

Agricultural Human Resource Development

Experiential Learning Units deal with 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 faculty through training, overseas scholarship, rewards and recognition etc.

The National Academy of Agricultural Research

Quality Higher Agricultural Education

In the ICAR the Education Division strives for maintaining and upgrading quality and relevance of higher agricultural education. The thrust areas identified under XI Plan continued to receive financial and monitoring support. One additional sub-programme of Niche Area of Excellence was added to the continuing list of 29 such sub-programmes. The Experiential Learning units were further augmented now totaling 220 units. To maintain the targeted number of emeritus scientists under the Emeritus Scientists Scheme, filling the vacant slots is now under progress. Financial support for the construction of museum and girls' hostels and international hostels has been extended to AUs. The overall financial and academic support to AUs continued for facilitating modern instruments and equipments to support post-graduate (PG) education and research, ICT environment, multimedia learning resources etc. Special grants announced by the Government from time to time have been continued to support high-performing universities and their colleges for refurbishing/renovation of laboratories, class rooms and farms. Under HRD programmes/activities, faculty development, trainings through CAS, CAF, Best Teacher Awards, Fellowships and Scholarships were continued. An additional position of National Professor named "*Norman Borlaug Chair in Agricultural Biotechnology for Crop Improvement*" has been created in the specific field of agricultural biotechnology for crop improvement.

Management (NAARM), a constituent component of the Division, complements in capacity building of the National Agricultural Research System (NARS). In addition, targeted capacity building of the scientists and teachers has been reinforced through Indo-US Agricultural Knowledge Initiative (AKI) by the Division.

Development and Strengthening of Agricultural Universities

Under budget estimate, a development grant of Rs 367 crore for all AUs and Rs 3 crore to NAARM, Hyderabad, were extended. The Special Grants comprised: (i) Rs 73.37 crore out of the total grant of Rs 100 crore to Mahatma Phule Krishi Vishwavidyalaya, Rahuri, (ii) Rs 4.99 crore to Tamil Nadu Agricultural University, Coimbatore, and (iii) Rs 5 crore to GB Pant University of Agriculture and Technology, Pantnagar. In addition, Centenary grants were also awarded to Rajendra Agricultural University, Pusa (instalment for this year: Rs 15 crore), Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola (instalment for this year: Rs 12.69 crore) and Chandra Shekar Azad University of Agriculture & Technology, Kanpur (instalment for this year: Rs 14.28 crore).

Infrastructure Development

The foundation stone was laid by Dr Mangala Rai, Secretary, DARE and Director-General, ICAR on 10 April 2009 at CIFE, Mumbai, for Boys' Hostel and Sports complex. At University of Agricultural Sciences, Bangalore, construction of greenhouse at Horticulture College, Mudigere and laboratory building for commercial production of bio-agents at Agricultural College, GKVK, Bengaluru have been initiated. At Navsari Agricultural University, Gujarat, onion dehydration plant, commercial biofertilizer and banana pseudo-stem fibre extraction units were established.

In the Divisions of Indian Agricultural Research Institute, New Delhi, PG laboratories were upgraded and the lecture halls have been modernised by adding audio-visuals, LCD projectors and multi-media systems. Computer facilities have been improved. Internet facility for PG students has been provided at the hostels and guest-houses for trainees and visiting faculty. The Wi-Fi system has been created in students' hostels. The Post Graduate School Calendar which contains PG School rules and courses and their contents has been put on IARI website in Hindi and English. Laboratory manuals were prepared in the teaching disciplines for practical courses. A 'Student Career Development and Industry Interface Centre' has been established for career counselling and arranging frequent institute-industry interface.

At the College of Home Science, GBPUAT, Pantnagar, blending and spinning laboratory and visual ergonomics laboratory have been developed from ICAR Development grant. At the College of Agribusiness Management, a new complex consisting of classroom and faculty chambers, conversion of a classroom into smart classroom and setting of video conference facility have been completed. The College of Horticulture, Bharsar added five lecture rooms and eight laboratories, one hostel each for girls and boys. In the Department of Food Science and Technology, construction of a building for housing soya milk and extruded products has been completed and an oil-fired boiler and jacketed kettles have been installed. At the College of Forestry and Hill Agriculture, Ranichauri, renovation of biocontrol laboratory, culture room for micro-propagation, furnishing of seminar hall, classrooms and hostels has been done. Construction of new girls' hostel, seed processing unit, and data processing laboratory has been completed.

Extensive civil work worth Rs 4.61 crore such as construction of third floor of new administrative



Dr Mangala Rai, Secretary, DARE&DG, ICAR laying foundation stone of the Boys' Hostel at CIFE, Mumbai

building, Ph.D. students' hostel for men, laboratory block for Institute of Organic Farming, post-harvest technology building at RHSC complex and food processing unit was undertaken by UAS, Dharwad.

At Orissa University of Agriculture and Technology, Bhubaneswar, extension of girls' hostel at Bhubaneswar, examination hall of College of Agricultural Engineering and Technology, renovation of buildings of College of Home Science, College of Agricultural Engineering and Technology, central library, conference hall, IPR Cell, boys' hostel of College of Agriculture at Chiplima and university main building have been done utilizing the share of ICAR grants.

International hostels/girls' hostel: Thirty-seven international hostels are under construction in 37 AUs during this year with an ICAR budget outlay of Rs 1,390 lakh. A grant of Rs 2,252 lakh was allocated for the construction of 63 girls' hostel in 48 AUs.

Special grants: A grant of Rs 4,197 lakh was allocated to Sabour College under RAU, Pusa; Nagpur College under PDKV, Akola, and Kanpur College under CSAUAT, Kanpur.

