

12. Agricultural Human Resource Development

In order to address the challenges of agricultural growth and upgrading quality and relevance of higher agricultural education, the Education Division of the ICAR is undertaking various activities and programmes through partnership with the Agricultural Universities (53 AUs), Deemed-to-be-Universities (5 DUs) and Central Universities (4 CUs) with Agricultural faculties under the National Agricultural Research System (NARS). During this year, five new universities, viz. Kerala Veterinary and Animal Sciences University (KVASU), Pookudu, Kerala; Manyawar Shri Kanshiram Ji University of Agriculture and Technology, Banda (Uttar Pradesh); Uttarakhand University of Horticulture and Forestry, Bharsar, Pauri Gharwal (Uttarakhand); Bihar Agriculture University, Sabour, Bhagalpur; and Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar (Haryana), have been established by respective State Governments.

The division through the implementation of XI Plan Scheme, “Strengthening and Development of Higher Agricultural Education in India” strives for maintaining and upgrading quality and relevance of higher agricultural education. The scheme is primed to assist the Agricultural Universities (AUs) to plan, undertake, aid, promote and coordinate agricultural education in the country, by providing enhanced financial support. It has enabled these institutions in building excellence in specific strategic areas in education and research through Niche Area of Excellence (NAE), promoting holistic higher agricultural education by blending knowledge, skill and attitude through Experiential Learning Units, RAWE and such related aspects concerning infrastructural development and gender mainstreaming, capacity building of the students by providing various fellowships and faculty through summer and winter schools and training including overseas, rewards and recognition.

Coordination Committees of the ICAR Deemed Universities were organized to streamline various educational activities. Consultative committee meetings held with the Deans of various Faculties and Vice-Chancellors of AUs assessed various programmes under NARS and identified thrust areas for XII Plan.

The identified thrust areas under XI Plan continued to receive monetary support during this year also. Financial support to 30 ongoing sub-programmes and four new centres of Niche Area of Excellence (NAE) on - *Development of Bio-sensors for Diagnosis of Peste des petits ruminants (PPR) and Brucellosis; Metagenomic Analysis of Ruminant Microbes; Ornamental Fishes; and Pilot-plant Processing of Coarse Cereal Foods through Extrusion Processing;*

at IVRI, Izatnagar; AAU, Anand; KUFOS, Kerala; and IARI, New Delhi, respectively, for creating excellence in specific areas has been extended.

The Experiential Learning units numbering 264 were established at 51 AUs to provide experience-based and skill-oriented hands-on-training to the students, with the grant of 19 new units during this year. Financial support to develop five zonal sports complexes at Jorhat, Udaipur, Jabalpur, Hyderabad and Pantnagar, in addition to strengthening of sports facilities in 38 universities encouraged the students to build up sporting skills and national integration. Financial support for the construction of educational museums, hostels for boys, and girls and international students was extended to AUs.

The support to AUs for facilitating procurement of modern instruments and equipment to support undergraduate (UG) and post-graduate (PG) programmes, as well as enabling education ICT environment, multimedia learning resources etc. has been provided. Special grants to MPKV, Rahuri and SKUAST, Kashmir, and their constituent colleges for refurbishing/renovation of laboratories, classrooms and farms have also been allocated.

Of the total outlay of ₹ 421.95 crore for XI Plan period, the financial support of 383.98 crore has been provided under modernization of AU farms for bringing uncultivated land under cultivation, improving irrigation facilities, upgradation/renovation of old farm laboratories/farm office buildings, enhancing seed production of crops and increasing farm income, etc.

With an objective to promote excellence and capacity building of NARS, faculty development in cutting edge areas, upgradation of skills in emerging disciplines through Centres of Advanced Faculty Training and best teacher awards were implemented. For quality assurance three State Agricultural Universities, viz. SVVU, Tirupati; NAU, Navsari and SKUAST, Jammu, were visited and accredited during this year and 12 other AUs prepared self study report. Twenty-one new scientists were identified under the Emeritus Scientist Scheme as a structural method of utilizing Skill Bank of the superannuated professionals.

