2009-10

Annual Report

National Academy of Agricultural Sciences
NASC, DPS Marg, New Delhi - 110 012, India

NATIONAL ACADEMY OF AGRICULTURAL SCIENCES
ANNUAL REPORT 2009-10

CONTENTS

1 Introduction

2 Management

2.1 General Body

2.2 Executive Council

3 Fellowship

3.1 Sectional Committees

3.2 Election of Fellows

3.3 Fellows Deceased

3.4 NAAS-Associateship

4 Events held

4.1 9th Agricultural Science Congress

4.2 Foundation Day

4.3 Brainstorming Sessions

4.4 Special Lectures

4.5 New Year Get-together

5 Regional Chapters

6 NAAS-TATA Bihar Project

7 Academy Awards

8 Publications

9 Academy Programmes planned for 2010-11

10 Finance, Budget and Audit

11 Acknowledgement

Annexure Balance Sheet, Audited Accounts and Auditors' Report 2009-10

1 INTRODUCTION

1.1 Background

The National Academy of Agricultural Sciences (NAAS), established in 1990, is among the youngest of the Science Academies in India. It owes its origin to the vision of the late Dr. B. P. Pal, FRS. The Academy focuses on the broad field of agricultural sciences including crop husbandry, animal husbandry, fisheries, agro-forestry, and interface between agriculture and agro-industry. The Academy's role is to provide a forum to Agricultural Scientists to deliberate on important issues of agricultural research, education and extension, and present views of the scientific community as policy inputs to planners, decision/opinion makers at the various levels. To achieve this, the Academy organizes and supports national and international congresses, conferences, seminars, symposia, workshops and brainstorming sessions on the critical issues in the field of agricultural sciences. The Academy accords recognition to scientists at various levels, and encourages cutting-edge research in different fields of agricultural sciences. In 2003, 'Associateship' of the Academy for Young Scientists was introduced.

The Academy has emerged as a vibrant national level body devoted to agricultural sciences. The Fellows of Academy, recognized for their contributions to science, include distinguished personalities in the field of Agriculture and Allied Sciences, both from India and abroad.

1.2 Objectives

The major objectives of the Academy, *inter-alia,* are to:

- promote ecologically sustainable agriculture,
- recognize and promote excellence of individual scientists in the field of agriculture,
- promote interaction among research workers of different institutions and organizations within the country, and with the world scientific community,
- organize inter-disciplinary analysis of issues of importance for farmers and farming, and prepare further policies designed to advance agricultural research, education and development
- carry out such activities as are relevant to the accomplishment of the above goals.

2. MANAGEMENT

2.1 General Body

The General Body: The General Body of the Academy constituted by its Fellows, met on 5 June 2009 and adopted the Annual Report and Audited Statement of Accounts for the year 2008-09.

2.2 Executive Council

Composition: The Executive Council was re-constituted on 1.1.2010 with changes in the incumbency of offices of the Vice-President, Foreign Secretary, Treasurer, and four Members of the Council. The composition of the Executive Council for 2009 and 2010 is as under:-

	2009	2010	Tenure
President	Dr Mangala Rai	Dr Mangala Rai	Dec 2010
Immediate Past-President	Prof M. S. Swaminathan	Prof M. S. Swaminathan	Dec 2010
Vice-President	Dr S. S. Acharya	Dr H.K. Jain	Dec 2011
Vice-President	Dr H.K. Jain	Dr S. Ayyappan	Dec 2012
Secretary	Dr P.K. Aggarwal	Dr P.K. Aggarwal	Dec 2010
Secretary	Dr A.K. Srivastava	Dr A.K. Srivastava	Dec 2011
Foreign Secretary	Dr S. P. Ghosh	Dr R.B. Singh	Dec 2012
Editor	Dr Rajendra Prasad	Dr Rajendra Prasad	Dec 2010
Editor	Dr P.S. Pathak	Dr P.S. Pathak	Dec 2011
Treasurer	Dr K.V. Prabhu	Dr Suresh Pal	Dec 2012
Member	Dr S.A.H. Abidi	Dr S.A.H. Abidi	Dec 2011
Member	Dr C.L. Acharya	Dr C.L. Acharya	Dec 2010
Member	Dr (Ms.) Rintu Banerjee	Dr (Ms.) Rintu Banerjee	Dec 2011
Member	Dr (Ms.) P. Geervani	Dr (Ms.) P. Geervani	Dec 2011
Member	Dr (Ms.) Shailaja Hittalmani	Dr H.S. Gupta	Dec 2012
Member	Dr B.L. Jalali	Dr (Ms.) Shailaja Hittalmani	Dec 2011
Member	Dr Opender Koul	Dr G. Kalloo	Dec 2012
Member	Dr C. Ramasamy	Dr A.N. Mukhopadhyay	Dec 2012
Member	Dr H.P. Singh	Dr Lalji Singh	Dec 2010
Member	Dr Lalji Singh	Dr R.P. Singh	Dec 2012
Member	Dr N.S.L. Srivastava	Dr N.S.L. Srivastava	Dec 2010
Member	Dr S.K. Bandyopadhyay	Dr M.P. Yadav	Dec 2010
Member	Sh A.K. Upadhyay, Secretary, ICAR	Sh Rajiv Mehrishi, Secretary, ICAR	(ICAR nominee)

During 2009-10, four meetings of the Executive Council were held on: (i) 4 June 2009, (ii) 21 June 2009 (iii) 17 September 2009 and (iv) 30 November 2009. The meeting of the Annual General Body was held on 5 June 2009. Some of the important items considered were as under:

- Revised rules for purchase and award of works, signing of contracts, etc.
- Change in the name of the Academy from National Academy of Agricultural Sciences to Indian Academy of Agricultural Sciences

- Involvement of Foreign Fellows of Indian origin settled in India, in policy decision making process of the Academy
- Review of implementation of Academy's programmes and formulation of proposed activities of the Academy for the year 2009-10
- Organizing 9th Agriculture Science Congress
- Finalization of the Theme and Sub-themes of 10th Agricultural Science Congress to be held at Lucknow in February 2011
- Academy's initiative to start a journal in Agricultural Sciences
- Suggestions for upgradation of science content in extension related writings and journals so that scientists working in extension units of NARS get selected as NAAS Fellows in view of their contributions in transfer of technology and extension education
- Constituting a Committee for review of entire process of election of Fellows including the criteria and weightage assigned to different items
- Recommendations of the Committee constituted to review and develop detailed guidelines / rules for regulating various awards of the Academy
- Adoption of (a) Annual Report and (b) Audited Statement of Accounts of the Academy for the year 2008-09
- Appointment of Auditors for the year 2009-10 and fixation of their remuneration
- Recommendations of Sectional Committees and the Conveners' Group for finalization of Academy's Fellows/Associateship for the year 2010
- Preparation of panel for election of the Office Bearers and Members of the Executive Council 2010
- Consideration of the need for bringing out the second issue of the State of Indian Agriculture to address agricultural contrast between Punjab and Haryana vis-à-vis Eastern India.
- Election of (a) Office Bearers and Members of Executive Council for the year 2010, and (b) Fellows 2010
- Constitution of a Committee for review and rating of scientific journals
- Calendar of activities of the Academy in the year 2010

3. FELLOWSHIP

3.1 Sectional Committees

A total of 9 **Sectional Committees** were constituted, which met in September 2009, and short-listed candidates for electing Fellows and selecting Associates for 2010. They presented their recommendations to Executive Council for approval and election by ballot.

