring centres for agricultural implements.
- Safety nets enabling composite agricultural insurance.
- Establishment of Regional Hubs, as a single window to agro-advisory services.

At the time of writing this page, monsoon has covered Kerala, Tamil Nadu and parts of coastal Karnataka and Maharashtra. The progress of monsoon is also very encouraging so far. It is hoped that collective action of R&D agencies will help to offset the deficiency in agricultural production caused by the likely occurrence of drought. Whilst the country is moving forward with a vision and mission to enhance agricultural production to achieve food security for the growing human population, concerted efforts of all the government departments are underway to sensitize the citizen farmers of the country with real-time weather data and agro-advisories to achieve climate resilience in monsoon-dependent agriculture in India.

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A Life without Journal Impact Factor

The Journal Impact Factor (JIF) was primarily devised as a tool for ranking scientific journals to help librarians to plan their priorities for budget utilization. But, over the time it has been misused to asses an individual scientist's productivity. Garfield, the originator of the JIF himself states that it is incorrect to judge an article by the IF of the journal where it has been published (Garfield, E., *British Medical J.* 313:411, 1996). This aberration has been overwhelmingly criticized by scientific societies, suggesting remedial action. Unfortunately, scientific academies, juries for awards, promotions and recruitment too have been using JIF as an indicator for judging scientific accomplishments. They are least inclined to read the publications of the candidate, assuming JIF to be a valid criterion. No wonder proforma for application/nomination come with instructions that reprints of publications need not be attached. There is a strong case for eliminating the use of journal-based metrics and the need to assess research on its own merits rather than the journal in which it is published.

The journal IF has been aggressively touted as a promotional tool by an international cartel of commercial science publishers. For those involved in the highly competitive business of publishing scientific journals, the JIF became crucial for their commercial interests. This leads to a scramble for devising mechanisms sometime unethical to improve JIF in order to attract scientists to publish their better quality research in their journals. The national science societies were left behind in this rat race to 'sell science' resulting in their hinterland drying up with fewer and fewer scientists publishing their good quality work in these national journals which were left with a lower JIF.

In an editorial, Bruce Alberts (*Science* 340:787; May 17, 2013) mentions that 'San Francisco Declaration on Research Assessment (DORA) aims to stop the use of the "journal impact factor" in judging an individual scientist's work in order "to correct distortions in the evaluation of scientific research". The DORA (http://am.ascb.org/dora/) is a wake up call to take up arms against the insidious JIF and boycott it: 'Do not use journal-based metrics, such as JIF to assess an individual scientist's contribution, or in hiring, promotion, or funding decisions.' Scholarship and achievement cannot be judged using a metric that was never designed for the purpose. The Declaration also has a message that may well be worth heeding by researchers in India: 'Challenge research assessment practices that rely inappropriately on JIF. In his Science editorial, Alberts is trenchant: The misuse of the journal impact factor is highly destructive, inviting a gaming of the metric that can bias journals against publishing papers in certain fields. (P. Balaram. Current Science. 104:1267, 2013) It's an incomplete journal-focused metric with a built in aberration due to its field specific nature. This is particularly true of agriculture and related disciplines which have low citations as compared to new emerging areas of nanotechnology, biotechnology, bioinformatics etc.

The use of JIF as a tool of research assessment has reached epidemic proportions worldwide. New entrants to ARS working in our best institutions, are constantly worrying, and under a lot of pressure about the JIF. While filing applications for jobs/awards/promotions most applicants segregate their publications into national and international journals with the mindset that papers in international journals with higher JIF are adjudged better in quality than those in Indian journals. By this they help the experts evaluating their work as the JIF provides a very convenient sword in the hands of experts, who are always short of time to actually read and understand an individual's research contributions. Armed with the JIF, the 'experts' rapidly cut out 'good' from 'poor' or 'bad' publications! Consequently, publications in 'national' journals are unceremoniously cut and thrown into the 'poor' or 'bad' basket. This rapid fire disposal, without actually learning anything about what was published, is unfortunate indeed. This discourages everyone from submitting their better manuscripts to the Indian journals.

This unsatisfactory position is in our opinion partly due to the tendency of many scientists to export their most important contributions for publication in foreign journals, with a proportionate impoverishment of Indian journals resulting in their lowest IF vis-a-vis journals from abroad. The scornful attitude of many senior 'experts' and their blind faith in IF have contributed to enrichment of 'international' journals through the 'export' of quality publications, leaving our own journals in a poor health. If the more established scientists take the first step to submit some of their good manuscripts to journals published in India and if the experts in selection committees begin to appreciate the nature of science rather than rely merely on the JIF, the younger and up-coming scientists would indeed begin to follow suit. (S.C. Lakhotia, *Current Science*, 105: 288, 2013).

The publication of a paper in a high impact factor journal indicates its approval by 2/3 persons eminent in the area of research of the paper who refereed that paper, nothing beyond that. On the contrary citations which the paper received is a measure of the attention the paper got from the researchers in that specific area of work. By using the number of times each of his publications has been cited by peers, scientist's productivity and the impact of his research can be quantified. However, it has also some disadvantages as there are papers such as case studies, reviews and papers describing new methodologies and modelling which tends to be over cited getting an inflated citation index not commensurate to their intrinsic value. But this lacuna can be overcome by the introduction of an appropriate correction factor. Professor Jorge Hirsch of UCSD, California quantifies this using what he termed as the H index, which is far superior to JIF, since it focuses on the paper and not the journal. The higher the *h* index the more citations are needed to increase it. *(Hirsch J. Scientometrics 2010. 85: 741)*. The *h* index can be employed to measure the research output of scientific institutions and countries. However there are apprehensions that it can be manipulated easily by unethical in house self-citations. Therefore, Schreiber has rightly suggested to exclude self-citations from its calculations and use "the honest *h* index (*h*h)" *(Schreiber M. Europhysics Letters 2007; 78:30002)*.

Citations are viewed as currency of the modern day science. It is suggested that citations not JIF should be used to assess scientific accomplishments. Sooner the better.

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Phytoremediation: A Newly Emerging Green Cure Technology for Remediating Heavy Metal Contaminated Soils

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The unscientific disposal of untreated or under-treated effluents has resulted in accumulation of heavy metals in land and water bodies. The cultivated areas under peri-urban agriculture in big cities or major industrial hubs of India are worst affected. The remediation of these heavy metal contaminated soils can be attempted through conventional treatments such as land filling and leaching, excavation, burial or soil washing. However, these approaches are cost intensive and thus not economically viable besides being intrusive in nature and deteriorating soil structure. The use of specially selected and engineered metal accumulating plants for environmental cleanup is an emerging frontline technology called, "Phytoremediation"; which describes a system wherein plants in association with soil organisms can remove or transform contaminants into harmless and often valuable forms. Phytoremediation popularly called as "Green cure technology" takes advantage of the inherent ability of plants to take up water and soluble nutrients along with associated co-contaminants through roots, to transpire through the leaves, and to act as a transformation system to metabolize organic compounds (hydrocarbons and pesticides) or to absorb and bio-accumulate toxic trace elements including heavy metals (Purakayastha and Chhonkar 2010). The plants which accumulate toxic heavy metals in their above ground parts are known as "Hyperaccumulator" and the process is known as "Phytoextraction" seems to be more attractive due to its versatility.

The criteria for designating a plant as hyper-accumulator for different metals are as follows:

1. Shoot metal concentration (oven dry weight basis) should be more than 1% for Mn, and Zn; 0.1% for Cu, Ni and Pb; and 0.01% for Cd and As.
2. Should be fast growing with high rate of biomass production.

Based on the ICAR funded Emeritus Scientist project of the first author (PKC)

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3. Should be able to accumulate metals even from low external metal concentration.
4. Should be able to transfer accumulated metals from root to shoot (above ground) quite efficiently.

At the end of the 19th century, *Thlaspi caerulescens* and *Viola calaminaria* were the first plant species used for phytoremediating polluted soils. Initial research in this area focused on *T. caerulescens* which had greater ability to accumulate metals like Zn and Cd in its above ground parts. However, small size and slow growth of this species limits its utility for phytoremediation. Later on Indian mustard (*Brassica juncea*) has been widely reported as a greater accumulator of Pb, Zn, Cr etc. Besides, it is also reported to phytovolatilize Se from Se laden soils. Other *Brassica* species namely *B. napus*, *B. rapa*, *B. carinata*, *B. campestris* have shown a similar tendency to accumulate moderate to high amounts of heavy metals (Chhonkar *et al.*, 2005).

Sewage effluents originating from Keshopur Sewage Treatment Plant has been used for irrigation purposes since 1979 in West Delhi (Fig. 1). Use of sewage effluents brought in economic prosperity and also resulted in an increase in factor productivity in that region. However, the vegetables and field crops grown in such soils exhibited enhanced accumulation of heavy

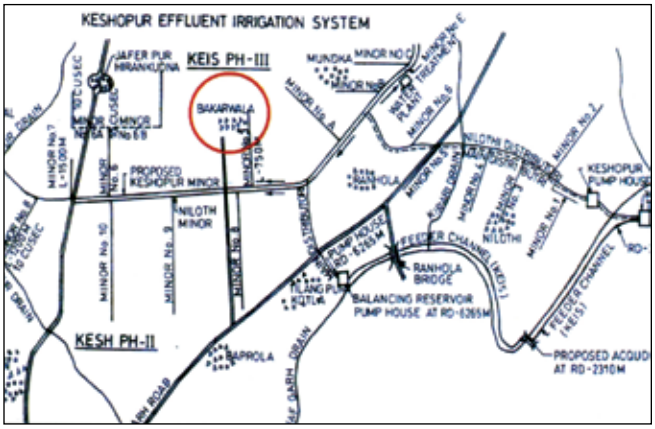


Fig. 1. Site map of the area of collection of experimental soil; the Bakarwala village in the UT of Delhi is a recipient of Keshopur Effluent Irrigation System for more than twenty years (Chhonkar *et al.*, 2005)

metals both in edible and non-edible plant parts which could get into the food chain proving a health hazard. On the basis of heavy metal load in these soils, the soils from Bakarwala village located in the region were chosen as the study material for the investigation.

