DARE/ICAR Annual Report 1998-99

सत्यमेव जयते

Department of Agricultural Research and Education
Ministry of Agriculture
Government of India

Indian Council of Agricultural Research
New Delhi

भाकृअनुप
ICAR

Indian Council of Agricultural Research

President	Shri A B Vajpayee Prime Minister and holding the portfolio of Minister of Agriculture	(Since 19 March 1998)
Vice-President	Shri Sompal Minister of State for Agriculture	(Since 23 March 1998)
Director-General	Dr R S Paroda Secretary Department of Agricultural Research and Education	
Secretary	Shri B K Chauhan Joint Secretary Department of Agricultural Research and Education	
Financial Adviser	Ms Usha Sahajpal Joint Secretary and FA Department of Agricultural Research and Education	(Till 8 July 1998)
	Shri Rakesh Joint Secretary and FA Department of Agricultural Research and Education	(Since 9 July 1998)

Foreword

The Nation has recently celebrated the Golden Jubilee of its independence. Our accomplishments in the field of agriculture, during the last 50 years of independence, have made us proud of our scientists, farmers and the extension workers. Through their hard work, nation is today self-sufficient in foodgrains and our achievements in different sectors of agriculture are indeed praiseworthy. While sustaining these developments, we have to attain a growth rate in agriculture to 4.5% in order to achieve overall national growth of 6.5% during the IX Plan. We have also to double our food production in next 10 years.

The emerging demands are to be met through increased productivity, sustainability, environmental and ecological security, profitability and competitiveness in the backdrop of decline in factor productivity, loss of bio-diversity, natural resource shrinkage and degradation, climatic change, intensifying competition in international trade and widening economic disparities. The challenges are formidable yet within our reach if the opportunities are harnessed judiciously. These include the fast evolving technology, revolution in information technology and globalization of the economy.

It is heartening to note that the Indian Council of Agricultural Research, our premier organization, for the conduct and co-ordination of agricultural research and education, has intensified its efforts to make our national agriculture research system better equipped to meet the future challenges successfully.

The achievements of this year have further encouraged the system towards an improvement in performance in the interest of the small and marginal farmers in resource-scarce situations, so that large number of small and disadvantaged farmers are benefited and the efforts to achieve doubling of food production and eradication of poverty in the coming decade can be set in motion.

(A.B. Vajpayee)
President
ICAR Society

Contents

भाकृअनुप
ICAR

The Mandate of the Indian Council of Agricultural Research

(*i*) To plan, undertake, aid, promote and co-ordinate education, research and its application in agriculture, agroforestry, animal husbandry, fisheries, home science and allied sciences.

(*ii*) To act as a clearing house of research and general information relating to agriculture, animal husbandry, home science and allied sciences and fisheries through its publications and information system, and instituting and promoting transfer of technology programmes.

(*iii*) To provide, undertake and promote consultancy services in the fields of education, research, training and dissemination of information in agriculture, agroforestry, animal husbandry, fisheries, home science and allied sciences.

(*iv*) To look into the problems relating to broader areas of rural development concerning agriculture, including post-harvest technology, by developing co-operative programmes with other organizations such as the Indian Council of Social Science Research, Council of Scientific and Industrial Research, Bhabha Atomic Research Centre and the universities.

(*v*) To do other things considered necessary to attain the objectives of the Society.

1. Overview

Commensurate with new challenges and opportunities both at the national and global level, the Indian Council of Agricultural Research (ICAR) has also reoriented its mandate to include human resource development and technology assessment and refinement as new paradigms for holistic advancement in agriculture and allied subjects, while ensuring optimal use of natural resources in partnership with all stakeholders, especially the State Agricultural Universities (SAUs), farmers, NGOs and private sector, etc. so as to achieve the ultimate goal of Evergreen Revolution.