The Operational guidelines for National Professorial Chairs and National Fellowships have been revised for more functional autonomy and efficient execution, besides appointment of 16 new ICAR National Fellows. Centralized admission for 15% in UG (1,763) and 25% in PG (2,076) programmes at the AUs towards national integration and reduction of inbreeding has been pursued. A National Agricultural Education Project has been developed to bring systemic reforms and

Strengthening of infrastructure

The infusion of the development grant continued for the fourth year of the XI Plan, SAUs now have modern classrooms, laboratories with state-of-art equipment and internet facility for imparting higher education and postgraduate research. Funds were also provided for the construction of boys' and girls' hostels in the AUs, sports complexes with state-of-art indoor facilities including gymnasium, swimming pool in five zonal centres. Funding has helped in the renovation of living amenities in hostels. Strengthening of library with learning resources has given advantage to students and teachers for planning the research and preparation of teaching material by consulting the latest research journals and books both in the main campus and off-campus colleges and complemented the availability of journals under Consortium of e-Resources in Agriculture. Six textbooks have been developed for the students during this year. Construction of separate examination halls in the colleges has resulted in maintenance of requisite privacy and secrecy in conducting examinations. The education technology to support the students for their training and counselling has been strengthened. Being the International Year of Veterinary Science, workshops and brainstorming sessions were organized to prioritize the issues and initiate new programmes during ensuing plan.



Modern classroom with the state-of-art equipment and internet facility

institutional development in higher agricultural education with a view to increase the scope and effectiveness of networking in educational institutions and in enhancing reach for rural development education in the country.

In order to promote capacity building in emerging areas, 15 candidates including three foreign students were selected during 2011-12 under ICAR-International Fellowship and 11 candidates of last year also joined their Ph.D. study at overseas universities. Twenty-seven (18 Masters and 9 Ph.D.) African candidates have joined their degree programme in various Indian AUs under India-Africa Fellowship Programme to build up South – South co-operation. Admission of 51 Afghan national were also recommended to 21 Indian AUs under India-Afghanistan Fellowship programme. The first ASEAN-India Ministerial Meeting on Agriculture, held on 8 October 2011 in Jakarta, adopted the medium term plan of action (2011-15) for enhancing co-operation in agriculture and forestry.

Infrastructural development

Development and strengthening of agricultural universities: The development grant is the engine for meeting the expenditure on new civil works such as hostels to boys and girls and international students, renovation and refurbishing of buildings, annual maintenance of laboratories with consumables and equipment, smart classrooms etc. Financial support for course curriculum delivery, study tours, education technology cell, examination cell, students counselling and placement cell, faculty capacity building, sports facilities, etc has been continued with a grant of ₹ 216.24 crore, to 55 AUs in the financial year 2010-11. In addition, special grants of ₹ 7.50 crore to Mahatma Phule Krishi Vishwavidyalaya, Rahuri, and ₹ 1 crore to SKUAS&T, Srinagar were provided for strengthening the special programmes in these institutions.



International Students' Hostel, GKVK, Bengaluru

Organization of Agri-unifest and Agri-sports: Twelfth All-India Agri-unifest was organized by the Anand Agricultural University during 17-21 January 2011 and participants from 35 agricultural universities displayed diversity of talents and skills in depicting the rich cultural splendours of the country. The University of Agricultural Sciences, Bengaluru, bagged the overall championship trophy. Twelfth Agri-sports was organized at the Kerala Agricultural University, Thrissur, during 16-20 February 2011. More than 1,700 athletes from 43 universities participated in the meet. The Punjab Agricultural University (PAU) emerged as the overall champion.