3.2 Election of Fellows

During 2010, twenty-one Fellows were elected. As on 31.03.2010 the total number of Fellows (in the live register) is 495, which includes 45 Foreign Fellows and one Corporate Fellow. Brief details of the new Fellows elected in 2010 are as follows:

Section I : Crop Science

1.	Dr. Amaresh Chandra	*Principal Scientist & Head, Division of Plant Physiology & Biochemistry, Indian Institute of Sugarcane Research, Lucknow, Uttar Pradesh*
2.	Dr. (Mrs.) Malavika Dadlani	*Head, Division of Seed Science & Technology, Indian Agricultural Research Institute, New Delhi*
3.	Dr. B.M. Khadi	*Dean (PG Studies), Directorate of PG Studies, University of Agricultural Sciences, Dharwad, Karnataka*
4.	Prof. P.B. Kavi Kishor	*Professor, Department of Genetics, Osmania University, Hyderabad, Andhra Pradesh*
5.	Dr. Sanjay Kumar	*Scientist IV (V), Biotechnology Division, Institute of Himalayan Bioresource Technology, Palampur, Himachal Pradesh*

Section II : Horticulture Science

6.	Dr. S.D. Shikhamany	*Vice Chancellor, Andhra Pradesh Horticultural University, Tadepalligudem, West Godavari District, Andhra Pradesh*

Section III : Animal Sciences

7.	Dr. R.B. Rai	*Principal Scientist, Division of Pathology, Indian Veterinary Research Institute, Izatnagar, Bareilly, Uttar Pradesh*
8.	Dr. A.K. Verma	*Principal Scientist, Centre of Advanced Studies in Animal Nutrition, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh*

Section V : Natural Resource Management

9.	Dr. S.K. Chaudhari	*Principal Scientist (Soil Physics), Central Soil Salinity Research Institute, Karnal, Haryana*
10.	Dr. D.K. Pal	*Principal Scientist & Head, Division of Soil Resource Studies, National Bureau of Soil Survey and Land Use Planning, Nagpur, Maharashtra*

11. Dr. A.K. Patra	*Principal Scientist, Divison of Soil Science & Agricultural Chemistry, Indian Agricultural Research Institute, New Delhi*
12. Dr. B.R. Rajeswara Rao	*Scientist (Director Grade), CIMAP Resource Centre, Hyderabad, Andhra Pradesh*
13. Dr. B. Venkateswarlu	*Director, Central Research Institute for Dryland Agriculure (CRIDA), Santoshnagar, Hyderabad, Andhra Pradesh*

Section VI : Plant Protection

14. Dr. C. Devakumar	*Assistant Director General (Education Planning & Development), Indian Council of Agricultural Research, New Delhi*
15. Dr. Alok Kalra	*Scientist F and Head, Microbial Technologies Division, Central Institute of Medicinal & Aromatic Plants, Lucknow, Uttar Pradesh*
16. Dr. A.K. Rai	*Professor, Department of Botany, Banaras Hindu University, Varanasi, Uttar Pradesh*

Section VII : Agricultural Engineering and Technology

17. Dr. T.K. Srinivasa Gopal	*Principal Scientist & Head, Fish Processing Division, Central Instittue of Fisheries Technology, Cochin, Kerala*
18. Dr. Surendra Singh	*Project Coordinator, AICRP on Farm Implements & Machinery, Central Institute of Agricultural Engineering, Bhopal, Madhya Pradesh*

Section VIII : Social Sciences

19. Dr. P.S. Birthal	*Principal Scientist, NCAP presently on deputation as Principal Scientist (Socioeconomics), International Crops Research Institute for Semi-Arid Tropics, Patancheru, Andhra Pradesh*

Section IX : Frontier Sciences

20. Dr. K.M. Paknikar	*Scientist F and In-Charge, Centre for Nanobioscience, Agharkar Research Institute, Pune, Maharashtra*

Foreign Fellow

21. Dr. R.K. Varshney	*Principal Scientist, Applied Genomics & Sub Programme Leader (GCP), Centre of Excellence in Genomics, ICRISAT, Patancheru, Andhra Pradesh*

3.3 Fellows deceased

The Academy condoled the demise of its following Fellows during 2009-10:

1. **Dr. G.M. Reddy**, expired in April 2009
2. **Dr. N.C. Ganguli**, expired in May 2009
3. **Dr. Rajat De**, expired in May 2009
4. **Dr. O.P. Meelu**, expired in May 2009
5. **Dr. Norman E. Borlaug**, expired in September 2009
6. **Dr. R.K. Arora**, expired in March 2010

3.4 NAAS-Associateship

The following were selected as NAAS Associates during 2010, thereby making the total number of Associates to 34.

Sl. No.	Name & Affiliation	Specialization
1.	**Dr. A. Arunachalam,** *Principal Scientist (Forestry) & Head, Division of Agroforestry, ICAR Research Complex for NEH Region, Barapani, Meghalaya*	Restoration Ecology & Natural Resource Management
2.	**Dr. V. Chinnusamy,** *Senior Scientist, Water Technology Centre, Indian Agricultural Research Institute, New Delhi*	Plant Physiology & Molecular Biology
3,	**Dr. Kuldeep Dhama,** *Senior Scientist, Avian Diseases Section, Division of Pathology, Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh*	Veterinary Microbiology and Avian Health
4.	**Dr. Y.P.S. Malik,** *Senior Scientist, Division of Virology, Indian Veterinary Research Institute, Muketeswar Campus, Nainital, Uttarakhand*	Diagnostic & Environmental Microbiology
5.	**Dr. Ashwani Pareek,** *Associate Professor, School of Life Sciences, Jawaharlal Nehru University, New Delhi*	Plant Physiology & Biotechnology
6.	**Dr. Brajesh Singh,** *Senior Scientist, Division of Crop Physiology and PHT, Central Potato Research Institute, Shimla, Himachal Pradesh*	Potato physiology and post-harvest technology
7.	**Dr. D.P. Singh,** *Senior Scientist (Biotechnology), National Bureau of Agriculturally Important Microorganisms, Mau Nath Bhanjan, Uttar Pradesh*	Microbial Biotechnology with Implications in Agriculture

4. EVENTS HELD

4.1 9th Agricultural Science Congress

The 9th Agricultural Science Congress was jointly organized by Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir (SKUAST-K) and National Academy of Agricultural Sciences (NAAS) at Srinagar from June 22-24, 2009. The theme of the Congress was **Technological and Institutional Innovations for Enhancing Agricultural Income**. Shri N.N. Vohra, HE, the Governor, Jammu & Kashmir (Chancellor SKUAST-K) was the Chief Guest on the inaugural function and Jenab Omar Abdullah, Hon'ble Chief Minister (Pro-Chancellor, SKUAST-K) was the Guest of Honour.

Dr. Mangala Rai, Secretary (DARE) & Director General, Indian Council of Agricultural Research, New Delhi and President of the Academy presided over the function.