The ICAR had been the facilitator of Green, White and Blue Revolutions. The technologies generated by the scientists had been the cornerstones of our past successes. To achieve the twin national objectives of poverty alleviation and welfare of the disadvantaged and weaker sections of the society, it has now become imperative to increase agricultural productivity, profitability, and sustainability through judicious and more integrated use of our natural resources. However, our production of agri-horticultural crops has secured a prestigious position with India being the second largest producer of rice, wheat, fruits and vegetables in the world. We have yet to go a long way in improving our productivity to ensure profitability and sustainability of Indian agriculture, through conservation of our natural resources, while entering into the 21st century. The salient achievements of the Council during the past one year are presented chapter-wise in this report.

Evaluation of plant and animal genetic resources and their conservation had been the main thrust of our efforts in order to maintain our biodiversity and broadening the genetic base by having improved varieties to increase productivity. Under germplasm-exchange programme during 1998-99, about 3,738 accessions were added to the National Genebank, while 280 samples of agri-horticultural crops were exported to 20 countries. In case of animal and fish genetic resources, efforts were concentrated to characterize our local breeds and strains.

Under Crop Improvement and Management, three varieties of rice (VL Dhan 81, Neeraja, R 629-256) and a hybrid Pro Agro 103; and six varieties of wheat [HD 2687, PBW 435, UP 2425, GW 1139(D), DWR 1006(D), NIDW 15(D)] were identified for release. In barley nine strains were found promising for malting quality. In case of maize, eight hybrids/composites (D 931, Parkash, Pro 316, PAC 776, Bio 9637, PAC 738, X 1174, FH 3049) were identified and released for general cultivation in rainy (*kharif*) season, while Parkash was found suitable for baby corn production. The new sorghum hybrid SPH 660 outyielded CSH 14 in respect of both grain and fodder. In pearl millet GHB 183 hybrid was released and notified for summer cultivation in Gujarat. In small millets, high-yielding, early-maturing, blast-resistant GPU 26 was released for general cultivation in Gujarat, and TNAU 186 was identified for release in Tamil Nadu, Andhra Pradesh and Karnataka. Soybean appeared ideal for crop rotation, especially for millet-based intercropping in several states. Process for preparation of malted finger millet and milk-based infant food was developed. In under-utilized crops, VH 82-1 fababean and RBL 6 rice were identified for release. In forage crops Bundel Jai 851 oat, FMH 3 pearl millet and Bundel Guar 3 clusterbean, etc. were released for different areas. In oilseeds three new varieties of groundnut (CSMG 884, HNG 10, LNG 2), one of soybean (MACS 50) and two of rapeseed and mustard (VSL 5, RN 393), one each of sunflower (LS 11) and sesame (TKG 55) and three of linseed (LCK 9211, LCK 9313, RL 993) were identified for release. A new promising castor hybrid DCH 177 was identified for release in Andhra Pradesh, Tamil Nadu, Karnataka and Rajasthan. In pulses, two new varieties in gram (GCP 101, BGD 72), one variety each in mungbean (Pusa 9531), horsegram (AK 21) and clusterbean (HG 5563) proved promising. In pigeonpea, first

medium-duration hybrid AKPH 2022 was recommended for Vidarbha region of Maharashtra. Dwarf field pea varieties DDR 17, KPMR 385, KPMR 389 and LFP 224 gave 15% higher yield than check HFP 4 in southern states.

In cotton, varieties/hybrids identified for commercial cultivation in different agro-climates are L 603 and L 604 in *Gossypium hirsutum*, AKA 7 and G. Cot 19 in *G. arboreum*, LAHH 4 (intra-*hirsutum* hybrid) and AAH 1 (intra-*arboreum* hybrid) identified for adoption in Andhra Pradesh and Punjab, Haryana and Rajasthan respectively. Rapid and inexpensive pyrethroid-resistance detection unit could be developed for determination of *Helicoverpa armigera* strains in field. CoLK 8102 and CoLK 8001 varieties of sugarcane gave 32.3 and 23.2 tonnes/ha higher yield when water-shoots/tillers were retained at harvesting of preceding crop. New strains of white jute were identified for fine fibre quality. Nine direct interspecific hybrids were developed in tobacco.

A total of 2,643.6 tonnes of breeder seed was produced against an indent of 2,501.6 tonnes and major quantity belonged to cereals, oilseeds and pulses. For certified and foundation seeds of castor, isolation distance of 300 m and 600 m was suggested to maintain genetic purity. Laboratory techniques using PAGE were standardized for characterization of varieties, hybrids, and their parental lines.