Niche Area of Excellence (NAE): This programme is aimed at creating global competitiveness in agricultural education and research through excellence in teaching, research, consultancy and other services in specific fields. Financial support worth ₹ 14.2 crore to 30 ongoing sub-programmes was provided in the year 2010-11 based on the fifth annual review organized at the CSKHPKV, Palampur, on 26-27 May 2011. The salient achievements include:

- In the project, genetic engineering for developing crops-resistant to drought, validated seven genes for protein turnover and folding, eight transcriptional activators and eight genes related to oxidative stress. Novel genes were

characterized and technology for creating double haploids was developed.

- Centre of diagnostic kits for avian viral diseases were developed and validation of chicken anaemia virus antibody detection kit completed. For Marek's disease, diagnosis kit is being validated.
- Transgenic tomato plants with resistance to leaf curl virus through transformation with RNAi technology were developed.



Transgenic tomato plants resistant to leaf curl virus

- Agro-based nutraceuticals, viz. maltodextrin-enriched ice-cream, lycopene-enriched whey fruit juice beverage, curcumin-enriched flavoured milk, noni natural juice and concentrate were formulated. Functional fermented dairy products with synbiotics having good shelf-life were evaluated at AAU, Anand.



Maltodextrin-enriched ice-cream

- Low-cost post-harvest processing technology for storage, packaging of raw drug material of different medicinal and aromatic plants were standardized.
- Technology for production of major freshwater fishes for sustainable farming was standardized. The breeding season of Indian major and exotic carps was prolonged by improved water quality and feeding management. Standardized technology for commercial farming of tiger shrimp (*Penaeus monodon*) in inland-saline water was developed.

Entrepreneurship development: Experiential learning provide novel platform for meaningful hands-on-training and working in project mode, through end-

to-end approach aimed at promoting entrepreneurship skills. The Council has provided financial support for the establishment of 264 Experiential Learning units in 51 agricultural universities. Out of these, funds to the tune of ₹ 26 crore were provided for setting up 33 new units in 29 universities during the last two years. General guidelines for experiential learning course and some suggestive modules in Horticulture, Forestry, Fisheries, Dairy Science and Home Science have been further firmed up to provide clarity. The major new units include: Plant and animal health clinics, Modern dairy farm management and practices, Feed production and processing, Broiler and layer production, Post-harvest technology in sea food, Bio-input units, Package for farm equipment, Unit for bakery and confectionery products, Processing unit for pulses and oilseeds, Visual and graphic communications.

National Information System on Agricultural Education Network in India (NISAGENET): In the NISAGENET system, all the AUs have been added and the system has been made effective to enter/update and upload data from their respective university/colleges. To expedite data management activities from AUs, three Sensitization-cum-Training Workshops for the nodal officers of the NISAGENET were organized.

Consultative meet of Deans of Agricultural Universities: Second Consultative Meet of Deans of Agricultural Universities on the Impact of Development Grant provided under XI Plan Scheme "Development and Strengthening of Agricultural Higher Education" was held at Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during 12-13 August 2011 and the issues related to higher agricultural education were discussed to build up strategy for XII plan. The emerging areas for capacity building and the need for infrastructure support were identified through break-out sessions of each discipline.

Interactive meeting of key functionaries of AUs: In a special meeting of Vice-chancellors of AUs held during 26-27 September 2011, at New Delhi, the issues and concerns related to agricultural research, education and extension under NARS were discussed in detail and thrust areas and reforms to be undertaken during the XII Plan were discussed. The meeting also helped in solving issues during the interactive meeting with the Vice-Chancellors, key functionaries of AUs and officials of the ICAR. It was resolved that the universities would suggest areas and cross-cutting themes for developing appropriate strategy during the ensuing plan for ensuring enhanced productivity and livelihood security. In this context, it was suggested that interaction with the CGIAR institutions be also organized.