Educational museum: A grant of Rs 1,330 lakh has been extended for construction of one museum each in 38 SAUs.

Zonal sports complex: The budgetary allocation of Rs 170 lakh for North zone, Rs 180 lakh for East zone, Rs 200 lakh for West zone, Rs 190 lakh for South zone and Rs 140 lakh for Central zone was made for the development of sports complexes including one crore grant for each zonal centre (GBPUAT, Pantnagar; AAU, Jorhat; MPUAT, Udaipur; ANGRAU, Hyderabad, and JNKVV, Jabalpur).

Capacity building

Niche area of excellence: To strengthen and build excellence in human resource in research and education, the sub-programme of niche area of excellence was started in the X Plan with a view to providing optimal resources for most relevant, appropriate and applicable output and impact. About 30 sub-programmes are operational in diverse areas, focusing on sustenance of quality of natural resources through diversification and productivity enhancement. For this, an initial allocation of Rs 15.10 crore was made. Third Annual Review Meeting was held at BAU, Ranchi, during 28-29 October 2009.

The salient achievements made by these centres are given here. Three centres, viz. BCKVV, Mohanpur, YSPUHF, Solan and MPKV, Rahuri have uploaded their work in the university websites attracting many site visits.

At Anand Agricultural University (AAU), Anand, under 'Functional fermented dairy products

with synbiotics', two new products, viz. synbiotic whey drink with orange juice and synbiotic *lassi* with carrot juice were successfully formulated for the first time.

At Acharya NG Ranga Agricultural University (ANGRAU), Hyderabad, under 'Research and capacity building for improving water productivity in agriculture', there was saving of 37% water in aerobic rice as compared to transplanted rice.

At Assam Agricultural University (AAU), Jorhat, under, 'Enriched organics for sustainable agriculture', the centre has enriched its repository of mother cultures of *Azotobacter*, *Azospirillum*, *Rhizobium*, phosphate solubilizing bacteria (PSB) and biofertilizers along with 15% *Azolla* compost, 17.5 tonnes optimal compost, 13 tonnes biofertilizer based organics and 15 tonnes enriched compost.

At Birsa Agricultural University (BAU), Ranchi, under 'Sustainable soil, water and plant nutrient management for rainfed cropping system', soil microbial biomass carbon and nitrogen, potentially mineralizable nitrogen and labile carbon in acidic soils improved with liming and organic manuring with recommended level of NPK fertilizer application in continuously cropped soils.

At Bidhan Chandra Krishi Vishwa Vidyalaya (BCKV), Mohanpur, under 'Arsenic management options including organic agricultural systems in West Bengal', the multi-drug and Toxic Compound Extrusion Transporter (MATE) might be a candidate gene, whose restricting arsenic loading in the rice grain was elucidated.

At the Central Institute of Fisheries Education (CIFE), Mumbai, under 'Utilization of inland saline and sodic soil for aquaculture', the tiger shrimp (*Penaeus monodon*) could be cultured economically in inland saline area; production of 1,332 kg/ha in 105 days achieved with potassium fortification proving that it is an economically profitable activity.

Culture of banana shrimp (*Fenneropenaeus merguensis*) and kuruma shrimp (*Marsupenaeus japonicus*) indicated that these can be cultured in inland saline areas with potassium fortification; as these species attain maturity under pond condition.

At Chandra Shekhar Azad University of Agriculture and Technology (CSAUAT), Kanpur, under 'Bio-intensive IPM strategies for major pest and disease problems of Uttar Pradesh', out of 5 modules developed and validated, the following bio-intensive IPM module was found to be the best in 22 districts of UP (Central and Eastern UP) on chickpea, pigeonpea and lentil, resulting in high benefit-cost ratio as well as minimal plant infection and pod damage due to pod-borer and pod-fly and wilt-root rot incidence.

At Deen Dayal Upadhyaya Veterinary and Animal Science University (DDUVASU), Mathura, under 'Rural livestock production augmentation

through disease monitoring and health intervention', characterization and confirmation of candidate strains for development of IBR virus marker vaccine and diagnostics, detection of genomic diversity of Rota virus in human and animal origin strains and development of quick detection PCR was done. Antiviral activity of 10 medicinal plants selected was tested on IBR virus (BHV-1) FMD Virus and Rotavirus.

At Govind Ballabh Pant University of Agriculture and Technology (GBPUAT), Pantnagar, under 'Quality production of major freshwater fishes for sustainable farming', international level education delivery and research facilities have been developed in freshwater aquaculture under the programme.

At Indian Veterinary Research Institute (IVRI), Izatnagar, under 'Veterinary biologicals', development of small ruminant vaccine, viz. sheep pox, ORF disease, high passaged goat pox and thermo-resistant PPR virus vaccine and their successful field validation, technology assessment of goat pox vaccine for licensing to commercial houses and development of platform technologies (recombinant protein and DNA based) for pox viruses, PPR virus, and *Texoplasma gondii* (Zoonotic) was done.

At Jawaharlal Nehru Krishi Vishwa Vidyalaya (JNKVV), Jabalpur, under 'Conservation, cultivation, processing and quality evaluation of medicinal and aromatic plants', resource generation through selling of quality medicinal and aromatic plant material, providing technical know-how to growers, NGOs, Ayurvedic and pharmacy college for cultivation and processing and Comprehensive Database of Medicinal and Aromatic plants species of Madhya Pradesh were prepared under transfer of technology programme.

At Marathwada Agricultural University (MAU), Parbhani, under 'Development of agrobased nutraceuticals for health security', the potential nutraceuticals like lycopene from tomato, bixin from annatto, curcumin from turmeric, carthamin from safflower, maltodextrin from corn starch, isoflavones from soybean and other bioactive compounds from noni fruits were processed from agro-based resources as fortifying agents to enrich need-based food products as functional foods.

At Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri, under 'Protected floriculture and vegetable production', manpower was developed and trained through trainings for 88 farmers in small cluster and 50 agriculture diploma students. Out of these 26 farmers and six students have started their own polyhouses for cultivation of flowers or vegetables, whereas rest of the students resumed jobs.

At National Dairy Research Institute (NDRI), Karnal, under 'Buffalo production and reproduction

genomics', major genes involved in maternal to embryonic transition during embryonic development in buffalo were identified. Expression pattern of these genes helped to modify the existing IVF procedure in buffalo, for better success rate.

At Orissa University of Agriculture and Technology (OUAT), Bhubaneswar, under 'Management of acid soils for sustainable crop production', integrated use of lime @ 0.2 LR and Boron @ 1 kg/ha to each crop increased the yield and nutrition of cabbage – okra – cowpea cropping system followed in acid soils. Integrated application of lime @ 0.2 LR and sulphur @ 40 kg/ha as gypsum/phosphogypsum increased the yield and quality of groundnut crop.

At Punjab Agricultural University (PAU), Ludhiana, under 'Soil and water resource management in high intensity cropping regions', a programme package called soil testing-based fertilizer recommendation (acronym STFR) has been developed for soil fertility evaluation and making fertilizer recommendation. This programme has been put in practice in soil and water testing laboratory.

At Sher-e-Kashmir University of Agriculture Science and Technology (SKUAST), Kashmir, under 'High value temperate horticultural crops of Kashmir valley', course curriculum developed for teaching at UG and PG level for proficiency upgradation in niche crops (walnut, almond, cherry, saffron and *Kala zeera*).

At Sardar Vallabh Bhai Patel University of Agriculture and Technology (SVBPUA&T), Meerut, under 'Isolation, characterization of production of bioagents', indigenous populations of egg parasitoids (*Trichogramma* spp), entomopathogenic bacteria (*Bacillus thuringiensis* and *Photorhabdus luminescens*), entomopathogenic nematodes (*Heterorhabditis indica* and *Steinernema asiaticum*), Baculovirus of *Pieris brassicae*, granulosus virus (CPb GV) were isolated and identified based on morphology, biochemical tests and DNA finger print.

At Tamil Nadu Veterinary and Animal Sciences University (TNVASU), Chennai, under 'Molecular diagnostics for emerging avian viral diseases and their immunopathogenesis', whole genome sequencing of Newcastle disease virus isolated has been completed from three isolates for the first time in the country.

At University of Agricultural Sciences (UAS), Bengaluru, under 'Integrated drought management with emphasis on genetic engineering for developing crop plants resistant to abiotic stresses', since stress-specific DNA library of finger millet is diverse, several up-stress regulating genes were validated that are potential candidate genes to improve stress tolerance in crop plants.

At University of Agricultural Sciences (UAS),

Dharwad under 'Microbial biotechnology for imparting resistance in plants against insect pests and pathogens', plant transformation vector carrying two genes each 42 encoding chitinase and B-1, 6 endoglucanase gene from *Trichoderma virens* have been developed.

At Dr Yahwant Singh Parmar University of Horticulture and Forestry (YSPUHF), Solan, under 'Technology for sustainable apple production' budwood bank of nine cultivars of apple were developed. Among various horticultural mineral oils (HMO's) to control red spider mite, Rilso @ 1.5% was most effective, followed by orchol-13 and HP-summer oil.

Experiential learning: A total of 220 units are being operated in 45 AUs. These units greatly help 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. Salient achievements specific to some universities are as follows:

At Rajasthan Agriculture University (RAU), Bikaner, vermicompost unit was developed from ICAR grant (Rs 80 lakhs) and production of vermicompost was started.

At University of Agricultural Sciences (UAS), Dharwad, crushing equipments and their transesterification units for the purification of crude oil extracted from bio-fuels and a model pilot plant have been procured and installed. Seeds from plantations have also been procured and demonstrated to the UG students. Efforts were being made to use the bio-fuels produced for running the vehicles of the university. The ICAR grant of Rs 15 lakhs to the Department of Textiles and Apparel Designing for the construction of laboratory unit- 'Garment Manufacturing and Value Addition Technology' under Experiential Learning during 2006-07 was put to good use in imparting hands on training for UG students (2+2 Syllabus) in the most challenging fields, viz. garment manufacturing, design studio practices, value addition technology, traditional and contemporary surface ornamentation and fashion accessories. Department of Food Science and Nutrition utilized the ICAR grant of Rs 21 lakh for the purchase of wet and dry processing equipments to establish 'Food Processing and Value Addition units' under Experiential Learning in the year 2006-07 to impart hands on training to UG students. More than 250 processing equipments have been purchased to ascertain product development, value addition and for utilization of grains,

vegetables and fruits, and dairy products.

At Kerala Agricultural University (KAU), Thrissur for protected cultivation of high value horticultural crops like cut-flowers, cut-foilage, pot plants and cool season vegetables, two fan and pad systems of dimension 320 m² each and two open ventilated rain shelters of dimension 384 m² each were constructed. This facility will be used for the purpose of training students on raising various categories of high value horticultural crops.

At the College of Forestry and Hill Agriculture, GBPUAT, Pantnagar eight new courses under Experiential Learning have been developed and included in the graduation requirements of B.Sc. Forestry degree programme, viz. production and management of nursery stock, production and management of medicinal and aromatic crops, post-harvest technology of edible wild crops, soil quality analysis, handling and testing of forest seeds, diagnosis of forest pest and their management, application of GIS in forest resources management and environment impact assessment.