A total of 592 delegates from almost all the States of the country including Jammu & Kashmir attended the 3-day Congress. More than 50 lead papers by professional Peers were presented during the Congress.

Out of 250 poster presentations, three poster presentations were identified as the best presentations after review by the technical committee and the concerned scientists were felicitated.

A National Elocution Competition was also held during the Congress in which 12 students drawn from six zones of the country including one from Jammu & Kashmir participated. The finalists were awarded with certificates and cash awards.

An exhibition on “Agriculture Technologies and Inputs” was also organized in which 55 exhibitants displayed the items related to agriculture and allied sectors. The exhibitants included Development Department of the State Government, SAUs, ICAR Institutes and private concerns dealing with Agriculture sector.

4.2. Foundation Day

About 169 Fellows attended the Foundation Day celebrations and Annual General Body Meeting, Academy's publication ‘State of Indian Agriculture’ release function, scientific sessions, foundation day lecture and business session. In the forenoon of 4th June, 2009, the 68th meeting of the Executive Council was held.

4.2.1. Release of Publication 'State of Indian Agriculture'

The first issue of **State of Indian Agriculture** series was released by the Hon'ble Shri Sharad Pawar ji, Union Minister of Agriculture, Consumer Affairs, Food & Public Distribution on June 4, 2009. Dr. M.S. Swaminathan, Member of Parliament (Rajya Sabha) and immediate past president of the Academy, Dr. S.S. Acharya and Dr. H.K. Jain, Vice-presidents of the Academy also graced the function. Dr. Mangala Rai, President, NAAS and Secretary, DARE & Director General, ICAR while welcoming the Chief Guest and other dignitaries observed that this book was an attempt to provide a critical analysis of the overarching issues in Indian agriculture.

Hon'ble Shri Sharad Pawar ji while releasing the publication exhorted agricultural scientists to work for doubling agricultural productivity to meet the growing demand for food and feed. This would require reducing post-harvesting losses, tackling environmental issues, enhancing production of foodgrains, specially pulses, oilseeds,

and harnessing potential in dairy and fisheries sectors. Dr. Swaminathan congratulated the Academy for bringing out the publication 'State of Indian Agriculture'.

4.2.2. Foundation Day Lecture

Dr. Sukhadeo Thorat, Chairman, University Grants Commission delivered the Foundation Day Lecture on 'Higher Education and XI Plan - Approach and Strategy' on 5 June 2009. Brief highlights of his lecture are given below.

- Investment in agricultural technology, rural infrastructure such as roads and more importantly investment in education induced agricultural growth and through increased income, employment, wage earnings and increased food supply can help reduce poverty.

- Government has indeed begun to realize the multiple role of higher education. Higher education has to be treated as an investment in human beings and an important source of economic growth. It also develops responsible citizens.

- Education influences society, economy, culture and politics in different ways. These impacts of education can not be necessarily captured by market mechanisms. It is difficult to estimate costs and benefits of education.

- The higher education in India has witnessed many fold increase in its institutional capacity since independence. During 1950 and 2009, the number of universities has increased from 20 to 477, colleges from 500 to more than 20,760 and the teachers from 15,000 to nearly 5.22 lakhs. Consequently, the enrolment of students has increased from a mere 1.00 lakh in 1950 to nearly 123.77 lakhs.

- The XI plan recognized the emerging issues and developed an approach and strategy to address them. These issues include - (a) Lower access to higher education, (b) Inter-regional and Rural Urban disparities in access to higher education (c) Inter-group disparities in access to higher education (d) Issues related quality and excellence, (e) Promotion of Relevant education, (f) Academic Reform and reform of educational governance (h) Other issues such as role of private sector and its regulation and, issue related to globalization.

- The central objective of the XI plan is now focused on expansion of enrolment in higher education with inclusiveness, quality, and relevant education and supported by necessary Academic Reforms in the university and college system.

4.2.3. Presidential Address

The **Presidential Address 'Agriculture - Fast Forward'** was delivered by **Dr. Mangala Rai, President NAAS, Secretary, DARE & Director General, ICAR.** Brief highlights of his address are as follows.

- The president informed the Fellowship that based on his last year's presidential address on *Agriculture and Biotech Culture,* emphasizing much-needed corrections in nutritional imbalances for soil-health, a path-breaking decision was taken on the nutrient based subsidy and fortification of fertilizers by the Union Government.

- For Managing Genetic Resources with Modern Tools - a mega project on "Gene Discovery and Allele Mining" has been initiated, involving 35 institutions, at an outlay of Rs 57 crore. A series of path-breaking programmes on the basic and strategic researches are to be undertaken.

- For ensuring continuum in the basic, strategic and adaptive researches befitting location, situation and system as many as 14 National Research Centres are converted into Directorate mode of operation. A series of networks cutting-across crops, commodities and disciplines are also put in place.

- For managing abiotic and biotic stresses, A National Network Project entitled 'Impact, Adaptation and Vulnerability of Indian Agriculture to Climate Change' has been launched with a focus on impacts of climate change on different sectors of agricultural production such as crops, fish and livestock. The programme is being implemented in 21 research institutions.

  A National Institute on Abiotic Stress Management has already been started, and in principle approval for establishment of additional two institutes, National Institute for Biotic Stress Management and National Institute on Biotechnology, has been accorded. These will also be the deemed-to-be-universities under the ICAR.

- Despite the fact that agriculture has recently received high priority on the world's developmental agenda, there is an unprecedented rush to use agricultural produce as biofuels in many developed countries, and sadly so in some developing countries as well. A caution is needed because the presently identified first-generation biofuels that are competing with food crops are not tenable in the

long run. Second-generation biofuels such as those from lignocellulosis feed-stocks are less likely to compete for land and water resources than the current first-generation biofuels that are based on food crops. Production of biofuel crops has to be targeted under waterlogged / degraded / barren lands so that it does not compete with food, feed, fodder and fibre.

- The President emphasised that National Agricultural Research System should strive for enhancement of quality and relevance of higher agricultural education to ensure much needed human resource for the kind of science and technology, it considers essential.

- The XI Plan Working Group on Agricultural Research and Education constituted by the Planning Commission has made an in-depth analysis and recommended Rs 30,000 crore for the ICAR. However, Planning Commission made an allocation of Rs 12,023 crore out of which ICAR could allocate Rs 2,585 crore for education. Unless we enhance budgetary support both at the Centre and the State level, it would be hard to attain and sustain enhanced velocity and vigour, and the sufferer would be the poorest of the poor. Can we afford it?

4.2.4. Scientific Sessions (Presentations by the Newly Elected Fellows)

There were two technical scientific sessions, one in the afternoon of 4th June, 2009, Chaired by Dr. H.K. Jain, Vice President, NAAS and the second in the forenoon of 5th June 2009, Chaired by Dr. S.S. Acharya, Vice President, NAAS. The following presentations were made.