For plant protection, 80 cultures of natural enemies were provided to co-ordinating centres and other research organizations to facilitate multiplication, establishment and for field trials. For the first time, Endogram, a Endosulfan-tolerant strain of *Trichogramma chilonis*, was developed for controlling *Helicoverpa armigera* on cotton and other crops.

In variety Cricket Ball of sapota, two bee colonies/ha were required for optimum pollination. Honey granulation was found negligible in hindolium and opaque plastic jars. In choice and no-choice tests, Difethialone (a third generation rodenticide) caused 100% mortality of test species at 25 ppm in locally available baits. Social engineering activity on rodent control undertaken by all co-operative centres showed 75% success in adopted villages. In different crops, waiting period for their safe consumption was suggested following application of pesticides. Thorny variety of Passifera oilpalm showed resistance to bird damage.

In fruits, Dashehari 51, a regular-bearing and high-yielding mango variety was released. About 34 new mango accessions were added to the existing rich mango germplasm. Guava selection CISH-G 4 with few soft seeds, high TSS and pink blush was promising. A number of banana cultivars were screened for virus resistance, especially for banana streak virus and banana mosaic virus. Papaya Surya, a gynodioecious papaya was released. In litchi, double hedge row system gave highest yield. In pineapple, a population of 44,444 plants/ha at 30 cm × 60 cm × 90 cm gave 65 tonnes/ha under rainfed condition. The CFB boxes of cotton plant stalk were found technically and economically-viable alternative for Nagpur mandarins.

In vegetables, 13 new varieties and 6 hybrids were identified for commercial cultivation. A number of improved agro-techniques along with their cost : benefit ratio were recommended for different regions. The Rakshak, a commercial neem product, was effective in managing American serpentine leaf-minor in tomato. Kufri Pukhraj and Kufri Anand, resistant to late blight, were released in potato.

In cassava, TCH 1 and TCH 3 hybrids were found promising for upland and lowland, whereas Sree Jaya and Sree Vijaya varieties were recommended for Kerala. Gouri and Sankar sweet-potato varieties were released for the eastern India.

In mushroom, single spore strains NCS 100 and NCS 101 and hybrid NCH 102 were released for commercial cultivation.

In gladiolus, nine varieties were released. An induced mutant of *Chrysanthemum* Kirti was found promising for bedding and potting. New marigold Pusa Narangi Gainda was found superior.

Coconut Laccadive Ordinary performed better. A low-cost technology for large-scale production of vermicompost from coconut plantation wastes was demonstrated to the growers. Oil palm tenera hybrids, Palode I and Palode II, both high oil-yielding coconut under rainfed conditions were released. A new cashew hybrid Vengurla 7, providing 18.5 kg/tree of bold nuts, was released.

A total of 40 accessions of black pepper, 68 of ginger, 67 of turmeric, 16 of nutmeg, 19 of cinnamon, 89 of coriander, 22 of cumin, 60 of fennel and 76 of fenugreek were collected, enriching the genetic resource of spices. Gujarat Asalio 1, a new asalio variety was released.

In case of Natural Resource Management, soil maps of Arunachal Pradesh were digitized and different states were also mapped. In Himachal Pradesh, soil-site suitability for apple could be evaluated. A vegetative barrier *Dichanthium annulatum* performed best in reducing run-off and

soil loss. Specifications for constructions and design equation were developed to keep the terraces in resistant condition and maintain sustainable productivity.

Incorporation of blackgram, wheat, mustard and groundnut residues increased the soil organic carbon and subsequently rice yield on lateritic sandy soils. *Azospirillum* and *Azotobacter* inoculations showed promising response to cereal and oilseed crops. Drip irrigation, border method of irrigation, mulching and supplemental irrigation were developed for saving of irrigation water. In rice, 10-cm bund height was found suitable for increasing yield through conserving rain water. Row spacing of 4 cm in Swarna and Haramadhu muskmelon resulted in maximum economic yield.

