12. Agricultural Human Resource Development

The identified thrust areas under the XI Plan continued to receive financial and monitoring support during this year. Financial support to 30 ongoing Niche Area of Excellence (NAE) sub-programmes and one new centre on 'Inland aquaculture in Punjab' for building excellence in specific strategic areas has been extended. In order to provide experience-based and skill-oriented hands-on-training to the students, during 2010–11, 25 more Experiential Learning units were approved in 14 universities, thus totalling to 245 units in 49 agricultural universities. For the first time, a Peer Review Meeting of NAE was held to monitor and evaluate output and outcome. A workshop to assess the impact of the Experiential Learning was organized at the UAS, Dharwad. To provide practical experience in real-life situation in rural areas to undergraduate students, AUs were also supported for implementing Rural awareness work experience (RAWE) programme effectively.

Financial support to develop facilities and host sports festival to encourage participation in games and sports by students, was provided to five zonal sports complexes at Jorhat, Udaipur, Jabalpur, Hyderabad and Pantnagar, in addition to strengthening of sports facilities in each university. Agriunifest was organized at the SHIATS, Allahabad, during 8–12 February 2010 and Agrisports at the Marathwada Agricultural University, Parbhani, during 23–26 February 2010 to build sporting spirit and national integration. Financial support for the construction of 38 museums and 63 girls' hostels and 37 international hostels was extended. The overall financial and academic support to AUs facilitated procurement of modern instruments and equipments to support undergraduate (UG) and postgraduate (PG) education and research, ICT environment, multimedia learning resources etc. Special grants were continued to support four universities, viz. MPKV, Rahuri, PAU, Ludhiana, TNAU, Coimbatore and GBPUAT, Pantnagar, and their constituent colleges for refurbishing/renovating laboratories, class rooms and modernization of farms.

To promote excellence and capacity building of NARS, faculty development in cutting edge areas, up-gradation of skills in emerging disciplines through CAFT, Best Teacher Awards, Fellowships and Scholarships to attract talent were continued and strengthened further. Financial provision to HRD Schemes like Summer/Winter Schools, National Professorial Chairs and National Fellows was doubled for greater autonomy. Sixteen new scientists were awarded under Emeritus Scientist Scheme. This is a structural method of utilizing Skill Bank of the outstanding superannuated professionals. Centralized admission for 15% in UG (1,694) and 25% in PG (2,122) programmes at the AUs towards national integration and reduction of inbreeding was pursued.

Eight AUs were accredited during the year. Under ICAR International fellowships, 14 fellows were selected for 2010–11. A sum of ₹ 156.70 crore to 48 AUs was provided for modernization of AU farms, for bringing uncultivated land under cultivation, improving irrigation facilities, up-gradation/renovation of old laboratories/farm office buildings, for enhanced seed production of crops and increased farm income. Under the India-Africa fellowship programme, started during the year for human resource development in Africa, 75 African fellows were selected for pursuing MSc and PhD degree courses in India. Fortythree candidates from 19 countries have already joined their respective programmes at 24 Indian AUs, and others are expected to join in the second semester. Similarly, under India-Afghanistan fellowship programme, 21 Afghan nationals were identified; out of which four have joined so far in Indian AUs.

The Education Division of the ICAR is mandated for maintaining and upgrading quality and relevance of higher agricultural education through partnership with the Agricultural Universities (AUs), Deemed-to-be-Universities (DUs) and Central Universities (CUs) with Agricultural faculties under the National Agricultural Research System (NARS). Performance enhancement of AUs is strived through implementation of a centrally sponsored scheme "Strengthening and Development of Higher Agricultural Education in India" by providing enhanced financial support. Support to the AUs to plan, undertake, aid, promote and coordinate agricultural education in the country for enhancing the quality and relevance of higher agricultural education was also provided. It has helped in building excellence in specific strategic areas in education and research through NAE, promoting holistic higher agricultural education by blending knowledge, skill and attitude through Experiential Learning Units, RAWE, personality development, assuring quality and relevance of higher agricultural education by accreditation and periodic revision of course curricula and such related aspects concerning infrastructure development, gender mainstreaming, capacity building of the students by providing various fellowships and faculty through training, overseas scholarship, rewards and recognition etc.

Development and strengthening of agricultural universities

For upgradation of facilities and performance enhancement, development grant of ₹ 171.65 crore to 52 AUs was provided. To acknowledge the contribution in agricultural education, special grants to create

infrastructural facilities to Mahatma Phule Krishi Vishwavidyalaya, Rahuri; Punjab Agricultural University, Ludhiana; Tamil Nadu Agricultural University; Coimbatore and GB Pant University of Agriculture and Technology, Pantnagar were given. To build up Agricultural education legacy, Centenary grants were also provided to old historical colleges under the universities, viz. Rajendra Agricultural University, Pusa; Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola and Chandra Shekar Azad University of Agriculture and Technology, Kanpur. Providing such special grants has led to the strengthening and modernization of teaching, research and extension facilities in AUs.

Infrastructure development

Gender mainstreaming: Support for the construction of 63 girls' hostels in 36 universities provided 2,520 additional seats which have resulted in attracting more girl students towards higher agricultural education. Funds were also provided for upgrading/strengthening of 37 international hostels to attract and accommodate suitably more number of foreign students thereby increasing the global visibility of agricultural education.