- **Dr. B.M. Prasanna : *Molecular breeding for maize improvement in India***

Molecular characterization of ~150 inbred lines was undertaken using SSR markers, providing valuable information about the genetic diversity in elite germplasm and heterotic grouping of inbred lines. Molecular and phenotypic characterization of nearly 400 Indian maize landraces was undertaken, leading to clear differentiation of 'Sikkim Primitives', identification of agronomically useful and nutritionally-rich accessions, and formulation of specialty corn pools. Allele mining in three important genes, *teosinte branched-1* (*tb1*) influencing prolificacy, *Yellow1* (*Y1*) regulating carotenoid biosynthesis, and *sugary1* (*su1*) affecting starch metabolism, has been implemented using Indian maize germplasm. Intensive studies were undertaken on mapping and validation of QTLs conferring resistance to downy mildews, Banded leaf and sheath blight, and drought stress tolerance. Molecular marker-assisted selection (MAS) was

implemented for improving downy mildew resistance in elite breeding lines; the QTL-NILs were utilized in transcriptome profiling for downy mildew resistance for the first time in the world. MAS for the developing QPM lines has been successfully implemented at both VPKAS (Almora) and IARI (New Delhi) and several products are in pipeline. Molecular marker assisted pyramiding of genes for resistance to Turcicum leaf blight and Polysora rust has also been undertaken through a Network Project. With an unparalleled genetic diversity in the form of inbreds and landraces, tremendous genetic knowledge, availability of genomic resources and tagged genes/QTLs, maize is now at the forefront of molecular plant breeding and functional genomics.

- **Dr. Ajoy Kumar Roy :** ***Genetic improvement of forage crops: achievements and prospects***

Significant additions to forage germplasm pool were made by explorations and procuring exotic germplasm. The available germplasm of perennial grasses (*Dichanthium- Bothriochloa, Sehima, Heteropogons, Panicum*), range legumes (*Stylosanthes*), Cultivated crops (Oats, Maize, Berseem) were evaluated, documented and conserved. One variety each in *Sehima nervosum, Heteropogon contortus* and *Chrysopogon fulvus* were identified/ released.

Lines expressing apomixis as well as only single component (apomeiosis, parthenogenesis, functional endosperm development) were identified utilizing Flow Cytmoetric Seed Screen (FCSS) in *Pennisetum* and *Panicum* agamic complex. Two novel cytotypes were registered - octoploid *Pennisetum pedicellatum* Trin (2n=8x=72) and *Pennisetum squamulatum* (2n=56).

By embryo rescue technique, hybrids were developed in *Berseem* (first global report) (*T. alexandrinum x T. apertum*, *T. alexandrinum x T. resupinatum*, *T. alexandrinum x T. constantinopolitanum).* Tetraploid lines were developed and stabilized and one variety was released.

- **Dr. (Mrs.) Neelam S. Sangwan :** ***Plant secondary metabolism in medicinal and aromatic plants : Understanding the basics and the opportunities ahead***

The biosynthesis and accumulation of secondary phytochemicals is tightly linked to and influenced by the growth and development, accumulation and sequestration in specialized structures, and the regulation under the various types of stresses. Suitable model systems were developed for understanding metabolite biosynthesis by

pathways operating in cytosol and plastids. Attempts are being made to identify, silence and over-express key pathway genes to decipher the functions of these erstwhile so-called secondary metabolites of no known function(s), in the plants.

- **Dr. N. Seetharaman :** ***New research agenda to revive sorghum economy***

The decline in area under *grain sorghum* has been mainly for the *kharif* (rainy season) crop, which needs to be now considered as industrial crop rather than a food crop. Being gluten free, sorghum provides excellent foods for celiac patients. The Centre has helped to create an industry (Sunira Foods, Calcutta) to produce and market such foods for infants. On the other hand the *rabi* (post-rainy season) sorghum area has been stable for the decades (at ~ 5M ha). The current thrust is on and working with the feed industry to manufacture feed blocks and for improving the digestibility of stover. *In fodder and feed sorghums t*wo multicut hybrids have been released. Incorporation of brown midrib has enhanced the digestibility of single-cut forage or dual purpose (grain & stover) sorghums by more than 5-8%. *In sweet-stalk sorghums* excellent cultivars to promote sorghum as bio-fuel have been developed.

In sorghum biotechnology marker-assisted selection has resulted in shoot fly resistant hybrid parents, and the work is progressing to use the DNA markers for pyramiding resistance to different foliar diseases and to incorporate the food, nutritional and evident (visual) quality traits. Sorghum-sugarcane hybrids when backcrossed with sorghum are yielding very valuable progenies for further study. Some crosses with wild sorghums are also now made possible.

- **Prof. S.K. Sen :** ***A brief account of plant genetic research studies***

Protoplast manipulation in *Brassica* and rice has opened up new avenues for generation of genetic recombinants followed by adoption of r-DNA technology and gene transfer methods for crop improvement. The possibilities for improving crop products and making newer products in principle are almost limitless. Research outcomes have been adopted on the farmers fields. Generation of insect resistant transgenic cotton, rice and mustard lines are acclaimed achievements. Genetic engineering of fatty acids in plants; gene transfer in many crop plants; molecular understanding of the mechanism of WA-CMS system in rice; and generation of nuclear male sterility in rice and sesame have been the areas of other major research activities. Furthermore, a large number of young research workers have been trained

in crop biotechnology. Two specialized laboratories in crop biotechnology have been established in two leading research institutes in the country.

- **Dr. Ramesh K. Aggarwal : *Germplasm characterization and linkage studies in rice and coffee: a few significant achievements using DNA marker technologies***

Over the years, DNA marker approaches for characterization of rice germplasm encompassing wild rice species, their derivatives and the elite native rice germplasm have been extensively used. Importantly, two new genomic constitutions (GG, HHJJ) in the genus *Oryza* were assigned; empirical data supporting a single center of origin for *Oryza* were provided, several novel potential rice sources for early nodulin gene homologues were identified, and DNA polymorphisms useful for the identification, protection and improvement of elite Basmati and specialty rice varieties were ascertained.

Significant achievements have been made that notably include - development of one of the largest repertoire of coffee specific microsatellite markers useful for diversity and linkage analysis; and development of a relatively dense molecular linkage map of robusta coffee; which is the first ever linkage map developed for any tree species in India.

- **Dr. A.K. Tripathi : *Functional genomics of a plant growth promoting rhizobacterium, Azospirillum brasilense for abiotic stress tolerance***

Azospirillum brasilense harbours eight extra-cytoplasmic function (ECF) sigma factors, out of which two are accompanied by anti-sigma factors. RT-PCR analysis revealed that both the genes encoding sigma factors and anti-sigma factors were co-transcribed. When gene encoding anti-sigma factor was knocked out in *A. brasilense* the mutant showed overproduction of carotenoids, whereas knocking out the gene encoding σ^E stopped production of basal level of carotenoids that is normally produced. The σ^E knockout mutant grew slower than the parent and was more sensitive to heat and salinity stress suggesting the role of σ^E in conferring tolerance to heat and salinity. We have also investigated the role of LysR-type transcriptional regulator, OxyR in coping with the oxidative stress. Knocking out each of the two copies of OxyR in *A. brasilense* resulted in increased sensitivity to hydrogen peroxide. Overexpression of gene encoding superoxide dismutase in *A. brasilense* resulted in increased tolerance to superoxide.