Manpower development

All-India Entrance Examination for Admission to UG and PG: For admission up to 15% seats in agriculture and allied subjects other than veterinary sciences, 16th All-India Entrance Examination for Admission to undergraduate degree programmes

(AIEEA-UG-2011) including the award of National Talent Scholarships (NTS) was conducted on 16 April 2011. In this examination, 34,741 candidates appeared and a record number of 1,763 candidates were finally recommended for admission in 49 Universities through counseling. All the candidates who joined a university falling outside their State of domicile were awarded NTS of ₹ 1,000 per month. For admission to 25% seats in PG programmes at 56 Universities, including award of ICAR Junior Research Fellowships, AIEEA-PG-2011 examination was conducted on 17 April 2011. A total of 19,413 candidates appeared in the examination and admissions were recommended to 2,076 candidates, out of which 472 students were awarded JRF in 20 major subject groups.

All-India Competitive Examination for ICAR Senior Research Fellowship for Ph.D.: A total of 186 Senior Research Fellowships were awarded and 561 candidates were declared qualified for Ph.D. admission without fellowship in 13 major subject groups and 56 sub-subjects through an examination held on 12 December 2010.

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 mostly African and Asian Countries (29) sought admissions in various agricultural universities.

Capacity building of faculty

Summer/Winter Schools and Short Courses: A large number of Summer and Winter Schools and Short Courses of 10-21 days duration at ICAR Institutes and State Agricultural Universities to train faculty in key areas of agriculture and allied sciences like Bio-informatics in agriculture, Application of Nanotechnology in agriculture, Bt-rice evaluation and deployment strategy, Detection of Bt gene and refugia management in cotton, Genome sequencing and microarray technique, Crop weather modelling, Fibre crop production, *In-vitro* toxico-dynamics, and Bio-fuel production from natural resources were organized.

Centres of Advanced Faculty Training: The 31 Centres of Advanced Faculty Training have been strengthened for continuing capacity building of scientific faculty and upgradation of their skills with the changing scenario in cutting edge areas of agricultural and allied sciences. Accordingly, 745 scientists/faculty members from the National Agricultural Research System were benefitted. The various training programmes were strengthened by sending experts at each locations.

Promotion of excellence and HRD

ICAR National Professor Scheme: For promoting excellence and creating a culture of basic research at national level, 10 positions of National Professors have been created. Major achievements of ICAR National

Professors comprised:

- *Designs for single factor and multi-factor experiments and their applications in Agricultural Systems Research:* Extended multi-level $E(\chi^2)$ -optimal supersaturated designs (SSD) have been obtained by adding runs to an existing $E(\chi^2)$ -optimal multi-level SSD. A lower bound to $E(\chi^2)$ has been obtained for the extended SSDs. The contents of Design Resources Server have been strengthened by adding catalogues along with the layout of k -circulant multi and mixed level, extended multilevel SSDs and a method of identifying subset of outliers in presence of masking has been developed for designed experiments.
- *Technologies development for subsoil structure modification, deep placement of fertilizers (P & K) and micro-nutrients and controlled field traffic for different cropping systems of Indo-Gangetic Plains:* An innovative machine named as 'Pant-ICAR Subsoiler-cum-Differential Rate Fertilizer Applicator' developed and being patented has now been commercialized. For soil cultivation between two consecutive subsoilings, another machine, i.e. 'Pant-ICAR Conservation Tillage Combine' has also been developed.
- *Plant-need based nitrogen management in rice and wheat:* Site-specific real-time fertilizer nitrogen management strategies have been developed and standardized for rice and wheat using gadgets like leaf colour chart, chlorophyll meter and Green Seeker optical sensor and have been tested on-farm.
- *Allele mining for agronomically important genes in wild rice germplasm and stress tolerant landraces of rice growing in the hot spots:* Ninety-nine accessions of wild rice and 20 accessions of rice landraces were collected from 11 districts of the Southern part of Eastern Uttar Pradesh and documented.