Depiction of university activity and technologies: By providing support for the construction of 38 Educational museums in 38 agricultural universities, it was possible to meaningfully demonstrate the activities and technology developed at the respective university at one place for their wide scale dissemination and adoption by the entrepreneurs, farmers and other stakeholders including the improvement of knowledge base of the students and visitors.

Infrastructure Development

Considering the continued increase in number of girl students in agricultural Universities, the development grant was provided for construction of girls' hostels leading to gender mainstreaming. Renovation/ modernization of examination halls, lecture rooms, agricultural museum, computer facility, sports facilities and laboratories equipped with sophisticated lab equipments was undertaken. Sports complexes with state-of-the-art indoor facilities including gymnasium, swimming pool and paddling pool were refurbished. The faculty was introduced to multimedia education through LCD projector system and smart class room which has exposed them to the new world of instruction. The computer literacy amongst the faculty and the students has increased tremendously due to creation of such facilities. Funding has been helpful in renovation of essential facilities in hostels. Strengthening of library and CeRA has given impulse to students and teachers for consulting the latest research journals, books and planning the research and preparing the teaching material. Construction of separate examination cells in the colleges has resulted in maintenance of requisite privacy and secrecy in conducting examinations. The Education Technology and Placement Cells have been established in the colleges to support the students for their counseling, training and placements.

An education museum funded by ICAR

Global visibility of agricultural education: On main campus of five universities, zonal sports complexes to host sports fest were developed. The budgetary support was provided for the development of sports complexes—for north zone to GBPUAT, Pantnagar; for east zone to AAU, Jorhat; for west zone to MPUAT, Udaipur; for south zone to ANGRAU, Hyderabad and for central zone to JNKVV, Jabalpur. This has increased the capability and capacity of universities to host sports meets /festivals and encourage participation of students in various games and sports thereby promoting national integration.

Capacity building

Niche Area of Excellence: One of the thrust areas identified in agricultural education is building excellence in specific strategic areas in education and research. The Niche area of excellence (NAE), the most prestigious programmes of the ICAR, achieved global competitiveness in agricultural education and research through excellence in teaching, research, consultancy and other services. It also helped in updating itself in accordance with best of global experiences and trends and has become responsive to regional, national, social and economic needs.

To strengthen and build excellence in human resource in research and education, financial support worth ₹ 10.78 crores to AUs and DUs for 29 ongoing sub-programmes and one new NAE on 'Inland Aquaculture in Punjab' in specific strategic areas has been extended.

During the IV Annual Review Meeting of NAE programme organized in New Delhi from 31 August to 1 September 2010, the leading experts in each area reviewed the progress and suggested for continuance, strengthening and need-based changes in the technical programme to make them more focused and result-oriented.

The salient findings from some of the programmes include:

- The study on 'Integrated Drought Management with Emphasis on Genetic Engineering for Developing Crop Plants Resistant to Abiotic Stresses' revealed that drought tolerance of crops could be improved by bringing together diverse adaptive mechanisms. An integrated approach

with distinct yet inter-related activities was adopted in this programme, which led to achieve significant output, both in basic scientific data and translational research. Using advanced phenotyping techniques, germplasm lines of groundnut, rice, sunflower and finger millet were characterized for WUE, transpiration rate, root traits, cellular level tolerance and other physiological screens. These validated contrasts have relevance in allele mining. Finger millet stress c DNA library developed is quite diverse and stress specific. More than 900 annotated genes are deposited in NCBI. Some of the functional and regulatory genes are potential candidates to improve stress tolerance in other crops. Combining traits that regulate water relations and cellular tolerance brings about improved tolerance to drought at field level. The centre developed the database on transcriptome factors and precise and robust phenotyping techniques.

- The study on 'Isolation, Characterization of Production of Bio-Agents' revealed that vacuum packaging of *Corcyra cephalonica* eggs prior to storage under refrigerated conditions enhanced the shelf-life. The partial sequence of ITS 2 regions of 5.8S and 28S rRNA of *Trichogramma* spp was submitted to NCBI Gene Bank and accession number GU810178 was assigned. Three PhD theses research works were carried out using the facility developed under NAE. Through mass production and sale of local bio-agents, ₹ 2.48 lakhs of revenue was generated.
- Technology of micro irrigation (drip) was successfully demonstrated and transferred to Warangal Watershed where it is being adopted by around 20 farmers in the village. Alternate crops to rice were suggested in Warangal watershed for improving and sustainable groundwater use. Water-saving technologies were demonstrated in farmers' participatory mode and 119 scientists from 15 states (SAUs and ICAR) were trained in 3 weeks programme on water management.
- The *Azolla caroliniana* was effective for compost production throughout the year. Hybrid *Azolla* produced two times more biomass. A total of 976 packets of rhizobia, 1,007 of *Azotobacter,* 1,018 of *Azospirillum* and 1,364 of PSB were sold to farmers, NGOs and researchers and this has resulted in enhanced use of microbial fertilizers for sustainable production.
- Expression of MRP5 gene in stem at milk stage was positively correlated with arsenic accumulation in brown rice. Potato-greengram-Elephant foot yam gave handsome net returns, with moderately high B : C and moderate loading of arsenic in economic parts of the stem. Significant accumulations of the toxin in selected leafy vegetables have been observed in the waste disposal sites compared to other sites (industrial and sewage effluent catchments).
- Under 'Bio-intensive IPM Strategies for Major Pest and Disease Problems of Uttar Pradesh' molecular characterization and variability of bio-agents (*Trichoderma* sp. and *Pseudomonas* sp.) based on RAPD analysis and development of specific markers for identification of various *Trichoderma*/ *Pseudomonas* species/ isolates, were achieved.
- A technology for commercial farming of tiger shrimp using inland saline water was perfected.
- Lactoferrin from cattle, buffalo, goat, sheep and camel milk was purified.
- Glycoprotein B (gB) gene of Marek's disease virus (MDV) was cloned and expressed under the programme on 'Molecular Diagnostics for Emerging Avian Viral Diseases and their immunopathogensis.' Whole genome sequencing of two Newcastle disease virus isolates was achieved for the first time in the country (GeneBank Ac. No. FJ 986192 and GU187941).
- The GM tomato plants with resistance to leaf curl virus were developed through transformation with RNAi technology.
- More than 6 lakh vegetable seedlings were raised in modern nursery and distributed to the farmers under the 'High Tech Horticulture including Medicinal and Aromatics Plants' sub-programme. A herbal park was developed, where more than 460 medicinal and aromatic species are being conserved and evaluated. Eleven fully residential trainings on hi-tech horticulture for youths/ farmers were organized. Three youths trained, raised more than 8 lakh saplings of different fruit crops and sold to the university and fruit growers of the region.
- The budwood bank of virus tested in apple varieties namely Vance Delicious, Starking Delicious, Scarlet Gala, Red Fuji, Gale Gala, Oregon Spur, Top Red, Scarlet Spur, Red Chief, Oregon Spur-II, Scarlet Spur-II, Early Red One, Coe Red Fuji, Super Chief was established. Evaluation of low chill apple cultivars revealed that Mollies Delicious and Anna performed well under sub-temperate climate.