- **Dr. Shyam Singh : *Highlight of significant contributions and their perspective on future lines of research and development***

Significantly contributions have been made in recent years on a wide range of crops including fruits, vegetables, plantation, spices, tuber, rhizomatous and ornamental crops. In citrus production and distribution of disease free planting material was made for the first time in the country. Simultaneously rejuvenation of declining orchards, fertigation, biological control of insect pests and reduction in post- harvest losses have collectively improved the status of citrus industry in India.

- **Dr. S. Ignacimuthu : *Effective botanical formulation and some isolated compounds against Insect Pests***

A novel oil formulation was prepared using Karanj and neem oils in equal proportion with some active extracts of both oils and emulsifier. This oil formulation was named PONNEEM. In field trials during 2005-06 and 2006-07 in groundnut (var. JL-24) PONNEEM significantly reduced the populations of thrips, aphids, *S. litura* and leaf miner compared to individual neem and karanj oil treatments and commercial neem based biopesticides.

The phytocompounds beta Caryophyllene isolated from *Hyptis suaveolens* and 7-hydroxyfrullanoide and Thiopene-A from *Sphaeranthus indicus* showed very good antifeedant and larvicidal properties against *Helicoverpa armigera* and *Spodoptera litura* larvae. 2,5-diacetoxy-2-benzyl-4,4,6,6-tetramethyl-1-cyclohexanedione from *Syzygium lineare* showed very high antifeedant activity against *S. litura* larvae. Caryophyllene and another sterol compound, beta sitosterol, isolated from *Melochia corchorifolia* when mixed separately with neem and karanj oils showed increased antifeedant and larvicidal activities. The oil formulations, containing either beta sitosterol or beta caryophyllene showed high efficacy in reducing the populations of aphids, *H. armigera*, *S. litura* and jassids below economic threshold levels in groundnut.

- **Dr. K. R. Kranthi : *Sustainable cotton pest management strategies for India***

Based on the results of a stochastic model 'Bt-Adapt' developed at CICR, Nagpur 'insect resistance management (IRM) strategies' were devised and Farmer usable field kits to detect Bt-crops were developed and commercialized. These were approved by the GEAC of the Ministry of Environment, Govt. of India. Pyrethroid, Carbamate and Organophosphate resistance detection Kits through SCAR markers and ELISA and dipstick kits were developed for use by researchers to detect and calculate allele

frequency in field populations of insecticide resistant *H. armigera.* A simple lateral flow immunochromatographic 'dipstick' kit was developed in a novel single strip format to test/verify the label claim of active ingredient in commercial insecticide formulations of endosulfan and the type-II synthetic pyrethroids, cypermethrin, deltamethrin and fenvalerate. The strips were designed such that two intensely coloured purple lines appeared when the strip is dipped in a solution devoid of any insecticide. A net-working research group on 'Insect resistance to insecticides and Bt-toxins' was formed and IRM strategies were disseminated in more than 1000 villages over the past 10 years with leadership from CICR.

- **Prof. T. Satyanarayana : *Multifarious applications of yeast and thermophilic mould phytases***

Phytates act as an antinutrient, and thus the reduction of phytic acid in foods and feeds by enzymatic hydrolysis using phytase is desirable. Phytases (EC 3.1.3.8 and EC 3.1.3.26) are phosphohydrolases that catalyze the sequential release of phosphate from phytic acid forming myo-inositol and lower phosphate esters. Phytase is of immense commercial value in feed and food industries.

The treatment of soymilk, sesame oil cake and wheat flour with the yeast biomass and thermophilic fungal phytase leads to reduction in phytate content with concomitant liberation of soluble inorganic phosphate. The enzyme as well as the compost prepared using *S. thermophile* promotes the growth of wheat seedlings by hydrolyzing insoluble calcium, magnesium, iron and cobalt phytates. The supplementation of fish and poultry feeds with yeast phytase enhances their growth and phosphorus retention, and further, reduces phosphorus content in the droppings.

- **Dr. Jag Mohan : *Strategies for augmenting reproductive efficiency in poultry production***

Reproductive inefficiency under natural mating is very costly and a limiting constraint for efficient poultry production. It causes tremendous economic loss to the poultry industry. Hence, to overcome this problem a new technique of artificial insemination (AI) associated with bio-molecular characterization of semen has been developed for chicken. A new diluent for 24 hrs of storage of semen has been developed for the successful execution of AI technique. Biomolecular characterization of semen further helps in extending the storage period and improving the fertility of chicken semen. Japanese quail provides the diversification to chicken dominating (90%) poultry

industry. To improve the reproductive efficiency of quail research work on AI technology was also carried out. The first fertility prediction test for quail based on the size of the cloacal gland has been developed. This test can improve fertility up to 13%. A simple drug formulation has also been developed for desi fowl which gave 10 to 18 more eggs/bird.

- **Dr. W.S. Lakra : *Molecular identification, characterization and gene banking of fishes***

The population genetics of several fresh water and marine fish species namely, scienids, freshwater carps, catfishes and endangered mahseers has been studied using molecular markers. Such data on genetic variability and population genetics combined with data on biological traits makes comprehensive information based on identified genetic stocks with the production traits for use in registration of germplasm and aquaculture improvement programmes. A new comprehensive research programme on DNA barcoding using CoI fragment of mitochondrial DNA has resulted in the generation of DNA barcodes of over 300 fish species during the past 3 years for the first time in South Asia. Successful cultures and cell lines from a number of freshwater fish species, namely, *Labeo rohita*, *Cyprinus carpio*, *Tor putitora*, *Chitala chitala* and *Puntius sophore* and marine species namely *Lates calcarifer, Etroplus suratensis* and *Ephinephlus merra* have been developed. The sperm cryopreservation protocols were developed for *Tor khudree, Tor putitora, Claraias batrachus* and *Heteropneustes fossilis*. The future efforts will involve development of species - specific protocols for the species of commercial and conservation significance.

- **Dr. B.P. Bhatt : *Integrated farming system for livelihood security in Eastern Himalaya, India***

In North Eastern Hill (NEH) region, where shifting cultivation (*jhum*) is mainstay of economy of majority of the population, a shorter *jhum* cycle has put tremendous pressure on resources affecting productivity of land caused by land degradation, increased level of soil erosion, hydrological imbalance, forest degradation and insecurity in food source. Hence, different farming system models were developed where complimentarity of crop-fish-livestock-horticulture-agroforestry was utilized for long term sustainable production, to achieve food and nutritional security at household level besides gaining round-the-year employment to the farming families, paradigm shift from mono to multiple cropping, *in-situ* water harvesting (up to 80%), checking soil loss from 46.0 to 4.5 t/ha and increase in cropping intensity. Economic yield with the

proven multiple livelihood options can be doubled. Marshy habitats have been rehabilitated for integrated fish farming. Cattle-cum-fish integration followed by fish-cum-duck, fish-cum-poultry and fish-cum-pigery have been found most suitable to increase the fish production almost by three fold compared to fish rearing without integration.

In addition, suitable multipurpose trees/shrubs have been identified for restoration of degraded lands through agroforestry models. Vegetative propagation technology has also been standardized in selected multipurpose tree species in order to optimize biomass yield in different farming systems. Keeping in view the importance of bamboo species in the food and nutritional security of tribal folk, economically important edible bamboo species of Eastern Himalaya have been identified and quantified for their edibility and delicacy.