Five species of *Brassica*, namely *B.* juncea (Indian mustard), Pusa Bold, *B. campestris* (Yellow sarson), Pusa Gold, *B. carinata* (Ethiopian mustard), DLSC 1, *B. napus* (Gobi sarson) var., Early Napus, and *B. nigra* (Banarasi rai) var., IC 247 made available by Directorate of Rapeseed – Mustard Research (ICAR), Bharatpur were tested under greenhouse conditions for their ability to hyper accumulate metals from heavy metal contaminated soils of Bakarawala in West Delhi which have been irrigated with sewage water for the past over two decades. *B. carinata* showed the highest uptake of zinc, nickel and lead at maturity. Though Zn content in the stalks of *B. carinata* was not the highest, yet it showed the highest uptake of zinc primarily because of enhanced stalk biomass production at maturity. Among the five species of *Brassica*, *B. carinata* cultivar, DLSC 1 emerged as the most promising hyper-accumulator of zinc, nickel and lead, while, *B. juncea* cultivar, Pusa Bold was the most efficient for copper. The above species could reduce the metal load by 15% of Zn, 12% of Pb and 11% of Ni from a naturally contaminated soil, while *B. juncea* cv. Pusa Bold emerged promising which reduced soil Cu content by 21% in a single cropping (Purakayastha *et al.*, 2008).

Apart from heavy metal contamination of soils occurring through heavy metal containing irrigation water, pollution could also be due to geogenic reasons as observed with Arsenic and Selenium. Arsenic (As) contamination in terrestrial and aquatic ecosystems is a very sensitive environmental issue due to its adverse impact on human health. It enters into the terrestrial and aquatic ecosystems through a combination of natural processes such as weathering, biological activity, and volcanic emissions, as well as due to anthropogenic activities. The problem of As contamination in groundwater of West Bengal (India) and Bangladesh has attracted attention.. Out of 20 countries in different parts of the world where groundwater arsenic contamination is known to occur, the magnitude is considered to be the highest in Bangladesh, followed by West Bengal, India. Therefore, there is a potential risk of As contamination in rice crop leading to its entry into the food chain. With the progressive use of groundwater for irrigation in the arsenic belt of West Bengal, the arsenic levels in irrigated soils have also increased.

The Chinese brake fern (*Pteris vittata*) is widely reported as hyper-accumulator of Arsenic. The major limitation for phytoextraction is phytoavailability of arsenic in soil. Therefore, development of appropriate soil and nutrient management strategies are essential for successful phytoextraction of Arsenic. Phosphate application and repeated harvests are considered as the most promising strategies for successful phytoextraction of arsenic from contaminated soils. The *P. vittata* completes its life cycle in sporophytic and gametophytic stages. The *P. vittata* was grown in arsenic contaminated soils from West Bengal. The effectiveness of phytoextraction was evaluated by monitoring arsenic concentration in rhizosphere soil

at the end of cropping and calculating the net out go of As from the contaminated soil. The application of diammonium phospate (DAP) showed maximum reduction of total soil arsenic followed by single super phosphate (SSP). As compared to the initial level of arsenic, its content in soil decreased significantly after 1st growth cycle of *P. vittata* which further decreased after 2nd growth cycle. The reduction of total arsenic content was 9.97, 15.81% to 20.05% in control, SSP and DAP treated soils, respectively after 1st growing cycle. The values after two successive growing cycles of *P. vittata* were 18.19%, 28.4%, and 34.6% in the above order. When rice was grown on phytoextracted soils, a mean reduction of 52% in arsenic content in rice grain after two growing cycles of *P. vittata* and 29% after the one growing cycle (Mandal *et al.*, 2012) was observed. The phytoextraction of arsenic contaminated soil by *P. vittata* was beneficial for growing rice as it resulted in decreased arsenic content in rice grain (<1 ppm). There was 14% improvement in rice grain yield after two growing cycles and 8% after the one growing cycle of brake fern. Two successive harvests with DAP as the phosphatic fertilizer emerged as the most promising management strategy for amelioration of arsenic contaminated soil of West Bengal for growing rice.

However, before the popularization of the above technology among those farming in metal contaminated areas of India it should be tested in the field level for further confirmation. It is also essential to evolve environment friendly, economically viable and socially acceptable methodology for successful disposal of metal contaminated fronds of *P. vittata*.

References

1. Chhonkar, P.K., Bhadraray, S. and Purakayastha, T.J. (2005). Phytoremediation of Heavy Metal Contaminated Soils, Monograph, Indian Agricultural Research Institute, New Delhi, 56 p.
2. Mandal, Asit, Purakayastha T.J., Patra A.K. and Sanyal S.K. (2012) Phytoremediation of arsenic contaminated soils by *Pterisvittata* L. I. Effect on arsenic uptake and rice yield. *International Journal of Phytoremediation* **14**: 621-628.
3. Purakayastha T.J., Viswanath Thulasi, Bhadraray S., Chhonkar P.K., Adhikari P.P. and Suribabu K. (2008). Phytoextraction of zinc, copper, nickel and lead from a contaminated soil by different species of *Brassica*. *International Journal of Phytoremediation* **10**: 63-74.
4. Purakayastha, T.J. and Chhonkar, P.K. (2010) Phytoremediation of heavy metal contaminated soils *in* Soil Heavy Metals. *Soil Biology Series* **19**: 389-429. **Springer Verlag, Berlin/Heidelberg, Germany**.

Programmes Held

NAAS Foundation Day Function and Annual General Body Meeting, 4-5 June, 2014

Scientific Presentations by the Newly Elected Fellows

Scientific Sessions chaired by Dr. P.L. Gautam, Vice-President of the Academy were held on 4th June 2014. Following newly elected Fellows made brief presentations on the following topics:

Crop Sciences

Prof. (Ms.) Paramjit Khurana

Genes and Genomics for Crop Improvement

Dr. A.N. Lahiri Majumder

Antiquity and Functional Diversity of L-*myo*-inositol 1-phosphate Synthatase (MIPS)

Dr. J.C. Rana

Management and Utilization of Plant Genetic Resources in the North-Western Himalayan Region of India

Dr. P.M. Salimath

Use of Conventional but Innovative Approaches for Genetic Improvement of Legumes

Dr. P.C. Sharma

Development and Use of Microsatellite Markers for Crop Improvement

Horticulture Sciences

Dr. Pritam Kalia

Breeding for Quality and Disease Resistance in Vegetable Crops

Animal Sciences

Dr. C.S. Prasad

Micronutrients in Livestock Production and Reproduction

Dr. Kusumakar Sharma

Closing the Efficiency Gap in Resource Use for Responsive Animal Nutrition

Fisheries Sciences

Prof. I.S. Bright Singh

Preventive Health Care in Aquaculture

Natural Resources Management

Dr. U.K. Behera

Integrated Farming Systems for Livelihood Security of Small and Marginal Farmers: Addressing the Knowledge Gap

Dr. Ranjan Bhattacharyya

Carbon Sequestration and Soil Conservation in Arable Highlands

Dr. B. Gangwar

Farming System Management for Improving Livelihood of Small Farm Holders

Dr. K. Sammi Reddy

Efficient Techniques for Improving Nutrient Use Efficiency in Different Crops and Cropping Systems

Plant Protection

Dr. Kaushik Banerjee

Some Novel Visions and Resolutions in Adopting Frontier Analytical Tools and Developing Methodologies: A Saga of Building A Community-Friendly Food Safety System

Dr. R.C. Kuhad

Microbial Bioconversion of Plant Material to Value Added Products

Dr. P.K. Mukherjee

***Trichoderma virens*: Genetics and genomics**

Agricultural Engineering and Technology

Prof. S.N. Panda

Rainwater Conservation and Reuse Structure for Climate Resilient Rainfed Agriculture in Eastern India

Dr. K.S.M.S. Raghavarao

Food Process Engineering - Research Contributions

Social Sciences

Dr. (Ms.) Shylaja M. Dharmesh

Nutraceuticals against Chronic Disorders; Molecular Interplay during Physiological Regulation/Pathogenicity

Brief Report on AGM

The 21st AGM was convened under the chairmanship of the President of the Academy on 5th June 2014 in New Delhi, which was attended by 219 Fellows.

The proceedings started with observing two minutes silence as a mark of respect to the departed souls of Drs. P.K. Mohanty, A. Appa Rao and B.P.N. Singh, the distinguished Fellows of the Academy.

The recommendations of the EC for enhancing the number of Fellowships in different disciplines were deliberated in detail. The AGM unanimously approved enhancing the maximum upper limit of the number of Fellowships in different disciplines as given below subject to attaining minimum qualifying standards and competence of nominees. The new areas included in various sections are given in parentheses.

Sections (additional subdisciplines included are indicated in parentheses).	No. of Fellowship	
	Existing	Revised
Crop Sciences	5	6
Horticulture Sciences	1	3
Animal Sciences (Dairy Science, Poultry Science)	2	4
Fisheries Sciences (Aquaculture, Fisheries Resource Management)	1	2
Natural Resource Management (Agricultural Physics)	5	5
Plant Protection Sciences (Organic Chemistry)	3	4
Agricultural Engineering and Technology	1/2	2
Social Sciences (Bioinformatics)	1/2	2
Total	**20**	**28**
Foreign Fellows	2	2

The AGM also decided to further analyse the matter for convergence of areas and shifting of areas/disciplines to different sections.