Entrepreneurship development

To provide experience-based and skill-oriented hands-on-training to the students, 220 experiential learning units were operational in 45 agricultural universities. This year, 25 more units in 14 universities have been sanctioned taking the total to 245 units in 49 universities.

Salient key areas covering the new units are:

- Aquaculture practices and value-addition
- Aquatic environment health clinic
- Bio-pesticides and bio-agents
- Feed production and processing
- Medicinal and aromatic plants processing unit

- Micro-irrigation technology
- Modern dairy farm management and practices
- Mushroom cultivation and spawn production
- Nursery management of horticultural crops
- Nursery production and management
- Post-harvest technology and value addition of fruits and vegetables
- Protected cultivation of high value horticultural crops
- Value-added dairy products and meat products

Efforts are underway to set up more units so that each university has enough opportunity to provide entrepreneurship skills amongst students. These units greatly helped in skill development and attitude building in undergraduate students and in linking agricultural education with professionalism. This sub-programme helped in transcending the mere knowledge-imparting education with limited practical training to experience-based behavioural change through comprehensive practice sessions involving all aspects of an agricultural enterprise, from production to consumption.

A Workshop under the chairmanship of Dr S Ayyappan, DG (ICAR) on Experiential Learning to assess its impact was held at UAS, Dharwad during 27–28 October 2010. The workshop included enterpreneurs, experts and faculty members involved in mentoring this programme. The mentors from various universities were sensitized about the expectations and output from the programme. Harmonization of course module across the colleges was discussed.

Textbook writing

The teachers are encouraged to write quality text books covering Indian germplasm, varieties, livestock, soils, agro-ecology etc. so that the researchers and students get authentic information on Indian agriculture. Five manuscripts received from the teachers have been sent to DIPA for printing.

Best teacher awards

To promote excellence in teaching in the field of agriculture and other allied sciences, ICAR supports this scheme involving cash incentives in the form of 'Best Teacher Awards' which are given to the faculty members who are rated highly by the students and alumni and have made excellent contribution in research and teaching. Many SAUs and Deemed Universities such as Sardarkrushinagar Dantiwada Agricultural University, S K Nagar, Indian Agricultural Research Institute, New Delhi and Indian Veterinary Research Institute, Izatnagar regularly administered this award during the year under report.

Recognition of students

Strengthening of infrastructure and facilities at the AUs has led to creation of enabling environment resulting in improvement in quality and output of students' research and education. As a result, a number of students from various universities won the prestigious awards and recognitions namely Jawaharlal Nehru Award from ICAR for best PhD theses, Birla White Cement Award, Best research paper presentation prize etc. In comparison to previous years, the number of students qualifying for ARS positions, JRF, SRF, and NET has markedly increased.

Conference of Vice-Chancellors of agricultural universities and interface with ICAR directors was held on 17–18 February, 2010 at NAS Complex, New Delhi. The Vice-Chancellors and ICAR Directors discussed the various opportunities for cooperation and collaboration in agricultural research and education and also the future thrust. To overcome the deficiency due to inbreeding, inter-university exchange of teachers was advocated. It was suggested that NAARM, Hyderabad may consider feasibility of imparting orientation/refresher courses to the teachers.

Dr Montek Singh Ahluwalia, Deputy Chairman, Planning Comission addressing the VCs' Conference

National consultation on agricultural education

- First Consultative Meeting of Deans of Agricultural Universities was organized at ANGRAU, Hyderabad on 25–26 June, 2010 to review the impact of various initiatives taken up to strengthen higher agricultural education in the country. It was concluded that AUs can form about 8–10 consortia on different flagship programmes and work for tangible outcomes. It was desired that each university may develop a comprehensive note encompassing vision of every college, research stations and KVK, etc.
- A Special Meeting of Vice Chancellors with Dr Montek Singh Ahluwalia, Deputy Chairman, Planning Commission, Government of India was organized on 4 October, 2010 in New Delhi to have interaction and discuss the issues concerning agriculture in general and higher agricultural education in particular in the country. Dwelling on the current topic of ranking of universities, Deputy Chairman suggested to set up Agricultural Challenge Fund for sprucing up the performance of agricultural varsities and expressed concern about underfunding of the AUs by many states.