At the College of Agriculture under Junagadh Agricultural University, Junagadh requisite faculties on "Microbial pesticides production unit" have been set up utilizing ICAR grant for imparting hands on training on production and processing NPV against *Helicoverpa* and *Spodoptera* and fungal bio-insecticides like *Beauveria* and *Verticillium* spp.

At the College of Horticulture, Dr Y.S. Parmar University of Horticulture and Forestry Nauni, Solan, the ICAR share to the tune of Rs 55 lakhs was utilized for the construction of poly-houses, packaging house, irrigation system, farm store and polythene tunnels. A modern nursery with two polyhouses and one field laboratory equipped with cold storage, laboratory for students under College of Forestry was also established.

Ninety students of College of Agriculture, Orissa University of Agriculture and Technology, Bhubaneswar were imparted training for handling bee boxes, queen rearing techniques, purification of honey for safe storage and acquainted with the functions of honey processing plant. Under hands-on training on production and processing of mushroom, these students produced 330 bottles of spawn of straw mushroom and 22.5 kg fresh mushroom. They were also acquainted with mushroom processing and preservation techniques like dehydration and pickling. Sixty students of third year B. Tech. (Agric. Engg.) were given hands-on training on preservation and value addition of different fruits and vegetables.

The students of College of Home Science registered under 'Family Resource Management' elective course were given hands on training on preparation of handicrafts from agricultural by-

products. Students prepared different utilitarian and decorative materials from agricultural by-products. Students of B.V.Sc. and Animal Husbandry of the College of Veterinary Science and Animal Husbandry availed six months internship at various centres of activity on veterinary and animal husbandry across the State on areas such as (i) production of animal vaccine (ii) collection, processing, preservation, artificial insemination and management of livestock and (iii) prevention, control and treatment of captive wild animals and birds.

At NDRI, Karnal, construction of an external block of the Experimental Dairy at a cost of Rs 50 lakh has been completed to provide the B. Tech./DT students with a wide variety of the practical aspects of the dairy and food processing activities.

At ANGRAU, Hyderabad, ICAR grant of Rs 112.0 lakh was utilized for setting up of facilities for hands-on training in the following 5 projects:

- Nurseries for vegetables and fruits including tissue culture technology, College of Agriculture, Rajendranagar.
- Green house production technology and mushroom production, College of Agriculture, Rajendranagar.
- Soil, water and plant testing laboratory at Agricultural College, Bapatla.
- Production of beneficial insects and other programmes at S.V. Agricultural College, Tirupati
- Training in home science production technology and value addition at PG and Regional College, Rajendranagar.

Six experimental units sanctioned to Maharana Pratap University of Agriculture and Technology University Campus, Udaipur have been made functional: (i) Renewable energy sources at College of Technology and Engineering, Udaipur (ii) Processing centre for food and vegetable and development of mixed food at College of Dairy and Food Science Technology, Udaipur (iii) Speciality food like high protein food, health food and milk food in College of Dairy and Food Science Technology, Udaipur (iv) Apparel Production Management Unit at College of Home Science, Udaipur (v) Bio-control unit at Rajasthan College of Agriculture, Udaipur (vi) Processing and Value Addition of Agricultural Products at College of Technology and Engineering, Udaipur.

The Colleges of Horticulture and Animal Husbandry, Marathwada Agricultural University, Parbhani utilized funds (worth Rs 70 lakh and Rs 40 lakh respectively from ICAR) for imparting hands on training to the students.

Modern agro-processing system for horticultural produce was established under the Department of Agricultural Engineering and Processing at the

Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut campus. The food processing unit mainly consists of multipurpose fruit and vegetable washer, crusher, pulper, juice extractor, steam jacketed kettle, chiller, homogenizer, pasteurizer, automatic filling machine, crown corking machine and a boiler for steam generation.

Emeritus Scientist Scheme: The major contributions under this include: Innovative approach to reduce postharvest losses in mango, guava and aonla, Site-specific nutrient management (SSNM) for sustaining soil quality and enhancing crop productivity in rice-wheat cropping system, Value addition to the non edible portion of fruits and vegetables for industrial use, Impact of climate change on Indian crops, Rapid bioremediation of environmental contamination caused by chlorinated pesticides, Strategies for enhancing traditional duck production system in under-privileged districts of TamilNadu, Genetic improvement of *Bacillus thuringiensis* S6 for its bioefficacy for the control of *Spodoptera litura*, Screening of collected germplasm and completion of experiments on agro-techniques aimed at enhanced productivity and quality in low chill pears, Tillage cum organics mediated rhizospheric modulation of winter initiated sugarcane ratoon for enhanced bud sprouting vis-a-vis cane productivity in subtropical India, Physiological studies on drought and high temperature stress tolerance in chickpea, Screening/evaluation of genotypes having tolerance to high temperature at seedling stage with high seed yield and bold seed size in Indian mustard (*B. juncea*), diffuse reflectance spectroscopy in assessing soil properties of vertisols and associated soils for sustainable development of agriculture, hybridization of oyster mushroom *Pleurotus* spp.), Impact assessment of climate change on major pests of maize and mustard, development and phenotyping of SSD populations of bread wheat and mapping of novel genes for durable resistance to leaf rust and stripe rust from French cultivar Capelle Desprez, development and evaluation of a simple antigen-based serological assay for diagnosis and screening of leptospirosis in animals assessment of noise induced hearing loss (NIHL) and modification/design of safety gadgets, enhancing crop productivity through Aqua-ferti sowing under rainfed and limited water culture, design and analysis of agricultural research experiments involving sequences of treatments with carryover effects.