Wild rice plant in its natural habitat and the seeds (right)

- *Soil organic carbon in relation to land use in two agro-climatic zones of Punjab:* Significantly higher concentration of microbial biomass carbon occurred in soils under agroforestry and maize-wheat compared to rice-wheat cropping systems. The labile C fractions constituted about 60% of total organic carbon in soils under agroforestry compared to only about 37% in soils under rice-wheat.
- *Broadening the genetic base of Indian mustard (Brassica juncea) through alien introgressions*

and germplasm enhancement: Two new sources of cytoplasmic male sterility developed in *B. juncea* by alloplasmic substitution of *B. juncea* genome in cytoplasmic background of *B. fruticulosa* and *Erucastrum*. Excellent variation for aphid resistance was recorded in *B. juncea* introgression lines over two years under field conditions, emphasizing heritable nature of *fruticulosa* resistance.

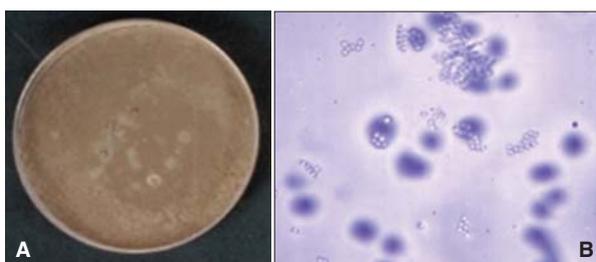
- **Design, construction and validation of DNA chips for virus identification and differentiation:** A list of all the viruses affecting animals reported from India was compiled and vetted. Two microarray chips for India specific animal virus were designed and tested.

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 have been provided in National Agricultural Research System. 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:** A heat shock protein gene *hsp 22.4* of 630bp identified in potential strains of *C. globosum* has been cloned and sequenced. The sequence obtained was analyzed and a 606bp open reading frame (ORF) having 202 amino acids was identified using the ORF finder program.
- **Decontamination of pesticide residues from edible commodities:** A new combination of edible alkali (0.5% solution of edible alkali with 0.1% solution of oxidizing agent) has been developed as a successful decontaminant (92%) of Malathion from contaminated vegetables. A microorganism identified as *Burkholderia cepacia*, for degradation of pesticides (Imidacloprid and Metribuzin) was isolated and sequenced data submitted to the GenBank.
- **Assessment of sustainability of treated/developed watersheds in rainfed agro-eco-sub-regions of**

Peninsular India using GIS and remote sensing: A spatial component with the use of a *spatial analyst tool* called *Raster Calculator* was added to the multidisciplinary study to evaluate 12 critical indicators identified through empirical studies in assessing impact of watershed development projects in rainfed regions for achieving agricultural sustainability.

- **Development of unique *P mobilizers* in arid-ecosystems:** A phosphorus (P) mobilizing fungus, *Penicillium purpurogenum* was developed from arid soils. Seed inoculation with the fungi has significantly improved phosphatases (acid and alkaline), phytase and dehydrogenase activities compared to un-inoculated fields.

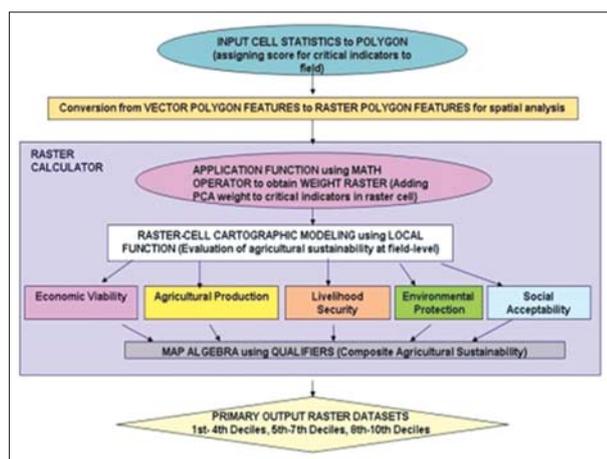


Phosphorus mobilizing fungus *Penicillium purpurogenum*. A, Culture in petriplate; B, spore of *Penicillium purpurogenum*