Rice-potato-wheat and sugarcane recorded higher net returns (Rs 45,937/ha and Rs 43,116/ha respectively) than the rice-wheat system (Rs 23,297/ha). The cropping systems found profitable at farmers' fields are rice-pea in Assam; groundnut-wheat in Bihar; soybean-gram and rice-tomato in Madhya Pradesh; rice-onion in Himachal Pradesh; sorghum-sunflower, blackgram-gram etc. in Maharashtra; clusterbean-wheat in Rajasthan; and maize-pea + wheat and blackgram-wheat in Uttar Pradesh.

Soil loss and run-off were controlled and farmers were convinced to follow the conservation treatments studied under an ACIAR project funded by Australia. Drought management strategies were evaluated under rainfed conditions for pearlmillet, upland rice, maize, soybean, safflower (late season) so as to minimize the impact of droughts on crop yields.

Under arid zone research, major achievements include discovery of Palaeochannel system in the Thar desert from Radar Imagery, ley farming technology for reclaming sandy wastelands, and new approach for chilli-disease management.

Under Agroforestry, salient findings include development of 'Pant Poplar', a promising polar clone for *tarai* region. Agri-silvicultural system, silvipastoral system, agri-horticulture system and horti-pastoral system have shown promising results. Air layering showed 100% success in *neem* with 800 ppm IBA solution during rainy season.

For Livestock and Poultry Improvement and Management, information system on animal genetic resources was upgraded at the National Bureau of Animal Genetic Resources. In Frieswal cattle, 2,604 kg peak milk yield could be obtained after selection. Bharat Merino sheep proved good substitute for import of Rambouillet and Australian Merino. Proper skin utilization tripled the margin of income in backyard rabbit rearing. Caribro-91 and Cari-Multicoloured broilers showed exceptional performance at random samples test. Naked neck (na) and sex-linked dwarf (dw) genes were introduced into separate gene lines, to make them useful as source populations for introducing the said genes. Vanaraja was found to be a suitable bird for backyard system of poultry rearing. Tests were developed to study the seroprevalence of *Brucella equi* infection. The action plan and recommendations were formulated to check foot-and-mouth disease in an effective manner, in which central and state level agencies are to be involved.

Disease forecasting computer-based models were developed. An in-depth survey was conducted to confirm the absence of rinderpest virus activity in various parts of the country. Camel milk was found to have therapeutic value in tuberculosis treatment. Diagnostic kits for infectious bovine rhinotracheitis, brucellosis and bluetongue were developed. Multiple emulsion haemorrhagic septicaemia vaccine was developed. Database could be developed for feed and animal resources availability for different agro-climatic zones. Fermentation parameters are being standardized for growing live culture of probiotics on conventional animal feeds. Leaf-meal of *Cestrum diurnum* showed certain anabolic factors that may improve performance of birds in terms of overall growth and performance. Status of micronutrients of livestock in Kerala, Tamil Nadu, Assam and Haryana was studied. Agricultural byproducts available in different regions were developed as animal feeds. A method was developed for *in-vitro* assessment of bull fertility to differentiate the bulls on the basis of fertility status. Platelet-activating factor improved the fertilizing ability of cattle and buffaloes. Bromocryptine induced lactation in buffaloes without affecting their milk yield and composition. A sperm-stipulatory protein was found in avian semen.

Embryo transfer technology protocols for cattle, buffalo, sheep, goat etc. are being standardized. Probiotic spray-dried food formulation was developed. Low fat cheddar-type cheese with traditional flavour could also be developed. Dried carrot milk food-production technology was standardized. Quality meat products were developed from spent goat and hen meat.

In case of Fish Production and Processing,

marine fish production increased by 11.6% compared with that of 1996. Unusual abundance of pearl oyster stock was observed in Gulf of Mannar along the Tuticorin coast, which may revive the old glory of pearl fishery in the Gulf of Mannar. Fish productivity of reservoir of Haryana, Punjab, Himachal Pradesh and Tamil Nadu was surveyed, and indicated that it can be enhanced through judicious stocking, followed by optimum exploitation. A new hormonal formulation, ovatide, was developed for fish breeding programme. At the Central Institute for Freshwater Aquaculture, feeds were formulated for different life stages of prawns. Virulence of Indian white spot virus could be changed. Captive broodstock development and seed production of groupers is now possible. Packing material was manufactured indigenously for fish and fish products. Production technology for mussels was popularized to the farmers.