- **Dr. A.N. Ganeshamurthy :** ***A new approach in soil quality evaluation***

Using native undisturbed forests as high quality reference soils an attempt was made to develop a single point soil quality index (QI) to evaluate soil health using microbial biomass C, mineralizable N and activities of phosphomonesterasc urease and glucosidase. The equation finally developed was: QI = (0.41 x 10^{-3}) microbial biomass C + (1.5 x 10^{-3}) mineralized N + (12.3 x 10^{-3}) phosphomonoesterase + (9.2 x 10^{-3}) phosphomonoesterase + (9.2 x 10^{-3}) glucosidase + (1.5 x 10^{-3}) urease.

- **Dr. D.M. Hegde :** ***Oilseeds production in India: A constraint analysis and suggested road map***

The per capita consumption of vegetable oils in the country has increased by nearly 300% in the last 60 years. The country needs to double oilseed production by 2020 to achieve near self reliance in vegetable oils. Appropriate policy framework for the oilseed sector with respect to processing, marketing and trade is the basic and overarching requirement to achieve self-reliance in vegetable oils. This calls for giving new thrust for improving the productivity of oilseed crops by use of genetically enhanced quality seeds, providing protective irrigation, resorting to efficient crop zoning, enhanced and integrated nutrient use, farm mechanization, efficient crop management, overcoming biotic and abiotic stresses through novel technologies and approaches and effective transfer of technologies to bridge yield gap and harness the exploitable yield reservoir.

- **Dr. M. L. Khan :** ***Mapping of plant resources of North East India, a mega-diversity hotspot***

Northeast India, a biodiversity hotspot region in the world, harbours a great diversity of plant resources and is considered to be the 'cradle of flowering plants'. All the north-eastern states form about 8% geographical area of the country, however, it has about 25% of the country's total forest areas supporting about 30% of the total growing stock of the forest of the country. The region is endowed with several endemic species of immense ecological and economic importance. The region is very rich in agridiversity and also harbors many bamboo and rattan species. However, such vast resources are under tremendous pressure and facing threat towards extinction. Thus it is warranted to map the plant resources of the region on priority basis.

- **Dr. K.G. Saxena :** ***Integrated natural resource management in the Himalaya***

Integrated natural resource management (NRM) is an approach to identify key interventions that tend to overcome ideally all problems concurrently leading to sustainable development. Sustainability in the Himalayas can be better approached by integrating the strengths of the indigenous farm and forestry knowledge and new scientific interventions. Such interventions need to be drawn from participatory diagnostic and experimental analysis of spatio-temporal dynamics of ecological and socioeconomic patterns and processes rather than by assuming the indigenous systems to be deficient in all respects and pushing the so called modern agricultural/forestry technologies and institutions.

- **Dr. V.K. Gupta :** ***Incomplete block designs in agricultural research***

Initial varietal trials in crop improvement programmes extensively use randomized block designs for variety selection. Resolvable incomplete block designs with small block sizes have been shown to be useful in these experiments. Square lattice, rectangular lattice and *alpha designs* are resolvable designs. *Alpha designs* have been found to be useful because these are available for any composite number of treatments.

In crop sequence experiments, the direct effects of Kharif and Rabi treatments, the residual effect of *kharif* treatments and the interaction between the residual effects of *kharif* and direct effects of *rabi* treatments are of interest. Generally these experiments are run as randomized block design for *kharif* and split plot design in *rabi* season. Because of the factorial structure of treatments, block designs having orthogonal

factorial structure with balance like extended group divisible designs, rectangular designs and Kronecker Product designs have been shown to be useful for such experiments. Structurally incomplete row-column designs are useful for experimental situations where interaction is not of interest to the experimenter.

- **Dr. Suresh Pal : *New institutional economics and agricultural development policy***

The principles of Neo-classical economics (NCE) were being applied for agricultural development policy research. These implicitly assumed that market forces ensure economic efficiency and rational behavior of individuals. The theory, however, failed to explain variations in economic development over space and time. These limitations of NCE and 'bounded rationality' of individuals encouraged economists to expand the analytical framework for better understanding of economic growth. The role of institutions was found to be important. Further work on this line showed that transaction is more meaningful level of analysis rather than market, because individuals or economic agents minimize transaction cost. This 'New Institutional Economics (NIE)' framework got a wider acceptance and is increasingly applied to understand economic performance. The NIE is also being applied to explain agricultural growth. It is recognized that institutional change is an important source of growth and can help explain variations in the growth performance among countries and regions. This source of growth interacts closely with other sources of growth like technology, policy, investment etc. In particular, NIE has been applied for the study of agrarian relations, contractual arrangements in production and marketing, management of common property resources, and delivery of R&D services.

4.3 Brainstorming Sessions

- **Agrochemicals Management: Issues and Strategies** [NAAS premises, NASC, New Delhi, 17th April 2009, Convener: Dr. Balraj S. Parmar, former Joint Director (Research), Emeritus Scientist and Head Agricultural Chemicals, Indian Agricultural Research Institute, New Delhi]. There were 32 participants.

  It was brought out in the deliberations that under plant protection chemicals, the policy guidelines need to address to the problems of inherent toxicity, the limitations in developing newer molecules and the strategies for an efficient use of the existing ones, pest resistance, resurgence and secondary outbreaks, protection of useful forms of life, the bio-pesticide option formulation research and development in overcoming various constraints and in sharpening performance of

the available tools, product handling, storage and transportation, legislation and quality control, environmental interactions, customer awareness, and disposal and decontamination strategies. As regards support chemicals, the policy options have been sought for the seed coats, superabsorbent hydrogel, plant growth regulators, chemical hybridizing agents, fruit ripeners, value adders, etc. The aspects covering both the production and the protection chemicals relate to technology development and promotion, intellectual property, trade and commerce, documentation and database and the likes.

The following **recommendations** were made:

1. Establish a national centre on agrochemicals, including bioorganisms and bioproducts, to cater to all the aspects of education, training, research, development, scale up, commercialization, etc.

2. Create agrochemicals discipline in all the national and state agricultural universities and research institutes.

3. Include biodiversity management in the context of agrochemical use in the curricula of schools and colleges.

4. Establish a network of centrally controlled and duly accredited laboratories to regularly monitor the xenobiotics load of the environment and other natural resources, agricultural and industrial produce and other commodities.

5. Strengthen the Krishi Vigyan Kendras as the knowledge based self sustaining agri-clinics for the diagnosis and solution of the constraints related to agricultural production and the human safety.

6. Create a single nodal agency, like the United States-Environment Protection Agency, to address to the multifarious aspects related to agrochemical use in totality.

7. Establish multi-disciplinary groups at the interministerial level comprising scientists, science managers, and other specialists to overview periodically the agrochemicals scenario.

8. License agricultural graduates as responsible distributors/ applicators / consultants of (on) agrochemicals and other agro inputs.

9. Integrate safe food with the recognized safety standards, minimum or no risk products and judicious agrochemical management rather than with the organic or any other less productive form of agriculture.