- **Development of ELISA based immunodiagnostics for Classical Swine Fever:** Produced and characterized monoclonal antibodies (mAbs) against a local isolate of classical swine fever (CSF) virus of subgenogroup 1:1. Lapinized vaccine strain of CSF virus has been adapted in PK-15 cell line and standardized the virus titre for using as a vaccine against CSF. More than 1,200 pigs were vaccinated with trial doses of the vaccine and the antibody response of the vaccinated pigs was determined by ELISA tests.
- **Assessment of soil quality key indicators for development of soil quality index under predominant management practices in rainfed agroecology:** Key soil quality indicators along with their per cent contribution towards soil quality in rainfed sorghum based system in black soils at Solapur dryland centre were identified.
- **Evolution of textile articles through processing of wool with silk waste and cotton to create entrepreneurial skills in rural women:** Different methods for fibre processing, i.e. scouring of wool, degumming of silk (eri and muga) and bleaching of both wool and silk and physio-chemical properties were analyzed to find out the best processing method.

Emeritus Scientist Scheme: The ICAR continued to operate Emeritus Scientist Scheme as a structural method of utilizing Skill Bank of the outstanding superannuated professionals of the NARS. Some of the major projects and their salient achievements include:

- Manuals developed on “Design of Experiment” and “Statistical Methods for Agriculture and



Evaluation of sustainability at Watershed-level using Raster Calculator

- Animal Sciences” for teaching of Statistics,
- Explored safer approaches to pest management by isolation of bioactive molecules from lichens,
 - Developed processing techniques for well acceptable cured and smoked chicken with shelf of 3 weeks and 3 months in refrigerated and frozen storage,
 - Developed methodology to screen and identify high sugar and high yielding sugarcane genotypes with field tolerance to red rot disease,
 - Studied physiology of drought and high temperature stress tolerance in chickpea,
 - Developed protocols for processing of small millets for nutri-rich value added products,
 - Reviewed present status of marine Crustacean aquaculture in India,
 - Profitability increase of rice-wheat cropping system by introduction of short duration cowpea as summer crop.

Quality assurance and reforms

Accreditation: Quality assurance in higher agricultural education was pursued through accreditation of agricultural universities, their constituent colleges and programmes. Three universities, viz. Sri Venkateswara Veterinary University, Tirupati; Sher-e-Kashmir University of Agriculture and Technology, Jammu and Navsari Agricultural University, Navsari, were visited and accredited during the year. Self Study Reports of 12 other SAUs were prepared for accreditation.

Revision of Experiential Learning Guidelines and Developing EL Modules: On the recommendations of the review workshop of the Experiential Learning (EL) Programme held during 27-28 October 2010 at UAS, Dharwad, massive exercise was carried out to develop the course structure, operational modalities, and evaluation procedure, etc. for the EL courses in consultation with experts and Deans of various faculties. The Committee has developed the general guidelines for experiential learning course and some suggestive modules in the disciplines of Horticulture, Forestry, Fisheries, Dairy Science and Home Science.

Modernization of AU farms: The SAUs could modernize their farms and upscale the development in terms of construction of housing structures for cattle, sheep, piggery and bullocks, fish ponds, construction of necessary farm structures such as drying yards, threshing yards, seed storage house and polyhouse, green house, digging tubewells, and installation of modernized irrigation system like sprinkler irrigation and drip irrigation, etc. with the financial support of 383.98 crore, in three years. With this support, SAUs have made enhancement in cropping intensity, fodder production and milk production with procurement and utilization of latest farm implements/ equipments like, power tillers, tractors, combine harvesters, levelers, rotovators and milking machine, etc.