Major achievements of Agricultural Engineering and Technology include development of 6-row tractor-mounted inclined plate planter; manually-operated single-row garlic planter; power tiller-operated multi-crop planter; power tiller-operated potato planter-cum-fertilizer applicator suitable for potato planting, fertilizer application and making ridges simultaneously; solar fruit and vegetable dehydrator; pin-mill for low temperature grinding of tough agricultural produce of 100 kg/hr capacity; technology for preparation of soy-souce from okara (a byproduct of soymilk and soy paneer–tofu) and cylindrical dryer for soy-based *idli/dosa* mixed-batter; stainless steel 8-frame radial honey extractor with lid for extraction of *Apis mellifera* honey; and dying technique to dye viscose-cotton blended fabrics with natural indigo.

A 2-time increase was found in protein content and quality index of enzymatically treated rice flour. Drip irrigation system resulted in higher cotton yield of 3.15 tonnes/ha, followed by sprinkler irrigation (2.86 tonnes/ha) and surface method of irrigation (2.42 tonnes/ha). Trivoltine quick-growing lac-insect species could be discovered. An economical varnish, based on dewaxed lac in spiritless solvents, along with an accelerator was developed for wood, the resulting film is heat resistant (90°C) for 2 min and water resistant. A double reflector portable box-type solar cooker (50 cm × 60 cm × 26 cm), which saved time and improved cooking quality of food, pilot plant for biphasic aerobic fermentation of various fibrous agro-residues, and a natural draft biomass gasifier were also developed.

The useful research findings were also disseminated through India's Science Vision Exhibition (New Delhi), other national and regional exhibitions, symposia and a number of Kisan Melas.

Under Agricultural Research Information System (ARIS), the main thrust is being given for networking and creating infrastructure under National Agricultural Technology Project (NATP) at ICAR (Hq), its institutes and all SAUs for global inter-connectivity through e-mail and internet. SUN SOLARIS training was conducted at 10 places, covering ICAR institutes and SAUs. ARIS cells at the institutes and SAUs have been established and are now functional.

Under Human Resource Development, revised course curriculum in Faculty of Agriculture, Home Science, Agricultural Engineering, Forestry, Horticulture, Fisheries were implemented in SAUs. For the first time, All-India Deans' Conference was organized in which uniform academic regulations were agreed upon. To remove inbreeding and promote Human Resource Development, Junior Research Fellowships (JRF) to 437 and National Talent Scholarships (NTS) to 275 and Senior Research Fellowships (SRF) to 200 candidates were awarded. The amount of fellowships was revised for JRF, SRF and NTS. A total of 200 foreign students were admitted in M.Sc. and Ph.D. programmes in SAUs, and Swaran Jayanti Fellowships were awarded to 50 students. For Summer/Winter Schools and Centres of Advanced Studies, 100 training courses were organized in new and emerging areas. A total of 112 scientists could be trained overseas for three weeks to three months duration in educational technologies and other emerging areas. Two courses on 'How to Manage Education Better' was organized in which 58 Deans participated. Computer training programme was also organized for Registrars of the SAUs. For developing professional competence, a brain storming workshop on Home Science was organized for broadening the very concept of Home Science. A Workshop on Textbook Writing was also organized in which 80 authors participated and 35 titles could be finalized for Textbook Writing. New accreditation procedures were implemented and two accreditation workshops were organized at Hyderabad and Pune. A total of 200 manuals and instructional material were developed, and 18 SAUs/DUs got their 'Vision 2020' documents released during Vice-Chancellors' Conference.

A Mid-Term Review of Agriculture Human Resource Development Project was conducted and

the World Bank has agreed to provide additional support for training of the faculties and infrastructure development. Second phase of AHRD project is being planned for negotiations.