General Discussions

Dr. K.L. Chadha, Dr. M.L. Madan, Dr. A.N. Mukhopadhyay and Dr. Gopakumar congratulated EC for rationalization and enhancement of a number of fellowships in different sections. Dr. D.P. Ray suggested inclusion of Post-Harvest Management in Horticulture section. Dr. J.C. Katyal suggested that in the disciplines where the number of nominees is not adequate, the Nomination may be considered in other sections. Dr. S.R. Singh and Dr. Gajendra Singh suggested for further enhancement of Fellowships in the Agricultural Engineering and Technology Section. Dr. Gajendra Singh also suggested changing Textile Chemistry to Textile Technology. Dr. C.D. Mayee suggested that Bioinformatics may be transferred to other sections like Crop Sciences or Horticulture Sciences or Animal Sciences as it has no relevance in Social Sciences. He also suggested that instead of enhancing the Fellowships of different sections, we should think of converging different disciplines and elect the Fellows from the competent pool of nominees. Dr. R.P. Singh advocated for increasing the Fellowship in Social Sciences. Dr. D.L.N. Rao suggested creating a separate section for new sciences such as biotechnology, bioinformatics, nanotechnology. Dr. Anupam Varma, Chairman of the Fellowship Committee, clarified the issues raised by the Fellowship. The Fellowship also appreciated the work done by Dr. Anupam Varma Committee and endorsed the decision of the EC.

Dr. Balram Sharma, Dr. Sushil Kumar and Dr. U.P. Singh presented their views on the use of GM technology and suggested for a Symposium on GM technology including biosafety and regulatory issues. Dr. R.K. Pathak proposed a Brainstorming session on Organic Farming. Dr. C.L. Acharya expressed concern on dismal state of agricultural education in the country and desired a discussion in this regard. The President informed that XI ASC has been organized on the theme "Transforming Agricultural Education for Reshaping India's Future", the proceedings of which are being released. Besides, The Road Map has already been published by the Academy and circulated to all concerned.

Presidential Address

Dr S. Ayyappan, delivered the Presidential Address on the theme "Family Farms: Farm, Feed & Flourish" and dwelt on a range of issues and challenges constraining the family farming and possible steps for making family farms sustainable. There are over 400 million family farms, mostly small-scale farms, cultivating less than 2 hectares of land producing nearly 70% of the world's food. Realizing its importance, the year 2014 has been declared as the 'International Year of Family Farming'

(IYFF) by the United Nations General Assembly. The diverse agricultural activities of family farms promote environmental sustainability, conserve biodiversity and contribute to healthier and balanced diets. For generations, family farmers have transmitted knowledge and skills, preserving and improving practices and technologies. The family farmers, besides enriching agro-biodiversity, are also custodians of rich genetic resources, and thus help in conservation efforts. Family farming is experiencing several challenges on account of natural resource degradation, climate change, biotic and abiotic stresses, weak market links, lack of credit facilities besides, globalization and trade liberalization.

In India, small and marginal holdings (below 2.0 ha) constitute 84.97% of the total holdings and 44.31% of the area. Continuously declining farm size gives rise to concerns for the sustainability of the small farms. To ensure livelihood security of the marginal and small farmers, it is necessary to focus on their technology needs and infrastructure, including diversifying avenues

for gainful employment in the non-farm sector. The estimates indicate that small and marginal farmers may account for more than 91% of farm holdings by 2030.

The family farming households require timely advice based on meteorological, marketing and management information for land-use decisions and investments to improve resource use efficiency. Timely availability of quality inputs, particularly the seed and planting material, fertilisers, or the feed and fodder in case of livestock, has to be ensured. Similarly, for such farmers, low-cost, light-weight, multi-purpose farm equipments are needed. The family farmers can be trained to undertake post-harvest processing and packaging of farm produce, preferably on a farm or near to the production site to promote a entrepreneurship and enhance employment opportunities in rural areas. Moving from subsistence to more commercially oriented activities require increased capital and investment flow, which would focus on smallholder farmers.

Family farming, therefore, needs to be made more attractive, exciting and rewarding so that self-employed workers in agriculture do not move out to non-agriculture vocation under distress. The approach, hence for Family Farms are 'Farm, Feed & Flourish'.

Foundation Day Lecture

Bharat Ratna Prof. C.N.R. Rao, National Research Professor, Linus Pauling Research Professor and Honorary President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bengaluru, delivered the foundation day lecture entitled "**Doing Science in India**". He began with the mention of the state of Indian science in 1947 when the country became free. India was a poor country, then faced with food crises. At that time the Indian Institute of Science, Bengaluru did not have even the basic facilities for research. Today we have all the facilities available at Indian Institute of

Science, Bengaluru, comparable to any US laboratory. Dr. Rao mentioned that he started his career working on solid material chemistry. He recalled Robert Frost's poem stating that I stood lonely in the woods and saw the roads split into two - one road that was highly crowded everybody went by that, other was a lonely road which I took. It helped me a lot. I belong to a field of research where you create your own direction.

He posed the question to the audience where does India stand on science today? India contributes only 2.5% to worlds research which is stagnant. China on the other hand was also contributing only 2.5% about 10-15 years back but now its share is 14-15% and it is going to overtake the United States within a few years. Quality of science is the however, evolutionary. He narrated the story of Srinivasa Ramanujan, who with almost no formal training in pure mathematics, made extraordinary contributions to mathematical analysis, number theory, infinite series, and continued fractions. Michael Faraday who did not go to any University could carry out front line research and made astonishing discoveries. He could achieve this due to his great love and interest in science. He was hopeful that India will be contributing 10% in world's science within next ten years.

Salient Decisions of the 88th Meeting of Executive Council

- International Year of Family Farming (2014), International Year of Soil (2015), Indian Decade of Innovations and International Decade of Biodiversity to be highlighted in the XII ASC.
- Apart from ICAR and ASRB, other organizations like UPSC, AIAU, AIU, SAUs, and DRDO etc. may be contacted for giving weightage to NAAS Fellowship in their selection process.
- The Executive Council approved the inclusion of one additional member in each Sectional Committee in order to facilitate 1/3rd retirement of Committee members each year. Sectional Committees for the year 2014 comprising 6 members in each section have been approved. The EC suggested that as far as possible young scientists to be recommended for election to the Fellowship.
- EC approved organization of Brainstorming Sessions on "Preparedness for Monsoon 2014" on June 7, 2014 under the Convenership of Dr. A.K. Sikka, DDG (NRM), ICAR and launching of a mentoring scheme under the convenership of Dr H.S. Gupta, Director, IARI and Dr. C. Devakumar.
- It was further decided that the status of programmes and follow-up action thereon may be first discussed in the Programme Committee meetings.

Brainstorming Session on Choosing Leaders in Agri. Research, Methods of Scientists Recruitment and Talent Search in Agri-Teaching, Research and Extension (Convener : Dr. C.D. Mayee)

The scientific manpower induction has been experiencing an upsurge in research activities and it is critical to evolve innovative recruitment and assessment methodologies endowed with objectivity, transparency and fairness. Realizing the importance of agriculture in Indian economy, Govt. of India initiated a series of reforms immediately after independence. As a result of these initiatives, a series of institutions of

higher agri-education and research were established post-independence to develop skilled human resources in this sector. The responsibility of recruiting, human resource to the National Agricultural Research Systems (NARS) is with Agricultural Scientists Recruitment Board (ASRB). Each of the SAUs has its recruitment and assessment systems which are independent of ASRB. Selection of human resource is an all important activity which has a direct impact on the performance of NARS. The system is known to spend a great deal of energy in selection of scientists. However, when it comes to lead the organization, several leadership skills and attitudes are required in the candidates. Selecting the right quality of manpower in agriculture is, therefore, one of the most challenging tasks for management of modern agricultural Teaching, research and extension (TRE).

A Brainstorming Session (BSS) on choosing leaders in Agri. Research, Methods of recruitment of Scientists and talent search in Agri. Teaching, Research and Extension was organized on Nov.11, 2013 at the National Academy of Agricultural Sciences, New Delhi. The BSS was chaired by Dr. Gurbachan Singh, Chairman, Agricultural Scientists Recruitment Board (ASRB). Dr. C.D. Mayee former Chairman, ASRB welcomed the participants specially the Chairman & Members of ASRB and Dr. R.B. Singh, The then President, NAAS. He apprised the present system followed for selecting scientists at ICAR and SAUs. It was suggested that 'Paroda Committee' recommendations should be adopted by NARS for selecting science leaders. He further pointed out that ASRB has already done a critical analysis of the system of soliciting scientists. The major concern of new recruitment has been the decline in ratio of eligible candidates, high degree of variation in SAU performance resulting in a skewed representation in ICAR and decline in movement of scientists across Institutions within and outside ICAR.

Dr. Gurbachan Singh reiterated the skewness in ARS selections. He showed great concern in declining NET clearance and large number of positions continued to remain vacant. He suggested that there is an urgent need to strengthen basic science subjects. He emphasized to expose the candidates to the new system of online examination. A mechanism need to be evolved to see that candidates should be able to apply across disciplines in basic sciences.

Dr. R.B. Singh suggested the system of 'Tap Them Young' put to practical use to attract talent in agriculture. He drew attention of all to the proceedings of 'Bhubaneshwar Conference' organized by NAAS on the subject of education and suggested that the policy paper on the topic on agri education should emphasize the role of proper recruitment. Dr. K.C. Bansal, Director, NBPGR pointed out the major gap in working conditions to retain talents. Dr. N.K. Tyagi, former member, ASRB suggested that there are no parameter to evaluate Emotional Quotient of the candidates. Experts are happy to conduct oral interviews, but the TRP is very low for paper setting, question bank and paper evaluation.