ICAR International Fellowships: During 2011-12, a total of 15 candidates including two from Egypt

and one from Sudan, were selected in the areas of Animal Science, Fisheries, Agro-forestry, Crop Science, Horticulture, Food Processing and Natural Resource Management. Out of 13 candidates selected during 2010-11, eleven candidates have already joined their Ph.D. study at overseas universities.

India-Africa Fellowships: To support the agricultural human resource development in Africa, this year 27 candidates (18 Master and 9 Ph.D.) from 16 African countries have joined their respective programmes in 17 Indian Agricultural Universities.

India-Afghanistan Fellowships: To strengthen and expedite the process of human resource development in Afghanistan, India is offering 40 fellowships (25 for M.Sc. and 15 for Ph.D.) to the faculty members and 75 fellowships (50 for M.Sc. and 25 for Ph.D.) to the fresh students (total 115) every year for higher studies in Indian AUs. A total of 51 applications (50 for M.Sc. and 1 for Ph.D.) of Afghan nationals have been recommended for admission in 21 Indian AUs.

ASEAN-India Co-operation in Agriculture: The first ASEAN-India Ministerial Meeting on Agriculture was held on 8 October 2011 in Jakarta. The meeting was Co-Chaired by Shri Sharad Pawar, Hon'ble Union Minister of Agriculture and Food Processing Industries, and Dr Suswono, Minister of Agriculture, Indonesia. In the meeting, the Terms of Reference and the Medium Term Plan (2011-2015) as developed in the first meeting of ASEAN-India Working Group on Agriculture held during 29-31 January 2011 at New Delhi, were adopted. The Plan of Action is envisaged to enhance co-operation in agriculture and forestry between ASEAN and India with a view to meeting challenges of food security; exchanging information and technology, creating farmers awareness and interaction, cooperating on research and development projects, encouraging agriculture and forestry-related industries, and to strengthen human resources development.

Conference of Vice-Chancellors of Agricultural Universities and Interface with ICAR Directors: The Vice-Chancellors Conference followed by Interface of Vice-Chancellors Agricultural Universities and ICAR Directors was held during 21-23 February 2011. In his inaugural address Shri Sharad Pawar, Hon'ble Union Minister for Agriculture and Food Processing Industries,



Conference of Vice-Chancellors of Agricultural Universities and Interface with ICAR Directors

emphasized the need to strive to be models of full round excellence creating institutions of global standards. He also mentioned that degradation of natural resources and unpredictable shifts in climate patterns have been impacting the farming practices. The conference was attended by Vice-Chancellors of all AUs, Senior Officials of ICAR, Directors and Project Directors of ICAR institutes and some invited distinguished guests. The Director General, ICAR, besides highlighting the Council’s successful efforts in developing improved crop varieties, quality seed production and supply, various production technologies, and improving quality of agricultural education, briefly mentioned the initiatives on launching climate resilient agriculture, strengthening scientist-farmer interaction and delivery of knowledge at farmers’ doorstep.

National Academy of Agricultural Research Management

The thrust of the Academy’s activities remained on three broad fronts, viz. capacity building, research and policy support, and Post Graduate education.

Capacity building: The Academy organized 50 programmes, which included 3 Foundation Courses for Agricultural Research Service (FOCARS), and 47 other senior-level training programmes to 1,682 participants. The programmes covered themes like Leadership development for promoting agricultural innovation; Developing winning research proposals; Priority setting, monitoring and evaluation of research; Geospatial knowledge management; Multimedia content development; Developing e-learning systems; Intellectual property management and technology commercialization; Data analysis with SAS; Seed management; and others.