Major achievements of Social Sciences and Policies includes studies on increase in the total factor productivity of rice-wheat based cropping system by incorporation of legumes. Share of livestock sector in agricultural GDP has been found to have raised from about 17% in 1980-81 to 26% in 1996-97. Investment in livestock research was shown to have resulted in higher returns. Expenditure on irrigation, rural roads, electrification etc. is a must for overall agricultural development. An action plan has been prepared for private-public sector interface. A survey method was developed for precise estimation of milk production at district level. A software was developed to add, retrieve, and analyse the data available in database on agriculture statistics. Reliable crop yield estimates were shown to be possible with the use of satellite data. A computer-based model was developed to study the spread of aphid population.

Under Technology Assessment, Refinement and Transfer, the research-extension linkages were further strengthend through integration of technology assessment and refinement component with the production system research programmes. Krishi Vigyan Kendras (261) organized several training courses, benefitting 258,332 farmers and farm-women including 70,518 SC/ST farmers and farm-women in 8 zones in agriculture and allied fields. A total of 2,502 vocational trainings were organized for 45,909 unemployed rural youth in poultry, dairying, piggery, bee-keeping, fisheries, etc. Front-line demonstrations were conducted in 2,830 ha, involving 5,867 farmers, on groundnut, mustard, sunflower, *toria,* linseed, niger, sesame and soybean. The yield potential of new varieties was much higher than the local checks. Trainers' Training Centres (8) had organized 179 trainings, benefitting 2,772 participants. The action programme pertaining to Institute-Village Linkage Programme (IVLP) was finalized for 42 institutes involving around 40,000 farmers. The National Research Centre for Women in Agriculture conducted 20 training programmes for rural women and formulated two research projects, viz. development of appropriate farming system suited to farm-women, and improvement in backyard poultry for different categories of farm-women. The divisions of Crop Sciences and Agricultural Extension also jointly started Technology Evaluation and Impact Assessment project to test promising varieties in pipeline on farmers' fields from *rabi* 1997-98, identifying 17 crops at 60 centres, and an action plan for *rabi* 1998-99 and *kharif* 1999 has also been finalized.

In Research for Tribal and Hill Regions, major findings of ICAR Research Complex for NEH Region include recommendations for adoption of agro-pastoral, livestock-based farming and agro-horti-silvo-pastoral systems in hilly terrain of north-eastern India. Under lowland of mid-altitude, 14 advanced breeding lines were developed through conventional breeding and anther culture. Groundnut was found successful oilseed in acidic soil of north-eastern region. Rabbit (New Zealand White and Soviet Chinchilla) fetched an additional income of Rs 12.0/ fur skin for both the breeds.

Significant achievements of the Central Agricultural Research Institute, Port Blair had been the identification of salt tolerance and development of aluminium-toxicity tolerance in rice; suitability of root-derived calli in rice genetic transformation; ratoon cropping of rice for resource-poor farmers, introduction of passion fruit, good performance of West Indian cherry and promotion of wilt-resistant brinjal; first report of natural larval hosts of 6 species of wild silk moths and transfer of growth-hormone gene of rainbow trought into Indian major carps as well as breeding of marine prawns of *Penaeus* spp. in Andaman.

The work at Vivekananda Parvatiya Krishi Anusandhan Shala led to release of VL Dhan 61, a blast-resistant rice variety for valley and hilly areas of Uttar Pradesh and Himachal Pradesh; an early-duration, blast-resistant VL Ragi 146 finger millet for hills of Uttar Pradesh and Karnataka; and a medium-duration Vivek 6 garden pea for North-Western hills etc.; and fulfilment of targets of breeder seed of 29 improved crop varieties best adopted for the hill region.

The National Agricultural Technology Project, a prestigious World Bank project of Rs 10,000 million, has become fully functional from 19 November 1998. The launch workshop for the project was organized on 6 October 1998 to sensitize partners about its plans and programmes. The NATP has three major components, viz. (*i*) Agro-ecosystem research in which Research Programme Committee (RPC) met twice and considered 21 research proposals; (*ii*) Innovations in Technology Dissemination under which Technology Dissemination Unit was

established in the Directorate of Extension, Department of Agriculture and Cooperation; and (*iii*) Organization and Management Reforms under which 3 task forces (organization and management reforms; priority-setting, monitoring and evaluation; and information system development) were set up for implementation. National Workshops on priority-setting mechanisms, monitoring and evaluation; agricultural research information service; and Public-Private Sector Interface were organized to develop mechanisms for priority-setting, monitoring and evaluation of the Project.