Dr. J.C. Katyal, former DDG (Edu) and Vice Chancellor, HAU Hissar, emphasized that the major focus of selection has to be on academic and scholastic achievements. Qualities like, innovation, teamwork or networking and learning ability are often neglected. He recommended investment in human capital than on instruments. Dr. H.S. Gupta, Director, IARI, New Delhi opined that the earlier system of ARS examination where English and GK were compulsory need to be brought back. The new recruits lack comprehension and knowledge beyond his or her specialization. He further pointed out that the Carrier Advancement Scheme (CAS) has done more damage than good as no distinction is being made between a good and bad worker, dampening enthusiasm of excellent researchers. At the top level, he suggested to have

uniformity in the selection process of SAU and ICAR selections of Deans and Directors of Research or even of Directors of Extension through the ASRB system on the pattern of ICAR. This will entail a certain uniformity in the SAUs. Dr. Gupta was very critical of NAARM attempting to get the status of an University but should remain a training institute for post recruitment scientists as was its original mandate. Dr. B.L Jalali former Director of Research of HAU found the gap in UG level teaching where courses on research ethics, IPR, History of Agriculture etc.; need to be added. Dr. R. Ramani, Director, Indian Institute of Natural Resins and Gums, Ranchi, advised to curtail the period between advertisement to entry for joining ASRB/ICAR. An alternative method other than the routine ARS examination should be explored either by way of campus interviews or identifying the potential researchers from the graduate students. The present system is too rigid to bring in exceptional talents into our research system. At middle level lot of distress recruitment has occurred just to fill the vacancies. This must be avoided. He further pointed out that the UGC package adoption has done more harm than benefit to promote talent. No other scientific organizations in the country have adopted the model Dr. R.K. Mittal, VC, RAU, PUSA suggested that it is time to critically review the three job requirements Teaching, Research and Extension for a teacher in the SAU. Dr. Gajendra Singh, Ex.DDG (Eng) suggested to have statutory powers like UGC in all matters of dealing in Agri-education. Even the selections of VC's in the SAU have to improve. Dr. Dhaliwal, Dean PAU, Ludhiana was critical of mushrooming of private colleges in agriculture and allied sciences which is hampering the quality education. He suggested to increase the positions of Adjunct professors in SAU's. Dr. P.K. Chhonkar, an Adjunct faculty of IARI suggested that the system of examination need innovation as simply memorizing the subject matter a month preparation prior to ARS examination should not get one through. Dr. R.P. Singh, Executive Secretary, IAUA suggested two areas of concern; roster of retired persons for guidance and increased funding in HRD. Dr. S.A.H. Abidi former member ASRB suggested that like CSIR and DST, ICAR should invite the students at 10+2 to give talks and presentation so that they can be attracted towards agricultural sciences.

Dr. M. Mahadevappa, Former chairman ASRB emphasized the need to have separate mechanism for selection of leaders. He also suggested opening of exclusive P.G. specialized Universities. Dr. S.K Bandopadhayay, member ASRB, suggested to make the disciplines more broad based. He also touched upon the issue of question bank and quality of experts and NAAS rating of journals. Dr. Anwar Alam, Ex. VC, SKAUST emphasized to strengthen the system of evaluation of teachers, researchers and extension workers.

During the BSS, new ideas were offered by the participants to improve the recruitment processes and several good and practical suggestions have emerged. The chairman in his concluding remarks requested NAAS to come out strongly with a policy paper on the subject Dr. R.B. Singh, President, NAAS, reemphasized the need for the responsibilities of the national AREE4D systems to meet the challenges and capture the opportunities and has asked the convener to compile all the suggestions and prepare road map for future recruitment processes are an integral part of our AREE4D.

Brainstorming Session on Massive Open Online Courses (Convener : Dr. C Devakumar)

Online learning is a practice of linking learners, learning materials and mentors/teachers using technology mediation (especially, the Web and social networking). MOOC enable a small group of teachers/mentors to offer learning services to a very large audience.

In his opening remarks, the President of NAAS emphasized the importance of pursuing innovations in large scale capacity building in Indian agriculture. The quantitative dimensions were extraordinary and the need was pressing. While initiatives were under way, the President was of the view that breakthrough innovations would be necessary and resources could be committed. Dr. V. Balaji (COL) and Dr. Balwinder Sodhi (IIT-Ropar) gave a comprehensive overview of MOOC developments while stressing the potential of India to be a global leader in MOOC-for-Development with focus on agriculture. Professor Ram Takwale, an eminent educational administrator pointed out that the need to link education process with development objectives and outcome was never more important. New developments such as MOOC provide important opportunities to form such linkages. Dr. Devakumar described the need for skills development in the rural

areas. The need for rapid capacity building on a very large scale, involving multiple stakeholders emerged clearly from his analysis. The significant achievement of e-courses (425 UG courses presented as 15000 lessons) was highlighted by Dr. P.S. Pandey. Providing a bridging analysis, Dr. N.T. Yaduraju outlined the way MOOC can help convert the available digital information into courses that can lead to profitable skills. Dr. Mahesh Uppal gave an analysis of how content and learning services can take advantage of existing telecom policies. Dr. N.V. Sathyanarayana gave examples to underline the importance of promoting viable business models of online learning on very large scale. There was a lively discussion where Dr. M.L. Madan, Dr. V.P. Sharma, Dr. Thirunavukkarasu and Dr. R.K. Jain, Dr. A.K. Jain and Dr. G.R.K. Murthy spoke about their experiences and suggested the unique opportunity provided by MOOC should be harnessed. There were four parallel discussion groups covering opportunities for each sector (farmers, livestock and fisheries sector, skills development for youth and women and in education and training). In the concluding session, Dr. R.B. Singh summarized a wide range of facts and highlighted the emerging view that there should indeed be a MOOC-for-Development movement that the agricultural sector could facilitate as well as lead. This would result in rich and meaningful opportunities for researchers, teaching faculty and students, extension personnel and lead farmers in every sector of agriculture to access learning services on demand. The group considered the scalability of MOOC, its flexibility (with regard to access devices and content availability) and inbuilt socialization of learning as highly desirable and critical aspects in meaningful and effective building of human capacities. Although not clear at this stage, the expectation is that MOOC4D would also contribute to the massive skills development in the farm and off-farm sector for rural India.

Brainstorming Session on 'Preparedness for Monsoon 2014' (Convener : Dr. A.K. Sikka)

A Brainstorming Session on preparedness in the wake of possible rainfall deficits during the ensuing SW Monsoon was organized by the National Academy of Agricultural Sciences (NAAS) at NASC, New Delhi on 06-6-2014. The session was chaired by Dr. S. Ayyappan, President NAAS. He explained the purpose of the meeting and urged all stakeholders to take prompt and proactive actions for the preparedness of Monsoon 2014. Dr. A.K. Sikka, DDG (NRM) outlined the objectives and expected outcomes of the brainstorming session. He informed the house about the possible scenarios that may include delayed onset, prolonged

dry spells – early withdrawal, less rainfall and excessive rainfall and other extreme weather events. Fallout of significant negative rainfall departures due to delayed onset of monsoon and/or breaks in its progress may result in the occurrence of droughts and drought-like situations whereas excessive rainfall may create flood-like situations. He further mentioned that contingency planning in agriculture is one of the major strategies for preparedness for the aberrant weather that could not be prevented. He informed that ICAR in collaboration with state agricultural universities through CRIDA has prepared more than 500 District Level Contingency Plans covering 23 states to tackle aberrant monsoon situations leading to drought and floods adversely affecting crops, livestock and fisheries. All the 500 district plans are placed in the 'farmer portal' of the Ministry of Agriculture, Government of India (http://www.farmer.gov.in) and also in the ICAR/CRIDA website (http://www.crida.in) for downloading the full plan by stakeholders for operational use.

The following recommendations and action points emanated from the discussion:

Short and medium term measures:

- In view of the forecast of a normal to below normal monsoon in *kharif* 2014, implementation of contingency plans should receive utmost priority in the vulnerable agro-ecological zones. Likewise cascading effect of deficit rainfall on ensuing *rabi* crops may be ascertained.
- State-level consultation meetings should be held before the end of June to sensitize the implementation of contingency measures advocated in the district plans.
- Project Directors of Zonal Project Directorates (ZPDs) will prepare and submit KVK-wise seed availability of short duration crop varieties suitable for delayed planting.
- Availability of quality seeds to be ensured and the source (KVK, SAU, Govt. etc.) of such seeds to be ascertained.

- Water lifting devices need to be included in the subsidy list so as to use the harvested water for providing life saving irrigation to crops during prolonged dry spells. Funds available under ongoing government Schemes like RKVY need to be leveraged for taking up drought management interventions.
- Availability of bio-regulators such as potassium nitrate (KNO_3) and thiourea to reduce stress during mid-season droughts need to be ensured.
- Practices for reducing evaporation from farm ponds as well as stored soil profile moisture need to be implemented during drought.
- Contingency plans may be updated periodically with regularity to cover more specific interventions to be implemented at the ground level.
- Encourage raising staggered community nurseries for facilitation of delayed sowing.
- Restoration and renovation of drains in flood-prone delta areas and cyclone affected regions.
- Desilting of water bodies should be done before the onset of monsoon with community participation which will facilitate supplementation of the groundwater use and promotion of conjunctive use of surface and groundwater.
- Promotion of agroforestry systems for resilience in chronically drought prone areas as they improve soil fertility and also provide fodder for the livestock.