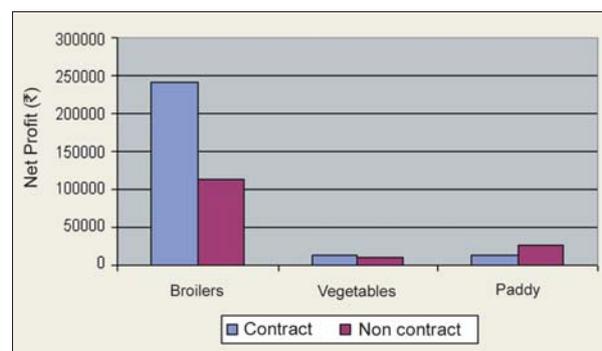
Further, under the Learning and Capacity Building project of NAIP, the training of about 320 professionals from ICAR, SAUs, and Agribusiness and NGO sectors in three partner institutions IIM, Lucknow, MANAGE and NIRD was facilitated, besides international training of nearly 200 scientists of NARS in frontier areas of science under the project.

Research and policy support: The research projects in five thematic areas: (i) Agricultural science and technology policy, (ii) Accelerating agricultural innovations through ICTs and institutional change

(iii) Organization and management for strengthening agricultural research, (iv) Agri-marketing and value chain management, and (v) Governance and institutional arrangements were operative. The faculty of NAARM has also published 39 papers in peer reviewed journals, 6 books and 11 book chapters, besides 52 other publications. Some of the key outputs for the year are summarized:

(i) Institutional innovations in agri-supply chains:

Contract poultry farming: New institutional and innovation methods adopted by the producers involved in contract and non-contract farming were studied to



Net profit of contract and non-contract producers

assess how they help reduce transaction and marketing costs for the producer and increase profits.

(ii) Assessment of future human capital requirements in agriculture and allied sectors: A system dynamics model has been developed for forecasting supply-demand scenario of agricultural manpower requirement in different sectors in India.

(iii) Mapping vulnerability of rural livelihoods and application of spatial data mining tools to vulnerability assessments: A framework that integrates the sustainable rural livelihoods framework of DFID into a GIS platform was developed to map heuristically derived vulnerability indicators and indices for 59 mandals/blocks of Nalgonda district in Andhra Pradesh based on livelihood assets data.

(iv) Policy support: Policy interaction workshops, conferences and seminars were organized at the Academy on several issues of concern for national and international policy in agriculture, viz. Agribusiness

Current availability of manpower in various disciplines and projections for 2020

Discipline	UG		PG		Ph D		UG and above	
	2010	2020	2010	2020	2010	2020	2010	2020
Crop Science	11,852	18,659	3,514	5,422	583	1,203	15,949	25,284
Horticulture	1,001	7,295	409	993	55	330	1,465	8,618
Veterinary	1,761	5,332	797	1,854	125	486	2,683	7,672
Fisheries	285	2,096	109	418	30	100	424	2,614
Dairy	255	2,605	30	503	25	207	310	3,315
Agri Biotech	558	582	156	323	20	134	734	1,029
Agri Engineering	1,218	2,359	262	709	27	189	1,507	3,256
Forestry	386	1,260	275	416	55	156	716	1,832
Total	17,316	40,188	5,553	10,638	920	2,805	23,788	53,630



knowledge exchange, use of fly ash in agriculture, redesigning agricultural extension in India, leadership development in NARS, small holder livelihoods, manpower planning for agriculture, and prospects for nanotechnology in agri-value chain.

Education

(i) *Post Graduate Diploma in Management (Agriculture)*: Seventeen students were admitted to the third batch of 2-year PGDM (Agriculture) on the basis of All India Joint Entrance Test (JET-ABM) conducted with MANAGE and NIAM, group

discussions and interviews. The first batch graduated in April 2011. All the students of the first batch were placed successfully in reputed organizations.

(ii) *Post Graduate Diploma in technology management in Agriculture (PGDTMA)*: The NAARM and the University of Hyderabad initiated a joint one-year Post Graduate Diploma in Technology Management in Agriculture (PGDTMA) in Agriculture during the year in Open Distance Learning (ODL) mode. And 128 students have been admitted to the first batch of the course. ■