Rural awareness work experience (RAWE) programme: This aims at training strategies incorporating rural agricultural milieu, provide opportunity for an undergraduate student of the last year to engage in fieldwork activity, to review

and analyze critically the real-world work experience and to refine decisions as a consequence and apply the result in practical life and field situation. Rs 263 lakh were allocated to 44 AUs during this year. The salient achievements are summarized below:

- The RAWE programme of the College of Horticulture, christened 'Niravu' was formally inaugurated on 26 April 2009 by the Vice Chancellor of Kerala Agricultural University. The RAWE was divided into nine modules such as Spring-board module (personality and soft skills development); Participatory Rural Appraisal, watershed management analysis and farm management module, Entrepreneurship development programme; Regional Agricultural Research Station and Krishi Vigyan Kendra Training; NGO training; Agro-clinic and village stay programme. The fourth year undergraduate students are given training in each of the module.
- In JNKVV, under the RAWE programme of 229 (fourth year) students of College of Agriculture, Jabalpur, Rewa and Tikamgarh have been placed in different Krishi Vigyan Kendras. The students got a first-hand experience in dealing with the problems of crop production technologies, fruit and vegetables production technology, insect pests and diseases, soil health, production and management of livestock, critical analysis of resource available at the disposal of the farmers. RAWE students have also learnt the PRA techniques and collected all kinds of information of the villages and identified farmers' problems.
- The TNAU (Coimbatore) RAWE programme consists of Village Stay Programme for 30 days, ADA/ADH Placement for 15 days and NGO placement for 15 days. Under Agro Industrial Tie-up Programme (AITP), the



ANGRAU students participating in RAWE programme

students were placed in various agro-industrial firms to learn managerial skill, organization culture, business marketing and business communication. The final year B.Tech (Biotechnology) and B.Tech (Bioinformatics) students underwent Biotechnology/Bioinformatics Work Experience (BWE) programme for 17 days.

- At GBPUAT, Pantnagar, evolution of textile articles through processing of wool with silk waste and cotton to create entrepreneurial skills in rural women has been carried out and value addition to agro and animal based fibers has been done. College of Horticulture Bharsar students are getting wide exposure through internship, viz. on plant health clinic village attachment, nursery establishment and industrial attachment. In the college of Agribusiness Management under summer placements scheme MBA (Agribusiness), MBA for engineers and MBA (Food Retail and Supply Chain) have got summer placement in various companies all over India.
- At Dr Y.S. Parmar University of Horticulture and Forestry Nauni, Solan, since the academic session 2001-02, 318 students (217 boys and 101 girls) have so far been trained in this programme. The students are subjected to practical training on the university stations of each zone under the overall supervision of the station/KVK's in-charges for one-third period of training and two-third period is spent in the farmers field and horti-industrial units of adjoining areas.

Best Teacher Awards: The Education Division extended fiscal support towards the reward and recognition of excellent teachers by mechanism of Best Teacher Awards in AUs.

Manpower development

All-India admissions and fellowships: The Council continued to promote merit and national integration through All-India Entrance Examinations for admissions at undergraduate and postgraduate level for certain proportion of seats in AUs and adequately supported with appropriate scholarship/fellowship provisions. The programs for faculty training in specialized, priority and cutting edge areas continued. The Council also provided for admission of foreign students in AUs.

All-India entrance examination for admissions to UG: For admissions upto 15% seats in agriculture and allied subjects other than veterinary sciences, 14 All-India Entrance Examination for Admission to undergraduate degree programmes (AIEEA-UG-2009) including the award of National Talent Scholarships (NTS) was conducted on 23 May 2009. In this examination, 19,469 candidates

appeared out of 24,222 applicants and 1,621 candidates were finally admitted in 49 Universities through counseling. All the candidates who joined a university falling outside their state of domicile were awarded National Talent Scholarship (NTS) of Rs 1,000 per month.

All-India entrance examination for admissions to PG: For admissions to 25% seats in PG programmes at 54 Universities, including award of ICAR Junior Research fellowships, AIEEA-PG-2009 examination was held on 24 May 2009. A total of 14,405 candidates appeared out of 16,162 applicants in the examination and admissions were granted to 2,010 candidates.

All-India competitive examination for ICAR Senior Research Fellowship for Ph.D.: The examination was held on 25 January 2009 at 7 centres in the country. Based on the results, a total of 171 Senior Research Fellowships were awarded and 436 candidates were declared qualified for Ph.D. admission without fellowship in 13 major subject groups and 56 sub-subjects. The SRF amount is Rs 12,000/month for first and second years and Rs 14,000/month for third year with a contingency grant of Rs 10,000/year for all disciplines other than veterinary sciences. For veterinary science students, it is Rs 14,000/month for first and second years and Rs 15,000/month for third year with a contingency grant of Rs 10,000/year.

Junior Research Fellowships: About 472 fellowships were awarded in 19 subject groups (90 subjects). The amount is Rs 8,640/month for non-veterinary and Rs 12,000/month for veterinary students to pursue PG degree programme. Besides, a contingency grant of Rs 6,000/year is payable to all awardees.

Merit-cum-means scholarship (MCM): This scholarship is granted to students of economically weaker sections of the society to undertake UG studies in agriculture and allied science subjects in SAUs, ICAR DUs, CAU and CUs with agricultural faculty. Maximum 7% students from a suitable university are awarded the scholarship of Rs 500/month.

Internship assistance: This assistance is being given to all final year students of B.V.Sc. and A.H. programmes during their internship at Rs 400/month besides Rs 200 for undertaking to-and-fro journey to place of internship for 6 months.