Livestock/fisheries/poultry

- Nutritive fodder blocks from locally available feed ingredients and crop residues may be prepared and kept ready for use during such situation.
- In case of drought, feed and fodder may be shifted from surplus states to deficient states to meet the requirement of animals during scarcity. Further, urea molasses blocks stocks (UMBS) should be made available in the rain-deficient areas.
- In the wetlands which are connected to the river through channels, the water of the wetland needs to be prevented from flowing back to the river by suitable barricades.
- Aquaculture and water management in fish ponds are essential during drought period. Replenishment of pond water and provision of extra aeration need to be taken up to maintain water quality and reduce fish mortality during drought.

Long term strategies

- Establishment of crop and fodder seed bank: With nodal officer identified at the SAU level.
- Ensuring seed availability of short duration varieties.
- Establishment of Custom Hiring Centres: For Promotion of farm implements on custom hiring basis or purchase by farmers.
- Demonstration of climate resilient agricultural practices.
- A policy framework to cover the risk of crop failure through appropriate insurance coverage and provision of credit.

NAAS Chapter Meetings

Meet on IPR in Agriculture by Eastern Region Chapter (Convener : Dr. B.P. Bhatt)

National Academy of Agricultural Sciences and ICAR Research Complex for Eastern Region jointly organized the Eastern Regional Chapter Meet on IPR in Agriculture during 27-28 February, 2014 at ICAR Research Complex for Eastern Region, Regional Research Centre, Ranchi. About 40 participants from different eastern states participated in the Regional Chapter Meet with Dr. R. Ramani, Director, IINRG, Ranchi as the Chief Guest and Dr. R.P. Singh Ratan, Director (Extension Education), BAU, Ranchi as Guest of Honour. Technical sessions were chaired by Dr. B.P. Bhatt, Director, ICAR-RCER, Patna & Convener of the programme, Prof. M.P. Pandey, Vice-Chancellor, BAU, Ranchi and Dr. R.P. Singh Ratan, Director (Extension Education), BAU, Ranchi. The salient points are given below:

- Strong linkages are required to address the IPR issues between ICAR institutes, including Bureau, SAUs, and other partners including PPV&FRA.
- Much needed awareness to be created for registration of farmers' varieties.

- The ITKs documented for the region need to be validated and refined in order to increase the agricultural productivity for the benefit of the stakeholders.
- The capacity of the Bureau (NBPGR) and Authority (PPV&FRA) in the country's eastern region is inadequate to deal with the statutory registration needs. A network of institutions in the area is needed to deal with large biodiversity of cultivated plants.
- Efforts be made to obtain GI for Muzaffarpur litchi and Mithila Makhana.
- Proper evaluation, conservation and documentation of indigenous animal germplasm to be undertaken.
- Feather back fish, Labeo species, pabda, pavo need to be conserved for better economic returns.

NAAS-Hyderabad Chapter Organized Brainstorming Session on "Agenda for Rainfed Agricultural Research and Drought Preparedness" (Convenor : Dr. Ch. Srinivasa Rao)

A two days Brainstorming session on "Agenda for Rainfed Agriculture Research and Drought Preparedness" was organized by NAAS, Hyderabad Chapter and AICRPDA-CRIDA during 9-10th May, 2014 at NAAS, NASC, New Delhi. Dr. S.M. Virmani, Former Programme Leader, ICRISAT, Dr. A.K. Sikka, DDG (NRM & Extension), Dr. Meenakumari, DDG (Fisheries), Dr. B. Venkateswarlu, VC, VNMKV, Parbhani, Dr. D. Rama Rao, National Director, NAIP, ADGs and Directors of ICAR Institutes of NRM Division, ZPDs, Project Coordinators, AICRPDA and AICRPAM, Chief Scientists of AICRPDA centres, and scientists from CRIDA, NRM Division of ICAR, and other Institutes participated in the deliberations. Dr. Ch Srinivasa Rao, PC (AICRPDA) and Convener, Hyderabad Chapter, NAAS, welcomed the gathering and presented the objectives of the brainstorming session and expected outcome.

Dr. S.M. Virmani, gave an overview of history of dryland agriculture in India. Dr. A.K. Sikka, DDG (NRM), ICAR, informed that the AICRPDA research programme should be in a new paradigm, to address the new emerging issues and emphasized focused action plan. AICRPDA should take a specialized research programmes to address extreme events, more focus on ideology and design of the farm pond system, deficit water management in order to develop biophysical and ecological resilience. Dr. B. Venkateswarlu suggested that the doable technologies should be converged with the government schemes and programmes like dryland farming mission of Maharashtra. Dr. Anwar Alam, Former DDG (Agricultural Engineering), ICAR suggested needbased and location-specific mechanization for dryland farming. Dr Ch. Srinivasa Rao gave an overview of rainfed agriculture and perspectives for the past 40 years across the AICRPDA network with details on the research trends, development of doable technologies, collaborative research programmes, technology up-scaling in convergence with national/ state level schemes/programmes.

Global Science and Technology News

India- Born Plant Scientist Awarded the 2014 World Food Prize

Padma Shree
Dr Sanjaya Rajaram

Renowned plant scientist, Dr. Sanjaya Rajaram, – an IARI alumnus and a citizen of Mexico has won the 2014 World Food Prize for his work in improving wheat crop and having far reaching effects on alleviating world hunger. At an event organized on June 18, 2014 in the State Department, Secretary of State John Kerry lauded Rajaram's efforts in helping 'feed millions across the world'.

The 2014 World Food Prize Laureate is an individual from India who worked closely with Dr. Borlaug in Mexico and who then carried forward and extended his work, breaking new ground with his own achievements. As the head of CIMMYT's wheat-breeding program for several decades, he developed 480 high-yielding disease- and stress-resistant wheat varieties that have been grown on 58 million hectares in 51 countries, thus increasing the world wheat production by more than 200 million tons. Norman Borlaug himself described him as "a scientist of great vision who has made a significant contribution to the improvement of world wheat production, working for the benefit of hundreds of thousands of farmers in countries across the globe"

mentioned Kenneth Quinn at The World Food Prize 2014 Laureate Announcement Ceremony. Further, he adds, "As we celebrate the United Nations Food and Agriculture Organization's International Year of Family Farming, it is most fitting that the 2014 World Food Prize Laureate is an individual who has truly fulfilled Dr. Borlaug's last words – "Take it to the farmer".

New evidence shows weakening of Monsoon caused Indus Valley civilization collapse

A new Indo-UK collaborative research by the University of Cambridge and Banaras Hindu University to investigate the archaeology, river systems and climate of north-west India using a combination of archaeology and geo-science has confirmed that the Bronze Age Indus Valley Civilization declined due to an abrupt weakening of the summer monsoon that affected northwest India 4,100 years ago. The resulting drought coincided with the beginning of the decline of the metropolis-building Indus Civilization suggesting that climate change could be the reason why many of its major cities were abandoned. Researchers say that the latest finding now links the decline of the Indus cities to a documented global scale climate event and its impact on the old Kingdom in Egypt, the Early Bronze Age civilizations of Greece and Crete and the Akkadian Empire in Mesopotamia whose, decline has previously been linked to abrupt climate change.

British scientists discovered snail shells preserved in the sediments of an ancient lake bed. By analysing the oxygen isotopes in the shells they were able to tell how much rain fell in the lake thousands of years ago. The results shed light on a mystery surrounding why the major cities of the period were abandoned. Climate change had been suggested as a possible reason for this transformation before but until now there was no direct evidence.

There are strong indications that a major climate event occurred in the area where a large number of Indus settlements were situated. It is confirmed that a widespread weakening of the Indian summer monsoon across large parts of India occurred 4,100 years ago," Hodell added. Hodell together with the University of Cambridge archaeologist Cameron Petrie and Gates scholar Yama Dixit collected *Melanoides tuberculata* snail shells from the sediments of the ancient lake Kotla Dahar in Haryana. "The major source of water here throughout the Holocene is likely to have been the summer monsoon," said Dixit. There was an abrupt change, when the amount of evaporation from the lake exceeded the rainfall - indicative of a drought, and there was a clear shift away from large populations living in megacities," said Petrie. It is unlikely that there was a single cause, but a climate change event would have induced a whole host of knock-on effects," he added

Source: Geology, published online on 24 February 2014 as doi:10.1130/G35236.1

Algae biofuel may solve energy crisis

Scientist say micro-algae-based biofuel has the potential to quench a sizeable chunk of the world's energy demands. According to Utah State University mechanical engineering graduate student Jeff Moody,

Green Bloom: Researchers estimate untillable land in Brazil, Canada, China and the US could be used to produce enough algae biofuel to supplement more than 30% of those countries fuel consumption

micro-algae produces much higher yields of fuel-producing biomass than other traditional fuel feed-stocks and it doesn't compete with food crops. He said "Our aim wasn't to debunk existing literature, but to produce a more exhaustive, accurate and realistic assessment of the current global yield of micro-algae biomass and lipids".

Moody and colleagues Chris McGinty and Jason Quinn leveraged a large-scale, outdoor micro-algae growth model. Using meteorological data from 4,388 global locations, the team determined the current global productivity potential of micro-algae, *'Phys.org'* reported. Quinn said "Our results were much more conservative than those found in the current literature. Even so, the numbers are impressive,".

Algae yields about 2,500 gallons of biofuel per acre per year. In contrast, soybeans yield approximately 48 gallons; corn about 18 gallons, researchers said. "In addition, soybeans and corn require arable land that detracts from food production. Micro-algae can be produced in non-arable areas unsuitable for agriculture," Quinn said. Researchers estimate untillable land in Brazil, Canada, China and the US could be used to produce enough algal biofuel to supplement more than

30% of those countries' fuel consumption. Some food for thought for India also.

Source: A.Z.A. Saifullah, Md. Abdul Karim, Aznijar Ahmad-Yazid (2014) American **Journal of Engineering Research (AJER)** : 03 (03) pp-330-338

Scientists isolate and clone Ug99 (Puccinia graminis, Uganda strain) resistance gene.