10. Document information on all the aspects of agrochemicals and create a database. Make the information accessible to one and all. Devise a mechanism for taking the researchable issues to the national agricultural research system.

11. Increase investment in agrochemical research, education and technology generation with due accountability and ensuring more efficient use of the national manpower and the research and development infrastructure.

❖ **Crop Response and Nutrient Ratio** [NAAS premises, NASC, New Delhi, 28th and 29th May 2009, Convener: Dr. Rajendra Prasad, Ex ICAR National Professor and INSA Honorary Scientist]. There were 30 participants.

The following were the major recommendations.

1. A Cell may be created at Indian Agricultural Statistics Research Institute or National Centre for Agricultural Economics & Policy Research to work out the optimum N : P_2O_5 : K_2O ratio in consultation with PDCSR, Modipuram using the data on crop response to fertilizers from different sources (PDCSR, Crop Improvement Projects of ICAR, Long term fertilizer experiments, state agricultural universities, state departments of agriculture, ICAR institutes). These ratios may be first worked out for different crops in 120 NARP zones. Weighted (area basis) N : P_2O_5 : K_2O ratios may then be worked out for different NARP zones, states and finally for the country as a whole. This needs to be done at a regular interval.

2. All SAUs should have a well equipped laboratory for analysis of all plant nutrients (primary, secondary and micro) in soils and plant samples. This is not to be restricted to the analysis of available nutrients in soils but should include total plant nutrient analysis in soil and plant samples.

3. All soil testing laboratories in the country should be well equipped for the analysis of available macro and micronutrients including B and Mo, which are not included in DTPA extract generally used for estimating available Fe, Mn, Cu and Zn. This will call for additional funds, which need to be provided.

4. Availability of fertilizer on time still remains a problem in several parts of the country. Logistics of fertilizer distribution needs to be improved.

5. Quality control of fertilizers including micronutrient fertilizers has to be assured.

6. Development and production of value-added and site specific customized fertilizers need to be encouraged as these will help in increasing the nutrient use efficiency.

7. Providing subsidy to promote cultivation of legumes for green manuring or / and grain may be considered. This will help in reducing nitrogen application rates to crops and to overcome the shortage of pulses in the country.

❖ **New Generation Biofuels** [NAAS premises, NASC, 28th August, 2009, Convener: Dr. P.K. Singh, Emeritus Scientist (CSIR), Dept. of Botany, BHU, Varanasi and former VC, CSA University of Agriculture and Technology, Kanpur].

A wide gamut of issues were discussed under five theme areas, namely, (i) higher plants as the source of fuels, (ii) potential of microalgae for biofuel and environmental sustainability, (iii) energy from organic wastes and other alternative areas, (iv) second generation biofuels and genetic engineering and (v) new generation biofuels.

1. It was emphasized that considerable potential exists on new generation biofuels but the technologies need to be developed, standardized and applied.

2. Agricultural biomass available from crop production was identified as a potential resource of energy.

3. Jatropha has proved to be good feed stock for biodiesel world wide. Efforts should be made on the collection, conservation and evaluation of its germplasm.

4. High throughput phenotyping and identification of biofuel-friendly genotypes in crops like sugarcane and sorghum must be considered.

5. Robust fermenting organisms, which are more tolerant to inhibitors and ferment all sugars in the raw material in concentrated hydrolysates at high productivity and with high ethanol concentration need to be identified.

6. Biological pretreatment of lignocellulosic biomass with microbes/ hydrolytic enzymes and commercial production of cheap/efficient cellulase, xylanase/ligninase has a significant potential.

7. Development of recombinant thermophilic ethanol tolerant bacteria for industrial level bioethanol production is an important area of study.

8. Selection and development of potential strains of algae, genetic engineering of metabolic pathways to enrich biomass or metabolites with hydrocarbons of fuel value needs to be given due priority.

9. Mass cultivation systems of algae suited to diverse habitats with additional benefit of wastewater bioremediation be modeled and processes need to be developed to manufacture (i) biodiesel, (ii) bioethanol, (iii) biomethane, and biohydrogen employing algal biomass as feedstock.

10. The major challenge (and opportunity) of our time should be to create a form of trade that uplifts the entire human community in a way that respects both natural systems and cultural diversity. This is the only realistic and viable pathway to a sustainable world.

❖ **Vaccine and Diagnostic** [NDRI, Karnal, 10 & 11 July, 2009, Convener: Dr. A.K. Srivastava, Director & Vice Chancellor, NDRI, Karnal]. There were 42 participants.

The country's network of veterinary health services include 26,717 polyclinics / hospitals / dispensaries and 28,195 Veterinary aid centers supported by 250 disease diagnostic laboratories. In India, vaccines are being produced at 26 veterinary vaccine production units. Of these, 19 are in public sector and 7 in private sector.

It was brought out in the deliberations that the productivity of livestock in India can be improved further by the effective mass vaccination program of brucellosis in dairy cattle and buffalo, and PPR, sheep pox and goat pox in small ruminants and classical swine fever in pigs.

The following are the main **recommendations**:

1. There is need to develop effective vaccination in small ruminants against PPR, blue tongue, small pox, JD and CCPP under National Control Programme.

2. Intensive Vaccination campaign should be launched against HS, BQ, Anthrax, under ASCAD programme.

3. There should be a regular screening of breeding stock of cattle and buffalo for 1BRI IVP. Semen from IBR sero-positive bulls should be screened for BUH-1 virus before AI.

- **National Action Plan on Climate Change and Food Security** [NAAS premises, NASC, 29th September 2009 New Delhi, Convener: Dr. P.K. Aggarwal, ICAR National Professor and Secretary, NAAS].

  The Prime Minister's Council on Climate Change has recently released a National Action Plan on Climate Change for improving the adaptive capacity of Indian economy. It has identified 8 missions and sustainable agriculture is one of them. The brainstorming session was organized to discuss the priorities defined in the Action Plan and, if required, develop an alternate list of priorities to enhance adaptive capacity of Indian agriculture leading to sustainable increase in food production to meet the growing demands.

  The major recommendation was that NAAS should develop an action plan for climate change adaptation and prepare key policy documents in the areas of drought management, integrated water management, integrated pest management and also redefine the agro-climatic zones based on climate change impacts.

- **Agricultural Waste Management** [NAAS premises, NASC, October 23 & 24, 2009, Convener: Dr. N.S.L. Srivastava, Joint Director SPRERI Vallabh Vidyanagar, Gujarat and former Asstt. Director General (Engg.) ICAR].There were 30 participants.

  The major **recommendations** made were:

  1. Proper attention needs to be given on efficient management of different types of agricultural residues/byproducts/wastes as they are required for maintaining soil health, feed and fodder to be used for animals, for producing energy for domestic and industrial uses, fibre and many other useful products.

  2. Retrieval and densification of agricultural residues/wastes using efficient machines for making them into fortified animal feed blocks, briquettes for energy purposes, chemicals, fibre etc. needs due attention.

  3. There is an urgent need to collect information on viable technologies for utilization of agricultural wastes, document them, create awareness, refine them, fill in the gaps if any and promote them.