On the verge of 21st Century, rapid changes are taking place and to face challenges ahead the ICAR is streamlining, reorienting working conditions at the headquarters and introducing and implementing several Organizational and Management Reforms to respond more effectively to present and future requirements. The perspective plan document of all ICAR research institutes has been prepared. The preparation of *ICAR Vision : 2020* was initiated and draft document prepared and is expected to be finalized soon. The report of Dr P N Bhat Committee to review guidelines for Quinquennial Review Teams was submitted in December 1998 and that of Dr M V Rao Committee constituted to review Functioning of Regional Stations under the ICAR institutes was drafted. Policy and Perspective Cell is dealing with issues of organization and management under the NATP and O and M Task Force was constituted. Project-based budgeting system was introduced in the Council for better fiscal management of our investments especially in view of donor fatigue for agricultural sector. Special attention was also given to the reservation of posts for Scheduled Castes/Scheduled Tribes and Other Backward Classes.

The ICAR Award Ceremony was held on 16 July 1998 and awards of 10 different categories were given away to 44 scientists, 6 teachers and 8 Institutions.

To develop linkages and collaborative programmes with related national and international institutions and organizations for undertaking programmes, the ICAR has revised its mandate to increase quality of life of farming communities in particular. The major achievements under Partnership and Linkages include international linkages through Memoranda of Understandings/ Work Plans (20). The ICAR has signed MoUs with the Texas A&M University, Iowa State University and Cornell University of USA; Republic of Peru; ICIPE (Kenya); ICGEB (Italy); FAO (Rome); IRRI (Philippines); AREEO (Iran); EMBRAPA (Brazil); Bulgarian Agricultural Academy (Bulgaria); RAAS (Russia); NARC (Nepal); ARG (Egypt); CARP (Sri Lanka); and ICLARM, ISNAR, CIP and ICRISAT etc. of CGIAR. About 370 scientists of the ICAR/SAUs system were sent abroad for trainings and meetings/ conferences. Training courses were also organized for foreign students under Nepal Aid Fund, sponsored by FAO/IAEA/World Bank. A total of 140 proposals for short-term/ad-hoc visits to foreign nationals processed, out of which 24 belonged to high level dignitaries and heads of the foreign organizations concerned with agriculture.

Publications and Information Division brought out 37 books and seven periodicals in English, and ten books and three periodicals in Hindi. During Golden Jubilee of India's Independence, *50 Years of Indian Farming* (51 selected articles from the *Indian Farming* 1948–97), special issues of two research journals, viz. *Indian Journal of Agricultural Sciences* and *Indian Journal of Animal Sciences* (both monthly), and one of popular magazine (monthly), viz. *Indian Farming* were brought out. A popular magazine *Indian Horticulture*, a newsletter *ICAR News*, and an in-house magazine *ICAR Reporter* were published in time and widely circulated, and a new quarterly newsletter *ARIS News* has been introduced to strengthen Information Revolution. In Hindi, *Kheti* (monthly) and *Krishi Chayanika* and *Phal Phool* (both quarterly) were also brought out timely. *Rajbhasha Alok* (annual number) and *Swarn Manjusha* (50 selected articles from the *Kheti* 1948-97) were the special publications in Hindi. Agricultural Research Information Centre brought out the *Directory of Conferences, Seminars, Workshops in Agriculture* and *ICAR Telephone Directory 1997-98* besides its own duties. Nine exhibitions, press releases, press conferences/briefings/photographs etc. were made available to the farmers for dissemination of information pertaining to agriculture and allied subjects.

DARE/ICAR Annual Report 1998-99 has been given a new orientation with addition of a few new chapters, published well in time and acclaimed to be one of the best reports of scientific departments in the Government of India.

(R. S. Paroda)