Agricultural Research Service of US scientists have found a gene in einkorn wheat, an ancient variety still cultivated in parts of the Mediterranean that appears to offer near immunity to Ug99, a stem rust that is a serious threat to 90 per cent of the world's wheat.

U.S. Department of Agriculture (USDA) scientists have pinpointed the location of a gene in a little-known ancient grass that could help save one of the world's most important cereal crops from an unrelenting fungus. Agricultural Research Service (ARS) scientists with the agency's Cereal Disease Research Laboratory in St. Paul, Minn., found the gene while studying the DNA of ancient grasses. They were searching for genes that could make wheat more resistant to Ug99 (*Puccinia graminis*), a type of stem rust that is constantly evolving and mutating.

Genes in wheat that seem to offer immunity one growing season become susceptible to newly developed "races" of the wheat stem rust the next. Ug99 was first reported by scientists in Uganda in 1999 and controlling it has since become an international concern because of the damage due to its spread. Scientists often study a crop's wild relatives for genes that will confer resistance to pests and pathogens. But what makes the efforts of Rouse and Jin noteworthy is the diversity of grasses being studied. They include einkorn wheat, an ancient variety still cultivated in parts of the Mediterranean; emmer wheat, found in archaeological sites and still growing wild in the Near East; and goat grass, a wild relative of wheat with genes that breeders have tapped to boost immunity in commercial wheat varieties.

In one study, scientists focused on locating a gene in einkorn wheat that confers near immunity to Ug99. They focused on locating a gene, known as Sr35, which was previously discovered in einkorn. But the exact location of this gene in the plant's vast genome remained a mystery. The wheat genome is huge, containing nearly two times more genetic information than the human genome. To find Sr35's position, the researchers sequenced areas of the plant's genome where they suspected it was located. In one set of mutant plants, they knocked out the cloned sequences and found it made those plants susceptible to Ug99. In another set they inserted the same sequences into previously susceptible plants and found it made them resistant. The results, published in Science in 2013, marked the first time that scientists managed to isolate and clone an Ug99 resistance gene. The achievement should make it easier to insert useful genes into wheat varieties.

Source: http://www.ars.usda.gov/is/pr/2014/140407.htm

'Homemade' electricity creates a buzz in Germany

On 28 May 2014 in Phys.org, Klaus Meier listed three reasons for generating his own electricity in his family hotel in Germany's southern city of Freiburg — "cost savings, energy efficiency, climate protection". Like a growing number of German small businesses, home-owners, schools, hospitals and industrial plants, Meier has opted for energy self-sufficiency.

Of the about 600 terawatt hours Germany consumes each year, 50 TWh are self-produced — about 8% of the total — in a trend that has seen solar panels installed on home roofs and gas plants set up in factories. In industry, the share is around 20% according to business and energy consumers groups. Their main goal: cost savings. Homemade power in Germany, which has among Europe's highest electricity bills, is not taxed unlike conventional electricity where one third of the customer's bill goes into the public coffers. And neither are the do-it-yourselfers subject to the duties used to subsidize the country's wider "energy transition" away from fossil fuels and nuclear power and towards clean energy.

R.K. Pachauri, Director General, TERI, Delhi says that the success story in India has been a sustainable solar energy project in the Gujarat state covering canals with photovoltaic panels. This innovation saved land by placing panels over canals which also saved water loss due to evaporation and solar panels performed better as temperatures are lowered. The power produced is directly made available to the local people who as stakeholders took care of the solar panels.

Source: Phys.org – spotlight science and technology news stories http://ift.tt/1kaYYr9

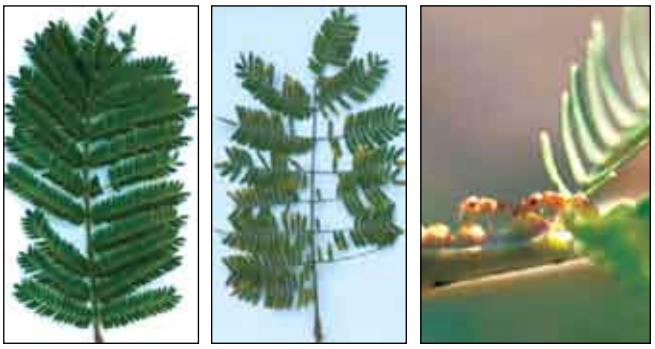
Fellows may send contribution at: *editors.naas@gmail.com.* Selected entries will be duly acknowledged

Symbiosis between mutualistic ants and plants: A new discovery

The biological term "symbiosis" refers to what economists call a win-win situation: a relationship between the two partners which is beneficial to both. The mutualistic association between the acacia species *Acacia hindsii*, which is native to tropical dry forests in Central America and its inhabitants are ants of the genus *Pseudomyrmex*is is an excellent example: The plants provide food and accommodation in the form of food bodies and nectar as well as hollow thorns which can be used as nests. The ants return this favor by protecting the plants against herbivores. Researchers at the Max Planck Institute for Chemical Ecology in Jena, Germany, have now discovered an additional level of this insect-plant symbiosis that ants also keep harmful leaf pathogens in check. The presence of ants greatly reduces bacterial abundance on surfaces of leaves and has a visibly positive effect on plant health. Study results indicate that symbiotic bacteria colonizing the ants inhibit pathogen growth on the leaves. (González-Teuber, M., Kaltenpoth, M., Boland, W. (2014). The protection from ants against bacterial plant pathogens has not been tested before, and so far no molecular studies have surveyed the changes in the epiphytic bacterial community in the presence and absence of mutualistic ants.

Plants of *A. hindsii* inhabited by the parasitic ant of *P. gracilis* showed a higher percentage of pathogen inflicted leaf damage than plants inhabited by mutualistic ants. The latter provides evidence of a direct beneficial effect provided by the mutualistic ants against microbial pathogens. Moreover, leaf bacterial abundance as well as the number of bacterial OTUs (bacterial richness) also increased when plants were inhabited by parasitic ants. This is the first study that demonstrates with a molecular approach that the absence of mutualistic ants from the host plant can lead to changes not only in the overall composition of the bacterial community but also in the abundance of potentially pathogenic bacteria on plant leaves.

The results show that the indirect defense of mutualistic ants also covers the protection from bacterial leaf pathogens, and that bacteria associated with ants' legs can potentially contribute to this protective effect by ants. Thus, the study of ant–plant defensive mutualisms would benefit from widening the current concept (Heil & McKey, 2003) and considering bacterial partners, which can contribute significantly to the ability of arboreal ants to protect the host plant from pathogens. The results of the present study raise the question as to whether only arboreal ants can fulfil this function of protection from pathogens or whether it is a potentially widespread function among ants. Further studies, however, are necessary to understand the mechanistic basis of the ant-provided protection from pathogens in ant–plant mutualisms in more detail.



Leaves of *Acacia hindsii* plants colonized by mutualistic (left) or parasitic ants (middle). Plants associated with the mutualistic ant species *Pseudomyrmex ferrugineus* (right) are visibly healthier than their neighbors.

Scientists at the Max Planck Institute for Chemical Ecology now looked more deeply into the insect-plant interaction, asking whether the tiny bodyguards also provide protection against microbial pathogens. They compared the leaves of acacia plants which were inhabited by either mutualistic or parasitic ants to leaves from which ants had been removed. Intriguingly, the leaves of acacia colonized by parasitic ants showed more leaf damage from herbivores and microbial pathogens than did the leaves that had mutualistic ants. The presence of the right symbiotic partner seemed to have a positive effect on the plant's health.

Analysis of the surfaces of the leaves revealed that the number of plant pathogens as well as of necrotic plant tissues increased considerably when mutualistic *Pseudomyrmex ferrugineus* ants were absent. These plants also showed strong immune responses in the form of an increased concentration of salicylic acid, a plant hormone which regulates defense against pathogens. Detailed analysis of the bacterial composition on the surfaces of the leaves suggested that the presence of mutualistic ants changed the bacterial populations and reduced harmful pathogens. Although far less pronounced, this effect could also be observed in parasitic ants.

How antimicrobial protection is transferred from ants to plant is still unclear. Chilean researcher Marcia

Photograph on left show red ants, middle show red ants colonising leaves and right curled mandarin leaves with webbing used for laying eggs. *Photographs courtesy Dr Sanjay Kumar* (*Central Agricultural University, Dibrugarh; Dr O.P. Toky.* (*CCS Haryana Agricultural University, Hissar*)

González-Teuber, first author of the publication, suspected that microorganisms associated with the ants might play a role. Because acacia leaves are touched mainly by the ants' legs, she extracted the legs of mutualistic and parasitic ants and tested the effect of the extracts on the growth of bacterial pathogens in the lab. Interestingly, some of the bacterial genera associated with the ants are known to produce antibiotic substances. The Jena researchers have thus added another level of interaction to the symbiosis between ants and their host plants.

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References

González-Teuber, M., Kaltenpoth, M., Boland, W. (2014). Mutualistic ants as an indirect defence against leaf pathogens. *New Phytologist*, **202**: 640-650.

Heil, M. McKey, D (3003) Protective ant plant interactions as model systems in ecological and evolutionary research. *Annual Review of Ecology, Evolution and Systematics* **34**: 435-453.

Additional supplementary information on Ant-Higher Plant Mutualism

The observations placed here are an add-on information to the report show cased in the column above. Corroborating the discovery one of your editors (PKC) while on a visit to a mandarin orchard located about 20 KM north of Passi Ghat (Arunachal Pradesh) adjoining NH 52 noticed colonisation of a large number of mandarin trees by red ants. There was a constant up and down movement of a large number of red ants on the tree trunk. Besides egg laying and nest of curling leaves and webbing could be noticed (See Photographs 1-3 below). The caretaker an old hand working in the orchard for many years informed that red ants helped plant grow better, get higher yields and fruits of better quality. It was also divulged that plants with red ants were less prone to attack by monkeys who descend from the forest on the adjoining hills during fruiting season. It is well known that the ant-plant associations have evolved to discourage herbivores.