Admissions of foreign students: During the first half of the year 2009-10, about 247 candidates from 22 countries have been processed/granted admissions in SAUs, AAI-DU, ICAR DUs, CAU and CUs having agricultural faculty. Candidates came mainly from Afghanistan, Bangladesh, Botswana, Bhutan, Ethiopia, Guyana, Indonesia, Iran, Iraq, Japan, Kenya, Myanmar, Nepal, Qatar,

Rwanda, South Africa, Sudan, Sri Lanka, Syria, Tanzania, Vietnam and Yemen. Maximum candidates came from Rwanda (56 nos.)

Summer/winter schools and short courses:

To provide continuing education and training in highly specialized subjects to teaching faculty, 104 Summer/Winter Schools and Short Courses of 10 to 21 days duration were supported by Organization at ICAR Institutes and State Agricultural Universities. Out of these, 84 courses were of 21 days duration and 20 courses were of 10 days duration.

Centers of Advanced Studies/Centers of Advanced Faculty Training: The 31 Centers of Advanced Studies/Centers of Advanced Faculty Training (CAS/CAFT), continued towards capacity building of scientific faculty engaged in teaching at UG and PG levels. Around 1,300 scientists/faculty members are trained annually under the scheme. The scheme has been under review for change in the nomenclature and mandate as would be Centers of Advanced Faculty Training (CAFT).

Promotion of Excellence and HRD

ICAR National Professor Scheme: An additional position of National Professor named “Norman Borlaug Chair in Agricultural Biotechnology for Crop Improvement” has been created in the specific field of agricultural biotechnology for crop improvement at IARI, New Delhi with the objective of developing a centre of excellence in this field.

Major achievements of six national professors comprised:

- The ‘Pant-ICAR Sub-soiler-cum-Differential Rate Fertilizer Applicator’ developed and being patented for breaking of compacted subsoil (upto 50 cm depth) and application of fertilizers has generated great demand from farmers, fertilizer industries, sugar mills and other institutions. This machine is now recommended for launch at National Level for subsoil structure modification and enhancing the ‘Green Water’ storage particularly in rainfed areas.
- Development of ‘Pant-ICAR Deep Soil Volume Loosener-cum-Fertilizer Applicator’ for sugarcane ratoon management. It is a technological breakthrough by cutting of old roots (off-barring) upto 30 cm depth between 75 cm rows and 90 × 30 cm paired rows, placement of fertilizers to both sides of rows at 20 ± 5 cm depths and pulverization of clods for moisture conservation is yet another technological breakthrough. This machine is recommended for soil cultivation in laser-levelled fields, as it leaves the field surface in its original form after operation. The

machine is being patented.

- Field specific real-time fertilizer nitrogen management strategies using leaf colour chart, chlorophyll meter and optical sensor have been developed and standardized for rice and wheat. Field-to-field variability in N supply from all sources other than fertilizer and temporal variability in demand of N by the crop are very well taken care of by these and both nitrogen rates and timing of fertilizer nitrogen applications are fine tuned.
- Impact of climate change scenarios on the potential length of growing period: The length of the growing period (LGP) is the period (in days) during a year when precipitation exceeds half the potential evapo-transpiration. Trend analysis showed that LGP is likely to gradually decrease with time in several parts of India especially peninsular and southern India. This may call of redesign of systems and crop calendars to adapt to climate change indicating that we may have to re-look into changes required in cropping systems and crop calendars to adapt to climate change.

ICAR National Fellow Scheme: The areas of identified priority covered by 16 such positions at present include, developing regional plans for managing poor quality irrigation waters, development of Elisa-based immuno-diagnostics for classical swine fever, exploitation of metabolic diversity for isolation of genes involved in lipid biosynthesis, sustainability of watersheds in rainfed regions of peninsular India using GIS and remote sensing, senescence: mechanism in crops in relation to abiotic stresses, sink strength and their interaction, molecular characterization of Indian maize landraces and allele mining for agronomically important traits, improvement of strain of *Chaetomium globosum*, a potential antagonist of fungal plant pathogens and developing molecular markers for its identification, textile articles through processing of wool with silk waste and cotton to create entrepreneurial skills in rural women, identification and quantification of phosphatase hydrolysable organic Phosphorus sources for plant nutrition and refinement of a non-destructive technique for phosphatase estimation, decontamination of pesticide residues from edible commodities, assessing soil quality key indicators for development of soil quality index using latest approaches under predominant management practices in rainfed agro-ecology, development of technology of seed production and culture of feather back, *Notoprerus chitala* and two medium carps, *Labeo gonious* and *L. fimbriatus* for diversification of freshwater aquaculture, genome analysis of indigenous breeds

of cattle, buffalo and goats, study of gene interactions in developing *Drosophila* embryo and efficient design of experiments for quality agricultural research. Some of the salient achievements are as follows:

- The relationship between leaf senescence and antioxidant metabolism on the removal of the reproductive sink in a crop plant has been demonstrated. Removal of reproductive 'sink', i.e. spikelets from wheat at anthesis delayed the rate of flag leaf senescence. Plants without spikelets had higher reduced glutathione/oxidized glutathione (GSH/GSSG) ratio and antioxidant enzyme activities than the control plants and the differences were apparent from 21 days after anthesis. The removal of the reproductive sink led to an increased antioxidant defense which may be contributing towards the delayed flag leaf senescence in wheat.
- A spray bioformulation of *Chaetomium globosum* developed, which proved effective in controlling late blight of potato, spot blotch and leaf rust of wheat (A patent is ready to be filed). A specific SCAR marker (Sequence Cleaved Amplified Region) has been developed for diagnosis of potential strains of *C. globosum* (A patent filed). The mechanism of antagonism is through antibiosis. A compound, chaetoglobosin A has been tentatively identified through NMR and GC-MS studies.
- Eight selected micro-watersheds located in four villages in the districts of *Rangareddy* and *Nalgonda* in Andhra Pradesh in AESR 7.2 were evaluated for agricultural sustainability using tools of Geomatics - GIS, Remote sensing and DGPS along with conventional methods like soil survey and analysis, PRA and socio-economic survey. A suite of 51 sustainability indicators (SI) were constructed and used to facilitate quantitative evaluation of various aspects of sustainability. Study indicated that for evaluating sustainability at watershed- level, the minimum data set of critical indicators were – efficacy of S & WC structures, soil moisture conservation measures, farm OM recycling, gainful employment, Contingency Crop Planning, crop diversity, security of tenure, gross agricultural income, crop production, local availability of cultivation of fodder, availability of irrigation facility and actual area under cultivation in the watershed.
- A software "Spatial Decision Support System (SDSS)" comprising Regional Resource Characterizing System (named ResourCeS[©])