Manpower development

To promote merit and national integration, and reduce inbreeding, All India Entrance Examinations, on limited

seats were conducted with the provision of appropriate scholarship/fellowships. The number of students applying for admissions in various AUs has increased during this year.

All-India entrance examination for admission to under graduate programmes: For 15% seats in agriculture and allied subjects other than veterinary sciences in AUs and 100% seats in DUs, examination was conducted on 17 April 2010. The examination attracted a record number of 30,279 applications of which 90% students appeared and 1,694 candidates were finally recommended for admission to 49 Universities through counseling in 11 subjects. The students admitted outside the state of their domicile selected through ICAR/ VCI were also awarded National Talent Scholarships (NTS).

All-India entrance examination for admissions to post graduate programmes: For admission to 25% seats in AUs and 100% seats in DUs, including award of ICAR Junior Research Fellowships, examination was conducted on 18 April 2010. In this examination, out of a record number of 20,098 applications received, 90% students appeared and 2,122 candidates were recommended for admissions in 20 major groups and 91 subjects.

All-India competitive examination for ICAR Senior Research Fellowship for PhD was held on 20 December 2009 at seven centres in the country and 174 Senior Research Fellowships were awarded and 374 candidates were also declared qualified for Ph D admission without fellowship in 13 major groups and 56 subjects.

ICAR Fellowships/ Scholarships for studies in agriculture and allied sciences have been provided for UG and PG studies in different disciplines of agriculture and allied sciences for recognition of talent and promotion of merit in general, and for encouraging talented students to undertake higher agricultural education in particular. The nature of financial assistance in the form of fellowships/scholarships provided during the year is given in the Table.

Globalization of agricultural education: The upgradation and creation of better infrastructural facilities, including support to one international hostel in each university led to increase in flow of foreign students and candidates from 19 countries who sought admissions. Candidates from Afghanistan, Bangladesh, Bhutan, Botswana, Egypt, Ethiopia, Fiji, Guyana, Indonesia, Iraq, Mozambique, Namibia, Nepal, Rwanda, Sudan, SriLanka, Vietnam and Yemen exercised their preference to join various agricultural universities.

Capacity building of faculty

Summer/winter schools and short courses: Continuing education and training in highly specialized subjects to teaching faculty was supported by organizing large number of Summer and Winter Schools and Short Courses of 10 to 21 days duration at ICAR Institutes and State Agricultural Universities in key areas of agriculture and allied sciences like:

- Precision farming
- Transgenics, Genomics, Molecular breeding and marker-assisted selection
- Nano-technology and Bio-informatics

Fellowship	No. of fellowships	Amount (₹/month)	Purpose
ICAR-Senior Research Fellowships (PGS)	202	Non-veterinarians 12,000, Veterinarians 14,000 with annual contingency of 10,000	To promote quality doctoral education and research
ICAR-Junior Research Fellowships	470	Non-veterinarians 8,640, Veterinarians 12,000 with annual contingency of 6,000	To promote quality Master's education in different discipline
Merit-cum-Means Scholarship	Not more than 7% UG students from an University	500	To support students of economically weaker sections
National Talent Scholorships	UG students admitted outside the State of their domicile	1000	To reduce inbreeding and promote national integration
Post Matric Scholarship for SC/ST	240	300	For SC/ST students at UG level
Rural Awareness Work Experience	In the final semester of B.Sc. Ag. students	750 (ICAR share) + 250 (State Share)	Creating awareness about rural and industry environment
Internship Assistance	All final year students of B.V. Sc. & A.H. programmes	400 for 6 months + travel grant of 200	Financial support to ensure relevant training

- Climate change-mitigation and adaptation
- Post-harvest technology, quality control and value-addition
- Development of designer foods and feeds
- GIS-based applications to natural resources management
- Technology forecasting and visioning
- Entrepreneurship development and management
- Gender mainstreaming and gender budgeting, etc.

Centres of Advanced Faculty Training: The 31 Centres of Advanced Faculty Training (CAFT) were strengthened for continuing capacity building of scientific faculty and up-gradation of their skills with the changing scenario in cutting edge areas of agricultural and allied sciences. Accordingly, 750 scientists/ faculty members from the national agricultural research system were benefitted.

Promotion of Excellence and Human Resource Development

ICAR National Professor Scheme: For promoting excellence and creating a culture of basic research at national level, ten positions of National Professors have been created. "Norman Borlaug Chair in Biotechnology for Crop Improvement" was created to commemorate the memory of Dr Norman Borlaug, for ICAR-agricultural university system in order to widen the reach in capturing the talent. In addition, the financial provisions for the scheme have been doubled and guidelines revised to provide greater functional autonomy. Major achievements of national professors in position at present comprised:

- **Designs for single factor and multi-factor experiments and their applications in agricultural systems research:** A unified approach of construction of resolvable factorial designs was given. These designs are balanced with full efficiency on main effects and control over the efficiency of the interaction effects and are very useful in crop sequence experiments. A small beginning has been made by creating a link on Statistical Genomics, hosted at Design Resources Server at http://iasri.res.in/design/Statistical_Genomics/default.htm, essentially as an e-learning platform, which can be useful to the researchers engaged in this area of research. Some sources of freeware useful in Statistical genomics and a small Bibliography are included in this link.
- **Pant-ICAR subsoiler-cum-differential rate fertilizer applicator/ subsoiling technology developed last year** has been accepted for feasibility trials by AICRPs on Sugarcane, Rapeseed-Mustard, Rainfed Wheat and Barley Improvement, Soil Test Crop Response Correlation and Farm Implements and Machinery projects. A substantial increase in yields of sugarcane (upto 36%), rainfed barley up to 44.5% and over 100% increase in case of rainfed rice-lentil cropping sequence in sodic land were obtained. The pant-ICAR deep soil volume loosener-cum-fertilizer applicator was modified.
- This machine cultivates the soil between the rows up to 30 cm, cuts the old roots of ratoons, apply the fertilizers, pulverizes the clods and leaves the soil surface completely levelled, all in a single pass and is being patented.
- A new machine Pant-ICAR subsoiler-cum-vermicompost and soil amendments applicator was developed for subsoil placement of organic materials (vermicompost, pressmud, FYM) and soil amendments (gypsum, lime, flyash, rice-husk, cement etc.) up to 45 cm depth and is being patented.
- **Design, construction and validation of DNA chips for virus identification and differentiation:** A microarray chip was constructed and tested with three known viruses, i.e. sheep pox, peste des petits virus (PPRV) and canine adeno virus (CAV) besides unknown viruses. Probes for microarrays for virus diagnosis were designed using online softwares. The probes include both conserved probes and uniques probes. Microarray data analysis indicated that two known viruses PPRV and CAV behaved as expectedly. The sheep pox virus picked up not only pox virus but also avula virus. Subsequent analysis of the original samples confirmed presence of new castle disease virus in this sample. The conserved probes for morbillivirus did not pick up peste des petits virus. Only one out of six conserved probes hybridized with PPRV. Basic Local Alignment Search Tool (BLAST) analysis revealed that except for all but one probe had less than 90% identity with the PPRV sequences.
- **Assessing vulnerability of crop production to increasing climatic risks:** Climate change was projected to increase temperatures more during *rabi* than in *kharif* season and to reduce the irrigated wheat production by ~5% in PRECIS A1b 2030 and up to 25% in 2080 scenarios. The irrigated rice production in India has been projected to suffer 2% loss in PRECIS A1b 2030 scenario while rainfed rice is likely to gain by about 2%. However, in 2080 the projected loss may be up to 10%. The negative impacts of climate change can be minimized considerably by adopting improved varieties and crop management strategies. Change in food habits also can help in reducing the carbon foot print and thus emission of greenhouse gases.
- **Analyzing impact of agriculture policy, technology, institutions and trade on agriculture growth, farm income, sustainability and urban poverty:** Factors affecting regional variations in agricultural productivity, nature and causes of food inflation, effects of monsoon failure in agriculture and challenges to ensure food security through wheat were analyzed. Development of new cultivars of wheat with strength to bear abiotic stresses, harnessing of

potential of existing and new technology through improved practices and resource management and policy environment favourable for wheat production are required to maintain growth rate in wheat production, to sustain food security.

ICAR National Fellow Scheme: With an objective to provide support and develop strong centres of research and education around outstanding scientists, 25 ICAR National Fellow positions were provided in National Agriculture Research System. The budget under this scheme was enhanced and guidelines revised to provide effective working environment. Highlights of the major achievements are:

- **Improvement of strain of *Chaetomium globosum*, a potential antagonist of fungal plant pathogens for enhanced bioefficacy and developing molecular markers for its identification:** Two bioformulations of *Chaetomium globosum* namely, Cg2 WP and Cg2 SL, were developed and tested against late blight of potato under field conditions. Both formulations showed reduced disease severity to 62% and 46% when three sprays were given. The protein profiling of mycoparasitic strain Cg1 and antibiosis causing strain Cg 2 was done which showed protein band of 47 and 30 KDa in Cg1 and 45 KDa and 20 KDa in Cg 2, respectively.
- **Senescence: Mechanism in crops in relation to abiotic stresses, sink strength and their interaction**: The Chl Cu/Zn superoxide dismutase gene (*Cm*CSV) was isolated from *Chenopodium murale* using RT-PCR and RACE techniques. The full length cDNA sequence of 672 bp had the putative conserved domain of the Cu/Zn SOD with the chloroplast transit peptide. The N-terminal sequence of the purified SOD protein showed 70% homology with the N-terminal region of the cloned full length cDNA. This is the first report on cloning of chloroplastic Cu/Zn SOD cDNA from *C. murale*. This sequence was submitted to the GenBank (accession no EF165097; Chl Cu/Zn SOD from *C. murale*).
- **Decontamination of vegetables from pesticide residues:** Decontamination of vegetable and detoxification of pesticides by using safe chemicals was attempted and a new technology was developed using edible alkali for detoxification of toxicants. Innovative method for qualitative analysis of farnasene without Head-space attachment using gas air-tight syringe which reduced the cost from ₹ 19 lakh (cost of head-space) to ₹ 5,000 only has been accomplished.
- **Assessment of sustainability of treated/ developed watersheds in rainfed agro-eco-sub-regions of Peninsular India using GIS and remote sensing:** Evaluation of watershed projects were undertaken in four villages in northern Telangana semi-arid and dry sub-humid tract identified as agro-ecological sub-region (AESR) 7.2. Thirty nine sustainability indicators from multiple disciplines were constructed to evaluate sustainability at three spatial levels, i.e. household-, field- and watershed-level for five aspects of sustainability namely, agricultural productivity, livelihood security, economic viability, environmental protection and social acceptability.
- **Development of ELISA-based immuno-diagnostics for classical swine fever:** Ten Classical swine fever virus (CSFV) isolates from field samples and a vaccine virus strain were adapted in porcine kidney (PS) cell line for the first time and the growth of the virus isolates was studied up to fifth passage level. An immune-peroxidase test (IPT) was standardized to detect the growth of CSFV in cell culture. More than 25 CSFV isolates from the field samples and the vaccine virus strain have been kept as repository. Twenty two cell culture isolates were confirmed by RT-PCR. Phenotyping of all the CSFV isolates by IPT using CSFV-specific monoclonal antibodies was done and nucleotide sequencing of sixteen CSFV isolates from different districts of Asom was carried out. The phylogenetic analysis of 5′ UTR, E2 and NS5B region nucleotide sequence typed all the sixteen CSFV isolates into sub genogroup 1.1.
- **Evolution of textile articles through processing of wool with silk waste and cotton to create entrepreneurial skills in rural women :** A well planned training programme for NGOs, SHGs and rural women was organized to (a) increase the rightful usage of merino wool, tibetan wool, mulberry silk, tussar silk and cotton fibres (b) improve feel, aesthetic appeal and performance of these natural textile fibres (c) to improve their skills on fiber blending, spinning, dyeing, fabric construction techniques etc. (d) help them improve their livelihood. Efforts have been made to develop forward linkages of trainees with Gandhi Ashram and Khadi and Village Industry Commission. Computer aided designing and customized weaving software were used to develop designs with all technical details of draft, lift plan and raw material requirements. These designs were appreciated by textile manufacturers as fabric simulation prior to the manufacturing of fabrics on loom.