The new level of discovery on ant-plant association now show that the ants may also impart resistance to plant diseases by altering phyllosphere (leaf surface) micro flora .Some biochemicals released as shown by researchers at the Max Planck Institute, Jena, Germany from the legs of ants may also alter physiology of plants leading to better growth and quality of produce. There is a need to study these aspects carrying out systematic research to unveil these associations between ants and mandarin trees observed in the cold humid climate of Passi Ghat (Arunachal Pradesh) unlike ant- Acacia association seen in the hot arid climate of central America showing that in nature these associations could be fairly widespread.

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Development Claims and Ground Reality: Time for Major Midcourse Corrections

In recent years India's growth story has been remarkable and has received world wide acclaim. For the first time food grain production crossed 257 million tonnes mark creating problems of plenty. There was a near collapse of storage infrastructure leading to extensive storage losses. In other agriculture sectors also the country is the largest producer of milk and second and third largest producer of fruits and vegetables respectively in the world. However, this progress looks hollow as its 300 million people are still living below the poverty line, 40% suffer from malnutrition, 42% of the children are underweight (Hindu, Jan. 11, 2012) and 13 lakh die before their first birthday (TOI Jan.17, 2012). India has averaged annual GDP growth of approximately 6% but in terms of Human Development Index (HDI) its ranking was an abysmal 134 in 1980 and ranked exactly same in 2011 showing no improvement in this development parameter. In spite of three decades of high economic growth, India has failed to achieve broad social progress and well being of its people.

There is an excessive obsession with the GDP growth which is touted as an indicator of the rapid stride of the country's economic progress. But what is forgotten is that with predominantly young population future depends on quality education, good health and jobs. The economist and Nobel laureate Amartya Sen said "one cannot judge the performance of the Indian economy by growth alone with the largest ratio of undernourished people. Bangladesh has taken over India in longevity, infant mortality, immunization rate, and all social criteria". This is an eye opener. The rural: urban ratio of income which used to be 1:3 in the past decade has widened to 1:6. The rural financial stress has increased resulting in an increasing number of farmers committing suicides. This clearly indicates a mismatch between resource allocation, management governance and development questioning our policies and priorities which calls for a serious introspection.

The present system might have given political mileage but has not proved productive in real terms. Recently the Global Food Security Index (GFSI), 2012, given by a London based Economic Intelligence Unit (EIU), a think-tank within the influential Economic magazine group, has ranked India 66th among 105 nations, placing it in moderate category and citing affordability rather than availability as a key food security threat to the country. India has scored the highest in food availability but low in terms of food access due to serious flaws in the food distribution system and inadequate purchasing power (TOI, Oct. 20, 2012).

Development of quality human resource is the key component for improving quality of life in which education plays a most important role. To achieve economics development in the absence of education is like trying to attain economic development in a vacuum. Investments in the education sector must precede investments in other economic sectors, since an economy equipped with the right type of human capital shall face no problem during the transitional period from a less developed to a more developed stage. Therefore, education cannot be seen merely an investment of one kind, but is the core element of all development.

The agrarian crisis in India has been deliberately engineered by the state to serve profit seeking interest and to pursue the urban-centric, growth-obsessed model of development. Credit to agriculture, public investment, irrigation, subsidies, the cost of inputs, minimum support, public procurement, technology, and trade-related international agreements-the list of areas where the government could have acted in the interest of our farmers, but chose not to do so. The core issues related to the agrarian crisis in the country needing immediate redressal are; neglect of the interest of farmers, deterioration of trade for agriculture, the predominance of marginal and sub marginal farmers, stagnating income from farming which hardly meets 80% of their needs resulting in a serious debt crisis, ineffective and negligible support price interventions and fast decreasing size of farm holdings.

Ecological impact of growth in reform era

The ecological and social impact of growth has been cause of concern. The blasted limestone and marble hills of the Aravallis and Shivaliks, the cratered iron ore or bauxite, plateau of Goa, Madhya Pradesh and Orissa; the charred coal landscaped of eastern India; and the radioactive uranium belt of Jharkhand is all witness to the worst that the so called economic development can do. Thousands of hectares of land have been rendered completely barren and unproductive, with only a small percentage restored to its original condition. The export under globalization have violated the key principles of ecological sustainability, which is not surprising when targets are set in terms of monetary figures of growth rather than the quality of the impact of such growth on human welfare. The glaring examples of this are the cases of fisheries and aquaculture, floriculture, commercial agriculture and mining, which are all among the fastest growing export sectors.

According to the available data, the fishery stocks in most of the world's seas have been over exploited by the only exception of the Indian Ocean. Therefore it is obvious that the major fishing companies and the rich fish-eating nations are eyeing these waters. The government claims that the big operators under the new policies will be allowed to fish only in deep waters (Blue water fishing), where traditional fisher folk do not go. But past experience has shown that trawler owners find it convenient and cheaper to fish closer to shore. Also, trawlers continue to be illegally used in the fish-breeding season. Physical clashes between trawler owners and local fisher folk are common.

There are not too many other assessments of the sustainability of India's development path. The Energy Resource Institute (TERI) carried out a study on losses due to environmental damage in the late 1990s and concluded that environmental costs in India exceed 10 percent of the GDP as a result of loss in agricultural productivity; loss in timber value due to the degradation of forests; health costs due to polluted water and air; and costs due to depleted water resources. Further, the economic loss due to soil degradation resulted in an annual loss of 11-26 per cent of the agricultural output. Another report by TERI on further scenarios for India pointed to worrying trends in resource depletion and waste generation.

Soil degradation affects almost half of the India's land, severely bringing down agricultural productivity and in particular affecting the marginal and small farmers. The globalization phase has also seen agricultural entering into an extended period of crisis, with abysmally low and declining growth rates and, more importantly, declining ability to sustain livelihoods. To top it all, farmers are enticed or forced to sell off the topsoil for brick-making, forever destroying the productive capacity of their farms. This has reached outrageous proportions around many cities where truck loads of soil from farms and tank-beds are removed *every day* for the construction purposes.

Of particular concern is groundwater as its over exploitation for agricultural, industrial and urban purposes has, in many parts of India, reached levels where the water table is going down alarmingly. A free-for-all has prevailed with regard to the digging of tube wells, over half the groundwater blocks in rural India are not recharging as fast as withdrawal. According to sources, one-third of the country's districts, groundwater is not fit for drinking due to high levels of iron, fluoride, arsenic and salinity. Punjab, Haryana, Karnataka, Gujarat, Tamil Nadu and Rajasthan are among the states worst hit by over-exploitation or pollution.

Finally, there is the massive impact of so called development on non-human nature. Hundreds, possibly thousands, of species of plants and animals are being pushed to the edge of extinction as their habitats are gobbled up by the same land-grab process that is displacing communities. This loss of wildlife is part of the erosion of agricultural biodiversity, as agricultural and other policies force massive homogenization in cropping and animal husbandry patterns.

To applaud India's achievements in the field of technological modernization-as evidenced for instance, in its successful satellite launches; its glass-and-chrome business buildings; its luxury hotels are one side of the story. To suggest that the process which has brought forth this kind of energetic enterprise will somehow magically deliver the vast poor population of the country from malnutrition and age-old forms of deprivation is at best an elite illusion. At worst, it justifies a historic fraud on the people of India. Most of them do not stand the ghost of a chance, under the present dispensation of policies, to share in the prosperity being enjoyed by the country's assorted elite minority. To assert that such a process can be ecologically sustainable is a grand deception. The Indian *economy* may be in good statistical health, but it is by no means in good social or ecological health. While growth breaks the old speed limits, the connection between growth and development becomes even more tenuous. When aspirations are not achieved, frustrations and anger grow with rising prices, unemployment and inequalities. In order to achieve sustained growth an integrated and more innovative agricultural development agenda must be adopted in forms of strategies, investment, technologies, institutions and partnership.

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Commercialization of Tree Products: Some Policy Options

Tree planting that is market-orientated has the greatest likelihood of being adopted on a large scale. For example, planting of poplars on the alluvial plains of northwestern India, has boosted the economy of the farmers and provided livelihood to large population. This is due to the fact that silvicultural practices of poplars have been standardized and well developed marketing system is available.

Eucalypts can make a similar impact on the waterlogged soils as it is well adapted to waterlogging conditions. Productivity and profitability of plantations of *Eucalyptus* have been revolutionized with the development of genetically improved fast growing and high yielding clonal planting material. Average

productivity of commercial clones is about 20-25 m3/ ha/ yr. Many States in India where World Bank aided forestry development projects existed, have adopted the clonal plantations of *Eucalyptus*. This has been very helpful to the farmers.

Prosopis juliflora and Prosopis pallida, which are excellent biodrainers, can be used for plantations on waterlogged soils. Many of the problems faced in the plantations of *Prosopis* have been due to the introduction of poor genetic material of *P. juliflora*. Seeds of *P. pallida* from Peru is much more superior than material of *P. juliflora* available in India. Prosopis species produce a wood which is a very high quality fuel, having a high calorific value of approximately 5000 kcal/kg. The charcoal obtained from the wood of *Prosopis* species is of very high quality. Ten kg of green wood will make 1-2 kg of charcoal using traditional earth kilns, normally in 2-4 days. The fruits produced by *Prosopis* species are legume pods, high in sugars, carbohydrates and protein, and can be used to prepare animal feed cakes. *Prosopis* species produce fruit every year and can be termed as unfailing crop even in most adverse climate.