and an Environment Impact Assessment Tool (named Usar[©]) was indigenously developed and their detailed user manuals (ISBN No. 978-81-88708-43-7 & ISBN No. 978-81-88708-45-1) are also in advanced stages of publication. Both ResourCeS[©] and Usar[©] have been registered for a COPYRIGHT. Using these tools, quality of irrigation waters was successfully validated on several farmers'/ controlled experimental fields in the Gurgaon and Karnal districts and on the Mewat, Faridabad and Palwal districts of NCR to show that they can be very useful tools for (a) targeting pollution contributing sources across different policy zones of NCR, (b) analyzing water use, water productivity and soil/water/vegetation health of any region of interest, (c) identifying areas with single/ conjunctive water use options and benchmarking/ analyzing canal irrigation performance in any canal command area, and (d) assessing (short/ long term) environmental impacts of wastewater applications on agricultural lands across different policy zones of NCR.

- Biological phosphorus fertilizer (Bio-phos) has been developed, which are now being used in farmer's field and saving 45-60 kg SSP application per hectare. The B:C ratio is 15. In general 16-25% increase in yield is expected in pearl millet, clusterbean, moth bean and mung bean crops under rainfed arid environment. A new method to measure resin phosphorus in arid soils has been developed. The basic anion exchange resin in Cl⁻ form was found to be the best resin under arid soils.
- A standardized double sandwich ELISA was standardized for detection of classical swine fever (CSF) virus antigen in 2063 tissues of pigs and 532 (25.79%) of the tested samples were found positive for CSF virus antigen. Twenty-two cell culture adapted CSF virus isolates confirmed by RT-PCR were kept in repository for development of a vaccine candidate from the local isolates. Standardized Immunoperoxidase test (IPT) was used for phenotyping these isolates. Liquid phase blocking ELISA (LPBE) was standardized for the first time in India for antigenic characterization of CSDF virus. Neutralization peroxidase linked assay was standardized for antigenic characterization of these isolates. The test is being validated for large scale screening of serum samples from vaccinated pigs to determine the protective antibody level and for sero detection of CSF virus specific antibodies in pigs.



Agricultural Universities/ programmes Accredited this year

1. Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir, Srinagar	25.06.2009 to 24.06.2014 (five years)
2. Maharana Pratap University of Agriculture & Technology, Udaipur	25.06.2009 to 24.06.2014 (five years)
3. Sardarkrushinagar Dantiwada Agricultural University, Dantiwada	25.06.2009 to 24.06.2014 (five years)
4. Bidhan Chandra Krishi Vishwavidyalaya, Mohanpur	25.06.2009 to 24.06.2014 (five years)
5. Junagadh Agricultural University, Junagadh	25.06.2009 to 24.06.2014 (five years)
6. MBA (Agri Business) of Rajasthan Agriculture University, Bikaner	25.06.2009 to 24.06.2014 (five years)
7. Rajasthan Agriculture University, Bikaner	Accreditation extended upto 05.08.2013

QUALITY ASSURANCE AND REFORMS

Accreditation: Accreditation was expedited through self-study reports of the AUs, scrutiny and recommendations of the ICAR Peer Review Teams and Education Division, ensuring the eligibility as per minimum accreditation criteria, and finally, the grant of accreditation by the Accreditation Board. This year, the Board granted accreditation to the additional five State Agricultural Universities (SAUs) and their programmes and, to the MBA programme of the Rajasthan Agriculture University, Bikaner. Also, the accreditation of the Rajasthan Agriculture University, Bikaner that was initially granted for two years in 2008, was reconsidered and granted for five years, i.e. up to August 5, 2013.

Revision of ICAR Model Act for agricultural universities: For enhancing the uniformity of structure, governance and efficiency of the agricultural universities in the context of emerging challenges, the Model Act for Agricultural Universities in India was revised and communicated to all agricultural universities for adoption.

Restructuring post-graduate course curricula and syllabi: The ICAR through a National Core Group, have revised the course curricula and syllabi of all PG (masters and doctoral) programmes to make them utilitarian, up-dated and competitive.

Workshop - Quality Assurance in Higher Agricultural Education

An ICAR sponsored workshop on "Quality Assurance in Higher Agricultural Education" was organized on 26 March 2009 at the Assam Agricultural University, Khanapara Campus, Guwahati. The workshop was the maiden effort for addressing quality improvement of agricultural education in the north-eastern hill region of the country. The need for not only improvement in quality of education but also to achieve excellence in imparting agricultural education was stressed. Various aspects including accreditation and criteria thereof, faculty development, student admission, evaluation and examination system, physical infrastructure, financial resources, academic governance, etc. were discussed.

Also, the academic regulations for PG education were revised for bringing uniformity in higher agricultural education in the country. Some agricultural universities have implemented the revised curricula and syllabi with effect from academic session starting July 2009 whereas others are in process.