- **Increased Food Production and Resource Conservation** [NAAS premises, NASC, November 27, 2009; Convener: Dr. Richard Joseph, Ex-Head, Department of Microbiology, CFTRI, Mysore]. There were 21 participants.

  The major **recommendations** were:

  1. Current emphasis should shift to developments in agronomy to realize an "agronomy revolution" as a logical sequel to green revolution

  2. Strategies in natural resource management should be in tune with developments in agronomy and based on local factors

  3. There is scope for amelioration of degraded land than land expansion for agriculture

  4. There is scope for achieving irrigation water adequacy if over-harnessing and under-harnessing of water resources currently practiced in different regions of India are moderated

  5. Developmental work on improved plant varieties with resistance to stress and acquired input utilization efficiencies may continue with due consideration to the requirements of environmental and user acceptability

  6. Policy advocacy should be for soil health enhancement, water harvesting, aquifer recharge and efficient use, credit insurance and input support, crop-livestock-fish-tree integrated farming system, farmer friendly market and bio-security, knowledge connectivity, innovations and technology transfer.

4.4 Special lectures

- **'Collaboration and Partnership: The Future of Higher Education'** by **Dr. E. Gordon Gee**, President, Ohio State University on August 13, 2009.

- **'Reconstructing Indian Population History'** by **Dr. Lalji Singh**, former Director, Centre for Cellular and Molecular Biology, Hyderabad on September 25, 2009.

- **'Norman Borlaug, The World Food Prize: Inspiring the Struggle Against Hunger into the 22nd Century'** by Ambassador Kenneth M. Quinn, President, The World Food Prize Foundation on 24th February 2010

4.5 New Year Get-together

A get-together of Delhi based Fellows was organized at NAAS premises on January 1, 2010. The get-together was chaired by Dr. Mangala Rai, President of the Academy. Dr. P.K. Aggarwal, Secretary of Academy welcomed and introduced the New Executive Council Office-bearers, Fellows and Associates to the Fellowship gathered. While extending his sincere thanks to the Fellowship for the honour bestowed on him as the President of the Academy, Dr. Mangala Rai in his address called upon the Fellowship to address for the challenges confronting Indian agriculture with respect to food security, soil health, water, climate change, nutrition, biosafety, marketing, post-harvest and value addition, IPR, profitability, HRD, etc.

5. REGIONAL CHAPTERS

The Academy has five Regional Chapters as follows. The Regional Chapters make suggestions with regard to policies and problems concerning their areas of operation.

The Conveners of these Chapters are:

Southern Chapter *(Hyderabad)*	Dr. N.H. Rao
Northern Chapter *(Lucknow)*	Dr. P.S. Pathak
Eastern Chapter *(Bhubaneshwar)*	Dr. T.K. Adhya
Western Chapter *(Mumbai)*	Dr. S.S. Kadam
North Eastern Chapter *(Imphal)*	Dr. S.N. Puri

The Chapters organized seminars/lectures from time to time.

6. NAAS-TATA-Bihar Project on 'Revival of the Agricultural Crescent of Bihar'

On the request of Hon'ble Chief Minister of Bihar for preparing a roadmap for revival of the agricultural crescent of Bihar, the Academy constituted a Core Committee under the Chairmanship of Prof. R.B. Singh, former Member of National Commission on Farmers to conduct the study on the subject. The financial support for this was received from Sir Dorabji Tata Trust. The Committee was advised to examine the agro-ecological and socio-economic situations, constraints and opportunities at the grassroot level, and suggest feasible plans and options to alleviate various constraints and to capture new opportunities at the level of village panchayats and connect them with the State and National Plans. The Committee has completed the study and its report has been published and released by Hon'ble Chief Minister of Bihar on March

14, 2010 during Biovillage Programme at Saraiya Block of Muzzafarpur district of Bihar.

7. ACADEMY AWARDS

The Academy has instituted the following awards to recognize scientists for excellence in research in Agricultural and Allied Sciences. The nominations for the following Academy's Awards for the biennium 2009-2010 have been invited:

(i) Memorial Awards
(ii) Recognition Awards
(iii) Young Scientists Awards
(iv) Endowment Awards (Sh. L.C. Sikka Endowment Award)

The Judging Committees of the Academy will consider all the valid nominations in September 2010, and awards will be presented at X Agricultural Science Congress scheduled to be held at National Bureau of Fish Genetic Resources, Lucknow, in February 2011.

8. PUBLICATIONS

List of publications brought out during 2009-10 is as follows.

(i) State of Indian Agriculture

(ii) Address by Sh. Sharad Pawar, Hon'ble Union Minister of Agriculture, Consumer Affairs, Food & Public Distribution on the occasion of release of the NAAS publication "State of Indian Agriculture"

(iii) Presidential Address on 'Agriculture – Fast Forward' by Dr. Mangala Rai, President, NAAS

(iv) Foundation Day Lecture on 'Higher Education and XI Plan – Approach and Strategy" by Dr. Sukhedeo Thorat, Chairman, University Grants Commission

(v) Year Book 2010

(vi) Planner 2010

(vii) Policy Paper 42: Crop Response and Nutrient Ratio

(viii) NAAS-News (four issues)

(ix) Agricultural News (six issues)

9. PROGRAMMES PLANNED FOR 2010

- Making IPM Effective in India - Convener: Dr. B.L. Jalali
- Livelihood Opportunities for Smallholders: Challenges and Opportunities - Convener: Dr. P.K. Joshi
- Soil Micronutrients and Human Health - Convener: Dr. A.N. Ganeshamurthy
- Water Use Efficiency in Agriculture - Convener: Dr. N.H. Rao

- Exploring Untapped Potential of Acid Soils of India - Convener: Dr. C.L. Acharya
- Drought Preparedness and Mitigation - Convener: Prof. P.B.S. Sarma
- Protected Agriculture in North-West Himalaya - Convener: Dr. Anwar Alam
- Prioritisation and Value Addition of Nutritionally Important Crops - Convener: Dr. G.A. Ravishankar
- Carrying Capacity of Indian Agriculture - Convener: Dr. C.R. Bhatia
- X Agricultural Science Congress - Convener: Dr. W.S. Lakra

10. FINANCE, BUDGET AND AUDIT

The main source of funds for the Academy is the grant received from the Indian Council of Agricultural Research (ICAR). During the year 2009-10, ICAR released Rs. 110 lacs.

The Accounts of the Academy are audited by Chartered Accountants appointed with the approval of the General Body. Utilization Certificates up to the year 2009-10 have been furnished to the ICAR, which have been duly accepted by them.

A brief Audited Statement of Accounts and Auditor's Report for 2009-10 is annexed with the report.

11. ACKNOWLEDGMENT

The Academy is grateful for the co-operation and support received from various organizations in implementing its activities. The Academy would, in particular, like to acknowledge with grateful thanks the support received from the Indian Council of Agricultural Research for its liberal and continuing support for Academy's programmes, and for extending generous financial support since its inception. This has greatly helped the Academy to: (a) organize a number of congresses, workshops, seminars etc on major policy issues; (b) award medals to distinguished scientists and young scientists in recognition of their contributions; (c) set-up office of the Academy with necessary infrastructural facilities, and (d) construct a permanent building for the Academy.