Emeritus Scientist Schemes: The ICAR continued to operate Emeritus Scientist Scheme as a structural method of utilizing Skill Bank of the outstanding superannuated professionals of NARS and allowing them to complete mainly on-going project for its fruitful conclusion and also to utilize their talent in teaching specialized courses and addressing nationally important policy issues. Sixteen new scientists were awarded under this scheme. Some of the major projects under this scheme include:

- Characterization of potential bio-pesticide molecule from lichen species, namely *Ramalina*

roesleri, Parmelia reticulata, Cladonia corniculataa and *Stereocoulon himalayense* hybridisation of oyster mushroom (*Pleurotus* spp.) for yield and quality,

- Characterization and evaluation of elite walnut genotypes for commercial exploitation,
- Production of monosomic alien addition lines (MAALs) to introgress yellow stem borer resistance genes from *Oryza branchyantha* to cultivated rice,
- Development and evaluation of technologies for value-added meat products for entrepreneurial adoption,
- Enhancement of crop productivity through aqua-ferti sowing under limited water and rainfed conditions,
- Development of methodology to screen and identify high sugar and high-yielding sugarcane genotypes with field tolerance to red rot disease,
- Physiological studies on drought and high temperature stress tolerance in chickpea (*Cicer arietinum* L.), and
- Evaluation of selected apple hybrids as early seasoned apple varieties resistant to scab.

Quality assurance and reforms

Accreditation: Quality assurance in higher agricultural education was pursued through accreditation of agricultural universities, their constituent colleges and programmes. Based on the self-study reports of the AUs, scrutiny and recommendations of the ICAR Peer Review Teams and Education Division, the Accreditation Board, this year, granted accreditation to the additional four State Agricultural Universities (SAUs)/Deemed-to-be-Universities (DUs) and their programmes and, extension of accreditation to four SAUs, their colleges and programmes. Constant persuasion led to submission of self study reports for accreditation by the seven more SAUs.

University	Period of accreditation granted
Asom Agricultural University, Jorhat	13.07.2010 to 12.07.2015
Birsa Agricultural University, Ranchi	13.07.2010 to 12.07.2015
Anand Agricultural University, Anand	13.07.2010 to 12.07.2015
Sam Higginbottom Institute of Agri. Technology and Sciences, (Deemed University), Allahabad	13.07.2010 to 12.07.2015
Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli	Extended till 12.07.2012
Dr Y S Parmar University of Horticulture and Forestry, Solan	Extended till 12.07.2012
Kerala Agricultural University, Thrissur	Extended till 12.07.2012
Punjab Agricultural University, Ludhiana	Extended till 12.07.2012

Revised parameters for accreditation: Quantifiable six parameters with assigned weightages were developed for accreditation of the agricultural universities and their constituent colleges. These include- Infrastructure and Learning Resources; Faculty and Staff Strength, Development and Performance; Student Support and Progression; Governance and Financial Management; Academic Regulations and Curricula; and Performance Review, Output and Outcome. Each parameter has several key aspects. Each key aspect is supported by indicators which are guidelines for assessment. Parameters and key aspects are assigned differential weightages. Cumulative grade point average is to be arrived at by considering grade points of parameters and the key aspects. Accreditation is to be recommended on the basis of Cumulative grade point average.

Modernization of agricultural universities farms: The mega programme for supporting farm structures, facilities, implements and machinery continued and a sum of ₹ 156.70 crore to 48 agricultural universities was provided. In a Review Meeting of all the agricultural universities on May 24–25, 2010, the budget utilization vis-à-vis identified activities during the previous two years was reviewed and the specific activities for the current year were identified.