Prosopis has evolved a symbiotic relationship with Rhizobium and other nitrogen fixing bacteria and as such plays an important role in desert ecosystems where nitrogen is very often limiting. The wood of *P. pallida* and *P. juliflora* has been used for almost every purpose for which wood as a raw material can be used. Biomass estimates from different sites vary as little as 0.5 t/ha/yr to very high over 39 t/ha/yr.

The fruits of *P. juliflora* and *P. Pallida* complex are sweet nutritious, with low concentrations of tannins and moderate to high digestibility. Natural selection favored these characters as they are attractive to foraging animals and thus, help in the dispersal of the seeds. Prosopis pods and seeds are consumed by a wide variety of animals. Prosopis group has immense potential of water logged soils and promises to boost the economy of the poor rural people.

Casuarinas can be grown in the coastal belts which are saline, low in fertility and do not support plant growth. It besides serving as wind break also enrich soils with nitrogen due to symbiotic nitrogen fixation. The produce can be used as green fodder for cattle and dry stocks as fuel. Bamboos in northeastern India, are other very important industrial species used for various purposes. It can be used in the waterlogged conditions.

However, to boost the economy of the farmers, this requires close working with the companies processing and marketing the timber. To do this a strong R & D is needed so as to avoid the risk of small land holder's investment.

Policies:

1. Promote local-level processing and marketing of timber and non-timber tree products on the scale of their production.
2. Organize trainings to rural communities that are required to achieve the goal.
3. Site specific R&D is required.
4. The governments plans for integrated development should include agroforestry/ biodrainage plantations for wood based industries and promote market demand for farm grown timber.
5. Permits for felling and transport of timber existing in some states need to be reviewed positively.

O.P. Toky
Ex- Dean, Post Graduate Studies, CCS Haryana Agricultural University, Hisar

Awards and Honours

The President and Fellows of the Academy congratulated and felicitated Dr. Madappa Mahadevappa, Dr. Brahma Singh and Dr. Ajay Parida, for having been conferred with the prestigious Padma Awards on 26th April. 2014 by President of India. It is a matter of great pride and honour for the Academy.

Dr. Madappa Mahadevappa former Chairman of Agricultural Scientists Recruitment Board and Vice-Chancellor at University of Agricultural Sciences, Dharwad was conferred with the coveted civilian honour 'Padma Bhushan' by the Government of India for his outstanding contributions in developing hybrid rice varieties. He has contributed extensively to the Indian agrarian community through various innovative applications and research initiatives. He is a rice breeder of repute and has several improved varieties and hybrids to his credit.

Dr. Brahma Singh former Director, Defence Research Laboratory, Tezpur (Assam) and at Leh (J&K) and Secretary, Life Sciences Research Board was conferred with the 'Padma Shri' Award for his significant contributions in Forestry and Arboriculture, and for developing High Altitude Horticulture and protective cultivation in cold desert areas.

Dr. Ajay Parida, Executive Director, M. S. Swaminathan Research Foundation was conferred with 'Padma Shri ' award for his outstanding contributions in the area of biotechnology application, dissemination and biosafety issues. His major scientific contribution is in the area of application of frontier technology for addressing major challenges in global and national declining agriculture productivity threatened due to climate change, sea level rise and reduced precipitation

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Forthcoming Programmes

- Hydroponic Fodder Production in India (Convener: Dr. H.S. Gupta & Dr. M.P. Yadav)
- Breeding Policy for Bovine in India (Convener: Dr. M.L. Madan & Dr. M.P. Yadav)
- Monitoring and Evaluation on AREE4D (Convener: Dr. P.G. Chengappa)
- Reservoir Fisheries Development in India: Policy & Management Options (Convener: Dr. W.S. Lakra)
- Climate Resilient Livestock Production (Convener: Dr. Khub Singh)
- Breaking Low-productivity Syndrome of Soybean in India (Convener: Dr. S.M. Virmani)
- Practical and Affordable Approaches in Implement Precision (Convener: Dr. S.R. Verma)
- Linking Farmers with Market (Convener: Dr. Anjani Kumar)
- Good Aquaculture Practice (GAP) Certification of Aquaculture in India – Criteria and Implementation Plan (Convener: Dr. I. Karunasagar)
- Symposium on GM Technology (Convener: Dr. K.V. Prabhu)

Obituaries

1934 - 2013

Dr P.K. Mohanty

Dr Prasanna Kumar Mohanty was born on 1st April, 1934 in Keshpur, Odisha, India. He obtained his Bachelors and Masters degrees from Ravenshaw College, Utkal University, Cuttack and M.S. in Botany, and Ph.D. in 1972 under the guidance of Professor Govindjee from University of Illinois at Urbana-Champaign (USA). He received post-doctoral fellowship of the National Research Council, Canada and worked on the EPR signal, arising from photochemistry of photosystem-I at cryogenic temperature at University of Western Ontario, Canada. He also received several national and international fellowships such as DAAD-UGC, Senior Fulbright Fellow, Senior JSPS, etc.

On his return to India in 1973, he joined the Jawaharlal Nehru University (JNU), New Delhi, as an Associate Professor in the School of Life Sciences and later became Professor of Bioenergetics and Dean at the same university. He retired in 1999. Professor Mohanty and his group made significant contributions in the field of photosynthesis and published more than 300 papers and many reviews in National and International journals of repute. He also did collaborative research with Russia, Japan, USA, Hungary, China, Korea and USA. He served on the Editorial Boards of several national and international journals including *Photosynthesis Research; Physiology and Molecular Biology of Plants, Journal of Plant Biology and Photosynthetica* etc. He served as Council Member National Academy of Sciences (India), Allahabad (1986). He taught new innovative courses at the University of Hyderabad under the UGC programme. Later, he engaged himself in teaching Cell Biology and inspired a generation of students and researchers as an Adjunct Honorary Professor at the Regional Plant Resource Centre (RPRC), Bhubaneswar and later in the Dept. of Agricultural Biotechnology at Orissa University of Agriculture and Technology, Bhubaneswar.

During his distinguished career, Prasanna Mohanty received many awards, including Robert Emersion Fellowship of the University of Illinois at Urbana-Champaign; Gold Medal from National Academy of Sciences (India), Allahabad; Hari-Om-Trust-Jagadish Chandra Bose Award from University Grants Commission (UGC) of India; Panchanan Mahaeswari

Memorial Lecture of Indian National Science Academy (INSA) (1996) and P. Parija Memorial Lecture Award of Utkal University. He was a Fellow of National Academy of Sciences (India), Allahabad; Founder Fellow of National Academy of Agricultural Sciences and Fellow of Indian National Science Academy, New Delhi.

Professor Prasanna K. Mohanty passed away on March 9, 2013, after a long illness at Cuttack, Odisha India. With his passing away, his students and colleagues have lost not only a great teacher and friend but also an eminent plant physiologist. The Fellowship of the Academy pays its homage and tribute to the departed soul.

Dr Debi Prasad Ray (Bhubaneswar)

1936 - 2014

Dr. B.P.N. Singh

Dr. Bireshwari Prasad Narayan Singh was born on 8th December 1936 in Varanasi. He did his B.Sc. and M.Sc. from Banaras Hindu University and Ph.D. from Allahabad Agricultural Institute, Allahabad and Post Doctoral from University of Massachusetts in 1960-63.

He joined as Assistant Professor of Agricultural Engineering in 1963-73 at the then U.P. Agricultural University, Pantnagar and subsequently became Professor of Food Process Engineering during in 1973-97 and Head, Department of Agricultural Engineering in 1984-87 He was Director, Centre of Advance Studies in Post Harvest Technology in 1994-96, Dean, College of Technology and Registrar in 1994-96 in G.B. Pant University of Agriculture and Technology in Pantnagar. In 1997, he became Coordinator of School of Agriculture Business Management at Pantnagar. He has significantly contributed in the area of Food Process Engineering Food Technology, Post Harvest Technology, Engineering of Bioconversion Processes. He will be remembered for his contributions in developing and nurturing agricultural Engineering through his outstanding contributions.

He received a number of awards and published more than 200 research papers. He was Fellow of Indian Society of Agricultural Engineers and Institutions of Engineers (India) and Fellow of National Academy of Agricultural Sciences.

He passed away on 15th May 2014 in Bangalore after a brief illness. With this loss his students and colleagues have lost not only a great mentor, researcher, but also a philosopher and thinker. The Fellowship of the Academy pays its homage and tribute to the departed soul.

Dr Alapati Appa Rao

1926 - 2014

Dr Alapati Appa Rao was born on 1st July, 1926, in Yedlapalli, Tenali, District Guntur Andhra Pradesh. He obtained B.Sc. (Ag.) from the Tamil Nadu Agricultural University, Coimbatore in 1945 and Doctorate from University of Madras in 1957. He completed post-doctoral research at Kansas State University, USA in 1962 and joined as Associate Professor in the Department of Plant Pathology, in the then Andhra Pradesh Agricultural University, Rajendranagar, Hyderabad and was subsequently promoted as Professor in the same Department in the year 1967. He was Director of Research during 1973-1982 and he was subsequently associated with World Bank as Agricultural Scientist. He distinguished himself as Vice-Chancellor, ANGRAU the post which he held from 1985 to 1991. He was President of the Indian Agricultural University Association between 1990-1991. An eminent Plant Pathologist of the country he was well known for his pioneering work on rice blast disease. He was a sincere, dedicated teacher, researcher and administrator. He received “R & D Linkar Award” from Indian Society of Extension Education for his contribution in the area of transfer of technology. He breathed his last on 30th April, 2014 in Hyderabad and survived by wife and two sons.

The Fellowship mourns the sad demise of its distinguished fellows and pays homage to the departed souls.

Ch Srinivasarao (Hyderabad)

Editors: Dr. P.K. Chhonkar & Dr. (Ms.) Prem Dureja

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