Modernization of agricultural universities farms: This new mega programme with a budget outlay of Rs 421.95 crores for three years, was initiated in 2008-09 to provide a one time grant to all the State Agricultural Universities and Central Universities with Agriculture Faculty. A sum of Rs 85.57 crores to 43 agricultural universities was distributed during the year. University farms have been renovated and modernized using this support.

ICAR International Fellowships: A new component of international fellowship has been introduced for pursuing Ph.D. program at the Indian Agricultural Universities (AUs) and Overseas Universities for Indian and overseas candidates with the objective to develop competent human resource and showcasing the strengths of Indian ICAR-AUs system. Applications were invited through wide publicity and the selection of candidates for the award is in progress.

Indo-US Agricultural Knowledge Initiative

Under the Indo-US Norman Borlaug Fellowship Programme, 4 out of 15 scientists selected from NARS during 2008-09, completed their trainings in US Universities. A joint workshop on 'Linking Farmers and Agro-based SMEs to Markets' was organized on 16-17 March 2009 in New Delhi. Salient achievements of the research projects are as follows:

Pigeonpea genomics initiative: A variety of molecular markers have been developed from bacterial artificial chromosome end sequencing (BESs), micro-satellite or simple sequence repeat (SSR)-enriched libraries and mining of express sequence tags (ESTs) and genomic amplicon sequencing. About 21,000 SSRs identified, 6,698 SSRs are under analysis along with 670 orthologous genes using a Golden Gate SNP (single nucleotide polymorphism) genotyping platform, with large

scale SNP discovery using Solexa, a next generation sequencing technology, is in progress. Solexa sequencing is being used to explore the feasibility of generating whole genome sequence.

Development of vaccines and diagnostics for control of avian influenza in poultry: A total of 20 AIV (H5N1) Index isolates were selected from different outbreaks (2006-2008) and different geographical locations. On the basis of Phylogenetic origin, IVPI index, Propagation efficiency, cell culture adaptation, four isolates were selected as Haemagglutinin (HA) gene donor for the reverse genetics based vaccine development.

Technology for plant and dairy ingredients-based formulated and functional foods using extrusion technology: A total of 70 formulations having soy incorporation upto 25% have been designed to achieve the nutritive profile for school children in the age of 7-9 years. Out of them, 26 provided good quality ready to eat snacks after their extrusion cooking.

Genetics engineering for abiotic stress tolerance in crops: Cloned abiotic stress-related genes encoding transcription factors, viz. *NFY*, *ZF2*, *NAC1* and *Apx* from hardy crop species, and promoters such as zeaxanthin epoxidase and a synthetic promoter. Five gene constructs using transcription factor (TF) encoding cDNAs and abiotic stress-inducible promoters were prepared. Twenty four primary transgenics in rice and 42 in cotton expressing TF genes with enhanced tolerance to abiotic stresses were developed.

Sustainable water resources management: For remediation of poor quality water, levels of heavy metal concentrations in soils, waters, plants and food were estimated and constructed 2-basic wet land cell structure (20*80 m²) at Ujina, Mewat (Haryana). Mesocosm at IARI, sewage plot side was developed to assess quality of wetland filter for determining optimal hydraulic retention time and screening wetland vegetation. Two students from PAU, Ludhiana visited University of Florida for doctoral research work.

Information and communications technologies for capacity building model in water management: US India collaborative extension/outreach and distance education: Reusable Learning Objects (RLO) on participatory watershed management, water user association, soil and water conservation, gender dimension, best management practices for soil and water use for rice-wheat cropping system of Punjab, soil moisture measurement, reclamation of salt affected waterlogged areas etc. were developed. Content Management System has been developed in Hindi to address the need for demand driven and value-added information for the use of local farming community.

Water harvesting for ground water recharge and bio-drainage for salinity control: Activated charcoal removed most of the chromium and nickel from the wastewater within six hours. Amongst the non-edible remunerative aromatic plants *Salvia aegyptica* and *Vitex nigundo* were found to be potential candidates for wastewater disposal.

On-farm water management for rainfed agriculture on benchmark watersheds in diverse eco regions of India: Systems of rice intensification (SRI) in rice and border irrigation in *rabi* crops in terms of agronomic productivity, economic profitability and social acceptability of RMP's for watershed management were executed and evaluated. The project concluded on December 31, 2008.

Water Management Review and Planning Workshop: A two days Final Review and Planning Workshop of Indo-US AKI Projects on Water Management was held at CSSRI, Karnal from 21-22 July 2009. Delegates from 3 ICAR Institutes (CSSRI, Karnal; IARI, New Delhi; CSWCRTI, Dehradun) and 6 State Agricultural Universities from India, and five scientists and students from 3 US universities (Iowa State University, Purdue University and University of Illinois) participated in this workshop.

National Academy of Agricultural Research and Management

Inauguration of PG Diploma in Management (Agriculture): The two-year Post Graduate Diploma in Management (Agriculture) was started at NAARM on 25 July, 2009 with the main objective of developing entrepreneurship skills for the youth to take advantage of the changing agricultural scenario in the country where primary, secondary and tertiary agricultural processes are gaining momentum for sustainable agriculture.

The PG Diploma course is a unique management course covering production, technology development and also agricultural marketing including agribusiness benefiting the students for direct employment. Twenty-seven graduates in agriculture and allied sciences were selected for this PG course through all India competitive examination.

HRD training programme for Programme Coordinators of KVKs: Technology assessment, refinement and demonstration should be tuned to the locational needs and these should be popularized at the ground level. Right technology combined with right methodology is the success of any extension activity. With these backgrounds, a training programme for Programme Coordinators of KVK of North East Region was organized for thirty-five KVK coordinators in July, 2009. □