Development of university land and bringing uncultivated land under cultivation, construction of boundary wall/fencing, preventing land encroachments, better road connectivity, improved irrigation facility, better electrification, establishment, expansion and modernization of animal sheds, up-gradation/renovation of old laboratories/farm office buildings, establishment of diagnostic labs, veterinary clinics, creation of new research facilities like poly-houses and storage facilities for farm inputs and outputs, excavation and renovation of farm ponds for research and instructions in fisheries, construction of threshing floors and processing facilities for farm produces, establishment of solar lighting facilities utilizing non-conventional energy, and purchase of farm equipments like tractors, crop combine, sprayers, power tillers, rice cultivators etc. have taken place at AUs. These have resulted in facilitation of more experiments/demonstrations, greater mechanization and labour savings, reduced cost of cultivation, enhanced seed production of crops and fishes, increased cropping intensity, better disease diagnostic and treatment facilities for animals, protection of farm from blue bulls and other stray animals, increased yield due to mechanization, technologies and irrigation, increased farm income etc.

ICAR International Fellowships: The new component of ICAR International Fellowship introduced in 2009–10, for pursuing PhD programme at Indian AUs and Overseas Universities for Indian and overseas candidates, respectively with the objective to develop competent human resource and showcasing the strengths of Indian ICAR–AUs system continued. All the five

Indian candidates selected for fellowship during 2009–10 have joined programmes at universities abroad and 14 candidates were selected in the areas of Veterinary and Animal Sciences, Plant Biotechnology, Fisheries and Natural Resource Management for 2010–11.

India-Africa Fellowships: To support the Agricultural Human Resource Development in Africa through formal education of African scientists/faculty and students, the Government of India started offering 75 fellowships for MSc and PhD degree programmes in agriculture, for 4 years, with a total budget outlay of ₹ 29.84 crore. During this year under this scheme 75 candidates from 23 countries namely; Benin, Burundi, Cameroon, Congo, Egypt, Ethiopia, Gabon, Ghana, Kenya, Liberia, Malawi, Mauritania, Mozambique, Niger Republic, Nigeria, Rwanda, Somalia, Sudan, Swaziland, Tanzanian, Uganda, Zambia and Zimbabwe were selected and offered placement in 31 Indian AUs. Out of them, 43 from 19 countries have already joined their respective programmes in India and remaining are expected to join in second semester commencing January, 2011.

India-Afghanistan Fellowships: India decided to offer 115 fellowships, every year to the faculty members and fresh students of Afghanistan for pursuing MSc and PhD degree programmes in Indian AUs, for five years with a total budget provision of ₹ 37.26 crore to support agricultural human resource development in Afghanistan. During this first year, 21 candidates were selected for admission in 15 universities, out of which four have already joined their courses at four universities.

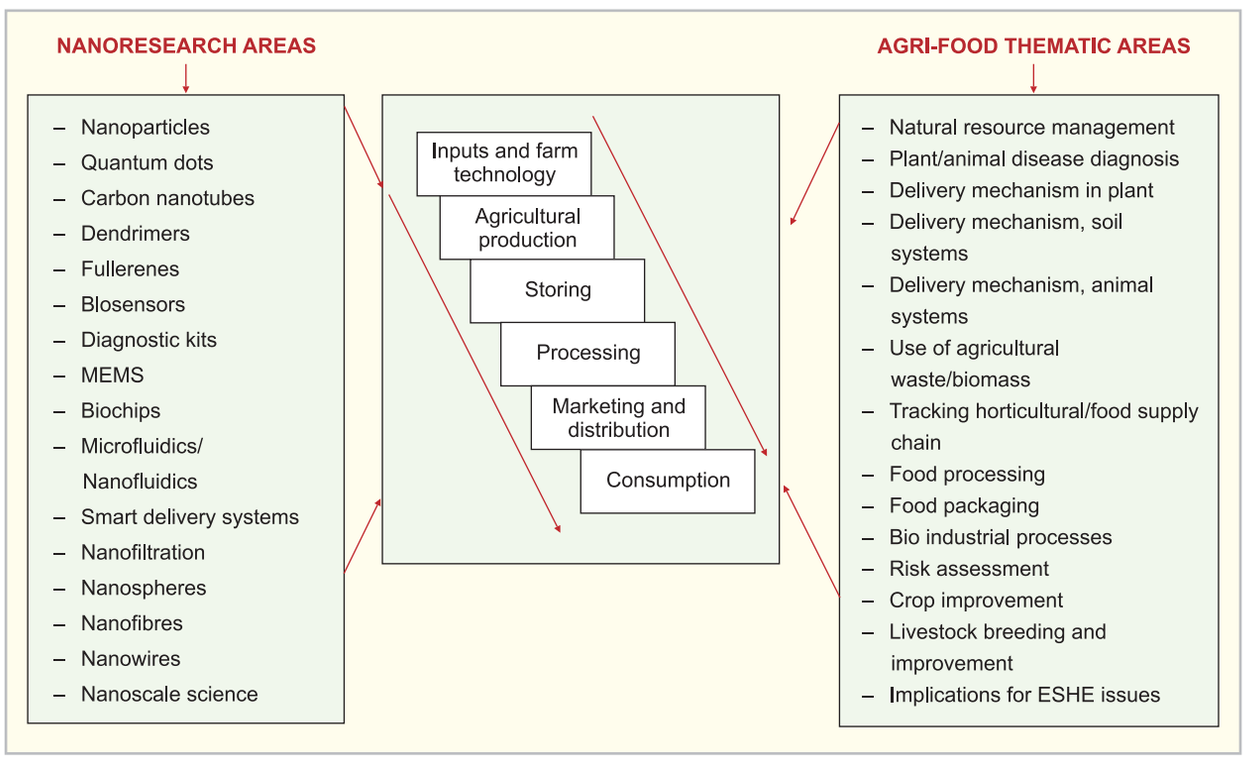
Coordination committee of ICAR deemed universities: For harmonizing the academic norms, regulations and systems in the four deemed universities of the ICAR, a meeting of this newly constituted committee was held in which the academic regulations including system of education, duration of programme, academic calendar, admissions and evaluation, credit requirements etc.; fee structure for students and rates of remuneration for external evaluation, and guidelines for adjunct, guest and part-time teachers, etc. were firmed up.

Liaisoning with other departments and academic institutions: Liaisoning with MHRD, AICTE, UGC, NCERT, CBSE, IAUA etc. was maintained to improve the quality of higher education in the country, in general and of agricultural education in particular through synergies and exchange of information.

NATIONAL ACADEMY OF AGRICULTURAL RESEARCH MANAGEMENT

Design and development of NAARM geospatial library: A prototype geospatial library to provide web-based access to geospatial data, services, and learning and knowledge resources to support agricultural research, education and technology transfer was designed. The prototype is based on data of the State of Andhra Pradesh. The NAARM Geospatial Library (NGSL) organizes spatial and attribute data, and knowledge resources in three main categories

- spatial data of soils, watersheds (sub, mini, micro watersheds), agroeco-subregions, agricultural markets, godowns, and other features
- Attribute data (for State, district, block, village levels) on different aspects of agricultural production.



Framework for integrating nanoresearch areas and agri-food thematic areas

- Learning resources (eg. training manuals for GIS and image processing software, and GIS applications in agriculture).

Design and development of geospatial village knowledge management system: A prototype Geospatial Village Knowledge Management System (GVKMS) was designed and developed to enable access by local village communities to spatial data of people and resources and support agricultural decision-making by rural communities. The GVKMS is a deployable windows application for Village Knowledge Centres (VKCs). While GIS software are used to create the spatial data layers relevant to the decision processes, at the VKC itself, there would not be any need to install complex GIS software.

The prototype has been validated and tested by installing it and demonstrating it in the village knowledge centre set up by an NGO, Sri Aurobindo Institute of Rural Development (SAIRD).

Nanotechnology for enhancing food security: A framework for assessment of the potential of nanotechnology for enhancing food security in India was developed. Agricultural productivity, soil health, water security, and food quality in storage and distribution were identified as the primary determinants of food security that can be impacted by developments in nanotechnology. The framework was developed in two stages: (i) mapping nanotechnology to thematic areas across the agricultural value chain, and (ii) from the thematic areas to the food security determinants. There is a need for investments in capacity building and development of an agri-nanotechnology infrastructure in India, and for *ex-ante* assessment of its implications for society.

Agribusiness knowledge centre: The NAARM conceptualized and put into operation, an Agribusiness Knowledge Centre (AKC) in Public-Private Partnership (PPP) mode. The AKC is the outcome of the felt need to create a platform that can provide a conducive ecosystem that will nurture and facilitate value-addition, business development and growth among the stakeholders across the agricultural supply chain. It consists of two components:

1. A physical component to house some of the stakeholders from the private sector, NGOs and farmer organizations at NAARM and provide knowledge services like training, data products, and others
2. A virtual component, called the Agribusiness Knowledge Exchange (AKX) to orchestrate the collaboration interactively and on-line to provided value-adding knowledge to the stakeholders.

Education: The year 2009–10 is a landmark year for NAARM as it embarked on and consolidated its role in management education. The following two one-year Post-Graduate Programmes were successfully completed:

- Post-Graduate Diploma in Information Technology Management in Agriculture (PGD-ITMA) with 24 students, and
- Post-Graduate Diploma in Intellectual Property and Technology Management in Agriculture (PGD-IPTMA) with 16 students.

All the graduating students were successfully placed in reputed national and multinational organizations. The year also saw the launch of the two-year Post-Graduate Diploma in Management (Agriculture) after approval by AICTE. The fist batch of students (24) was admitted in July 2009. The All India Admission Test (NAARMAT-2010) was successfully conducted for admission to the second batch of students in July 2010.

Capacity building: Capacity building is the primary mandate of the Academy. The Academy imparts training in the areas of research and education management, information and communication technology and administrative and finance management. Its clients include scientific and teaching community, administrative and finance officers, executives, and senior research managers of the ICAR and SAUs, which form major sub-systems of the National Agricultural Research System (NARS). The following programmes were organized:

Programme	No. of programmes	No. of participants
Foundation Course for Agricultural Research Service	4	279
Senior-level Programmes	24	654
Workshops	11	363
Executive Development Programme	1	16
International Programmes	2	4
Off-campus Programmes	11	265
Total	53	1,581

Under learning and capacity building component of NAIP, a total of 25 training programmes were organized. Two workshops, viz. Revitalizing Agricultural Education; and Interactive Dialogue-cum-Workshop on Technology Management and Commercialization in Agriculture were organized. Ten faculty members from NAARM were deputed for international training and study visits to Cornell University, University of Florida, University of California, Georgia State University, and University of Maryland in Agricultural Management. And also, 80 scientists of NARS underwent international training in frontier areas of research to IRRI, ICARDA, CIMMYT, and Universities in USA, Europe, Australia and New Zealand.

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